TRONOX

Cooljarloo Environmental Management Programme

Table of Contents

Figures

PART A: CONTEXT AND SYSTEM DESCRIPTION

1 INTRODUCTION

1.1 Background

Tronox (formally Tiwest) has been operating the Cooljarloo Mine since 1989 principally to extract and concentrate titanium rich mineral sands. The mine is authorised under the *Mineral Sands (Cooljarloo) Mining and Processing State Agreement Act 1988* (SAA) and is subject to three Ministerial Statements under Part IV of the *Environmental Protection Act 1986,* including:

- Cooljarloo Mineral Sands Project (Excluding the Proposed Dry Processing Plant at Muchea), Ministerial Statement 37 (MS37) (approved 1988);
- Cooljarloo Mineral Sands Project, Mining of Titanium Minerals, Orebodies 27,000 and 28,000, Ministerial Statement 557 (MS557) (approved 2000); and
- Cooljarloo Mine Falcon Extension Ministerial Statement 790 (MS790) (approved 2009).

The Cooljarloo Environmental Management Programme (EMP), originally prepared to fulfil Condition 7 of MS37, pre-dates the approvals of MS557 and MS790. The EMP, having been approved by the Environmental Protection Authority in 1989, has been maintained as an integrated component of the Cooljarloo Environmental Management System (EMS). Figure 1 summarises the relationship between this document, the Ministerial Statements and the Tronox EMS. A more detailed document map is provided in Appendix A.

Due to the consistency in environmental factors, objectives and environmental management approaches applicable to the three approvals, Tronox manages the areas of different approvals under the same management regime and has elected to update this EMP to provide a single management framework for the whole site. Tronox recognises that the Ministerial Conditions relevant to each approval apply in a compliance sense.

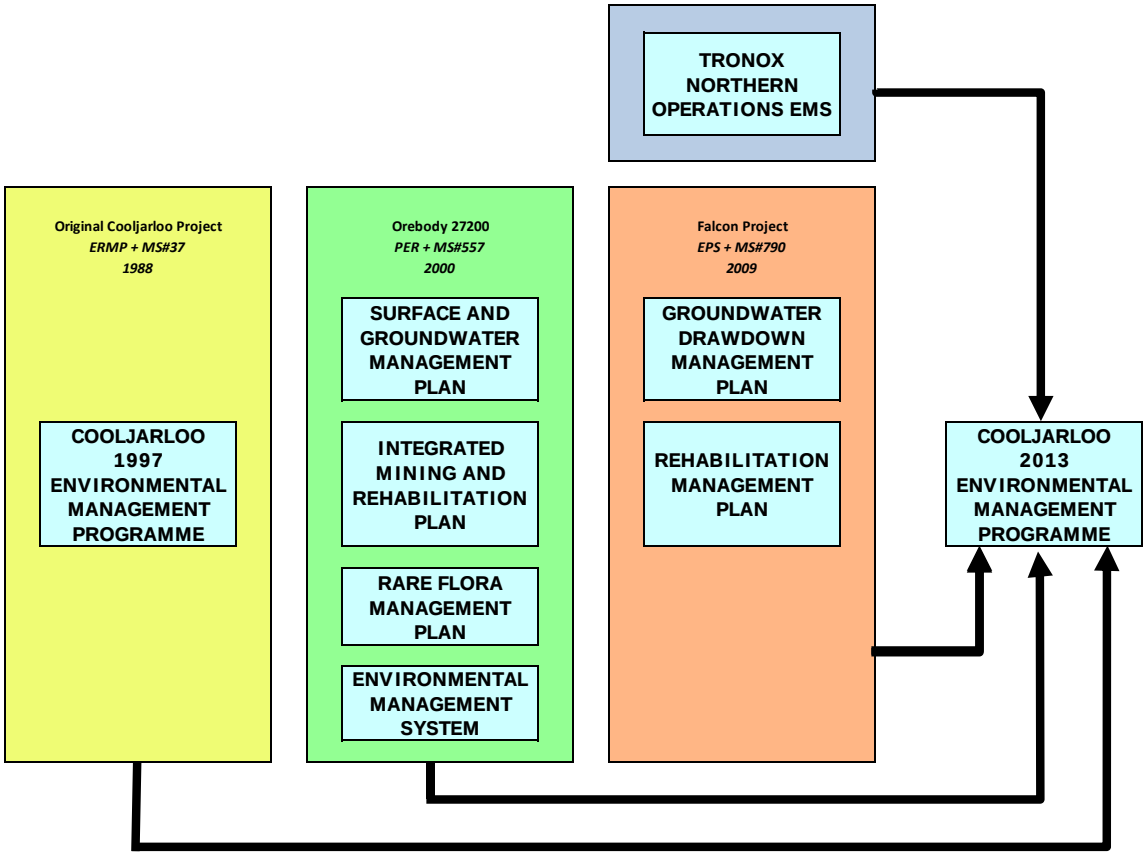


Figure 1: High Level Structure of the Cooljarloo EMP

1.2 Purpose of this document

The purpose of this document is to collate and communicate the environmental management information relevant to the Cooljarloo mining operations. In doing so, the document summarises key components of the Cooljarloo EMS and addresses the EMP requirements outlined in Ministerial Statement MS37 and the Mine Lease conditions issued under the *Mineral Sands (Cooljarloo) Mining and Processing State Agreement Act* 1988.

The principal audience for the document is expected to be Tronox employees, Tronox contractors, Regulators and other key stakeholders.

1.3 Scope of this document

The scope of this EMP covers the environmental management aspects of all activities undertaken by Tronox, its employees and contractors within the Mining Lease ML268SA. It includes the activities and infrastructure described in proposals as approved in MS37, MS557 and MS790. It covers the time period from the point of acceptance of this EMP by the EPA. This means that the EMP covers all stages of future mining process at Cooljarloo from pre-mining through to rehabilitation, acknowledging that mine closure issues, including the

development of rehabilitation completion criteria, are covered in a specific Mine Closure Plan.

1.4 Objective

The objective of this document is to outline the key environmental management strategies for Cooljarloo within a single framework. In addressing this objective, the EMP:

- Is configured to address the environmental factors identified through the environmental impact assessment and approval processes;
- Identifies the key environmental aspects, activities and impacts associated with each factor;
- Describes the approach to managing key aspects at Cooljarloo by identifying objectives, performance targets and operational controls for each factor; and
- Outlines monitoring and contingencies to track progress toward the desired environmental objectives and outcomes.

1.5 Approach

Tronox articulates its commitment to environmental protection within its Environmental Policy and maintains an Environmental Management System (EMS) accredited to the International Organization for Standardization (ISO), ISO14001 standard. The EMS defines the processes, standards and procedures Tronox use to achieve the outcomes mandated in the policy. The EMP summarises key components of the EMS system and in doing so has been developed in the context of the:

- Cooljarloo Environmental and Community Statement of Commitment;
- Site Legal and Other Obligations;
- Site Aspect and Impacts register;
- Tronox Corporate Safety Health and Environment (SHE) Management Standards (Tronox 2013);
- Tronox Corporate Environmental Performance Standards (Tronox 2013a); and
- Site Operating Procedures.

2 COOLJARLOO MINE OVERVIEW

2.1 Project Location

The Cooljarloo Mineral Sands Mine is located approximately 170 km north of Perth, 12 km north of Cataby in Western Australia Figure 2. The site is located to the west of the Brand Highway within the shire of Dandaragan.

Tronox has processing operations at Muchea (Chandala Processing Plant) and Kwinana, where further downstream processing of the Heavy Mineral Concentrate (HMC) is undertaken. A corporate office is located in Bentley.

2.2 Land Tenure

The Cooljarloo Mine operates within Mining Lease ML268SA. The lease is approximately 9,744 ha, comprising of the Tronox owned Mullering Farm (1,035 ha), two freehold lots (45 ha and 13 ha) owned by local stakeholders and the remainder being Unallocated Crown Land (UCL) (8,651 ha) Figure 3. Unallocated Crown Land is vested in the Department of Regional Development and Lands (DRDL) with the environmental aspects of land management being the responsibility of the Department of Environment and Conservation (DEC).

2.3 Mining Operations Overview

Mining at Cooljarloo is undertaken using dry mining methods (Figure 4) to access the upper to mid ore-bodies and dredge mining (Figure 5) to access lower grade ore deeper in the profile. The following sections describe key mining, rehabilitation and process waste disposal aspects at Cooljarloo.

2.3.1 Mining Operations

A description of both mining operations is provided in Table 1. In this table some of the processes are similar and therefore grouped, however both mines are discrete units with few overlapping processing aspects.

Figure 2: Location Map

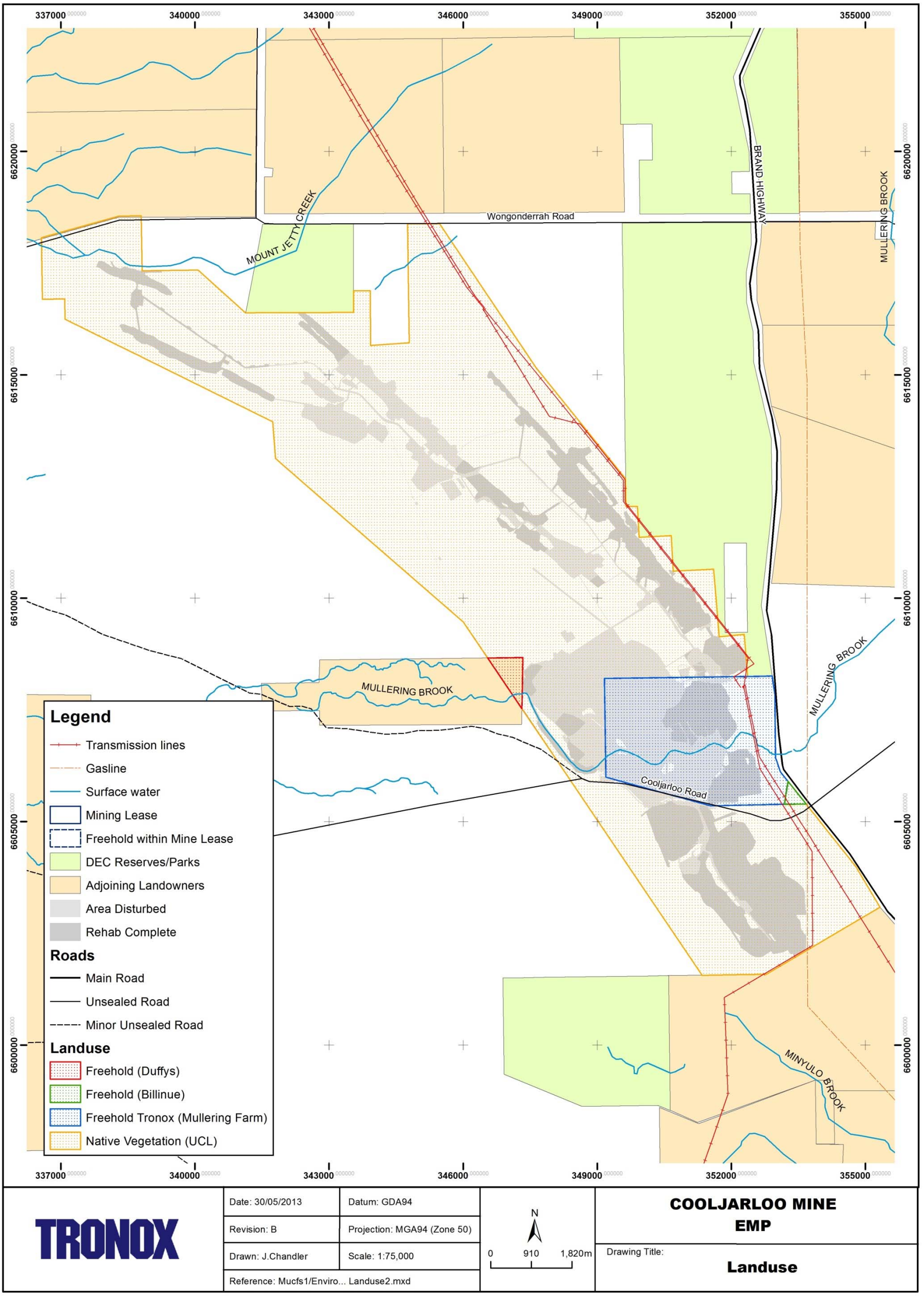


Figure 3: Land Tenure

Table 1: Mining Process

<table>
<tr><th>Dry Mining</th><th>Dredge mining</th></tr>
<tr><td> 
Figure 4: Dry Mining</td><td> 
Figure 5: Dredge Mining</td></tr>
<tr><td colspan="2">The site is prepared by harvesting, clearing, stripping topsoil and removing the upper overburden using excavator and truck.</td></tr>
<tr><td>Dewatering pumps are used to evacuate water from the active mining pit in areas below the water table. This water is generally utilised in the process or stored in water holding dams for later use.

Bulldozers push material into an in-pit hopper to screen the ore and remove oversize.

Water is then injected to create a slurry that is pumped to the trommel to remove the oversize.</td><td>Dual dredges are operated capable of mining to 25 m below the water surface. Ore is dredged then pumped via a floating pipeline to the wet concentrator situated behind the dredge in the pond.

Process water used at the concentrator is obtained from the dredge pond, nearby abstraction bores and decant water from the tailing dams. Water overflow from the various processes are recycled to the pond.

The ore slurry is screened through a trommel to remove oversize.</td></tr>
<tr><td colspan="2">The slurry ore is passed through a series of hydro-cyclones to separate the fine slimes fraction.</td></tr>
<tr><td colspan="2">The remaining ore is passed over the gravity spiral circuits which upgrade the ore to a heavy mineral concentrate (HMC).</td></tr>
<tr><td>Sand tailing rejects are deposited in nearby tailings storage facilities. Slimes tailings rejects are deposited in external solar drying cells.</td><td>Sand tailings rejects are deposited in the dredge pond or nearby tailings storage facility. Slimes tailings rejects are deposited in external solar drying cells.</td></tr>
<tr><td colspan="2">HMC is pumped to a land-based stockpile where it is allowed to drain and is then transported by road for further processing at Chandala.</td></tr>
<tr><td colspan="2">Final landform is created by backfilling and or shaping prior to rehabilitation with topsoil, seed and organic mulch.</td></tr>
<tr><td colspan="2">Rehabilitation transforms the new landform into land suitable for the post mining land use. Similar rehabilitation processes are employed at both mines as described in this document.</td></tr>
</table>

2.3.2 Rehabilitation

Planning for the rehabilitation process commences well in advance of ground disturbance. Pre-disturbance vegetation surveys and data collected from reference sites in undisturbed native vegetation are used to characterise the vegetation and develop targets for native vegetation rehabilitation.

In UCL areas, native vegetation communities are simplified from around 27 into four key Rehabilitation Vegetation Groups (RVG). The RVG's include a range of woodland and heath communities developed to broadly represent the species composition of the reference vegetation communities. Each RVG is associated with a set of soil characteristics defined from baseline reference sites. A planning matrix is used to match each RVG with a suitable soil profile and source of mulch. Native seed mixes are tailored to suit each RVG, with a keystone species model applied to manage the relative abundance of the key vegetation components recorded in native systems.

Tronox progressively backfills and rehabilitates disturbed areas as they become available. Plans are developed ahead of mining for landforming and rehabilitation as an integrated part of the mine planning process. Critical resources including topsoil, mulch, native seed and soil profile materials are identified, characterised and selectively managed according to site specific rehabilitation plans.

The final landforms are integrated with pre-existing surrounding landforms and the continuity of existing drainage lines from east to west is maintained. Rehabilitated soil profiles comprise various classes of overburden and/or tailings material appropriate for the final land-use. All soil profiles are designed to maximise infiltration and minimise the risk of overland flow. To minimise erosion risks, dispersive materials are identified during the mining process and buried at depth or treated with gypsum.

Rehabilitation plans are developed encompassing details of landform construction, topsoil/mulch placement and native seed application with approval and sign-off by the relevant line managers. Each plan aims to optimise the collection, storage and use of available resources based on pre-mining survey.

Landform development (backfilling and shaping) is conducted year round with maximum slope angles of 1:12 and the installation of infiltration banks where the potential for overland flow exists. Topsoil and mulch is targeted for application between March and May. In native vegetation areas topsoil is collected and spread in two cuts with the first (upper) cut comprising approximately 50 mm and the second cut approximately 200 mm. In agricultural areas a single cut of at least 100 mm of topsoil is collected and spread in rehabilitation areas.

Native vegetation rehabilitation areas receive a minimum of 10% fresh topsoil (topsoil that has been stockpiled dry for less than 9 months) or direct returned. Ripping is predominantly conducted after second cut topsoil has been placed to minimise compaction. A stabilising cover crop is then seeded, followed by native seed placement and stabilisation with mulch.

Each phase of rehabilitation establishment is recorded in Rehabilitation Operations Sign-off files developed for each rehabilitation area. This recording process captures all relevant data required to assess the successful completion of areas against the rehabilitation objective and completion criteria. Figure 6 shows a Woodland RVG at three years of age.

Figure 6: Woodland Rehabilitation (Year 3)

2.3.3 Waste Facility

Within Mullering Farm, Tronox operates a licenced Class lll waste disposal facility. This facility receives waste products from processing facilities at Chandala and Kwinana. The Cooljarloo site is approved to accept up to 500 000 wet tonnes of process waste each year.

The major constituents of the process waste are outlined below in Table 2.

The Cooljarloo waste facility has been designed, constructed and operated to minimise pollution. General requirements include;

- Establishing a liner for each pit with a permeability of less that 10^{-9} m/s;
- Pit capping with a low permeability layer;
- At least 2 m of overburden placed prior to rehabilitation;
- >100 m from Mullering Brook; and
- >3 m separation from the base of the pit to the water table.

Figure 7 shows the construction of the current waste cell during 2005.

Table 2: Indicative Process Waste Constituents

Waste	Source	Characteristic	Indicative Proportion
Filter cake (SRE)	Chandala SR Plant	Predominantly iron-oxide and calcium sulfate with some heavy metals.	~3%
Filter cake (IO/NAE)	Chandala SR Plant	Predominantly iron-oxide and calcium sulfate with some heavy metals. Benign material useful as a soil conditioner.	~23%
Pugged waste	Chandala SR Plant	Pugged Waste (iron oxide and char) or liquor pond solids or slurry (iron oxide).	~9%
Waste fines	Chandala SR Plant	Partly combusted coal from the SR kiln.	<1%
Pre-screen tailings	Chandala Dry Mill	Clay and oversize waste sand.	~9%
White tailings and screen 1 and 2 oversize	Chandala Dry Mill	Benign waste sand.	~13%
Coarse rejects	Chandala Dry Mill	Coarse sand containing up to 0.5% monazite, a low-level radioactive material.	~13%
Filter cake	Kwinana	Metal hydroxides.	~30%

Figure 7: Construction of Waste Cell (2005)

2.4 Future Operations

2.4.1 Process Waste Disposal

Process waste disposal is likely to operate beyond the life of the Cooljarloo Mine assuming an alternative feedstock supplies the Chandala and Kwinana Processing Plants. Figure 8 shows the process waste tipping face. Figure 9 shows the current waste landfill and planned extension which will maintain capacity for the current operations until around 2016. Further extensions will be developed as required and submitted as separate Works Approvals prior to commissioning.

2.4.2 Mine Plan

Mining at Cooljarloo is expected to extend through to 2026 within ore bodies located in the central and northern areas of the Lease. The Dredge mine is expected to mine broadly in a northerly direction from its current location through GR6, 27000E, 20500 and 27300 ore-bodies as indicated in Figure 10. The Dry mine will continue mining within the 20500 orebody up to 2014/15 after which it is expected to relocate to prospects outside of the mining lease during 2014.

Figure 8: Process Waste Disposal

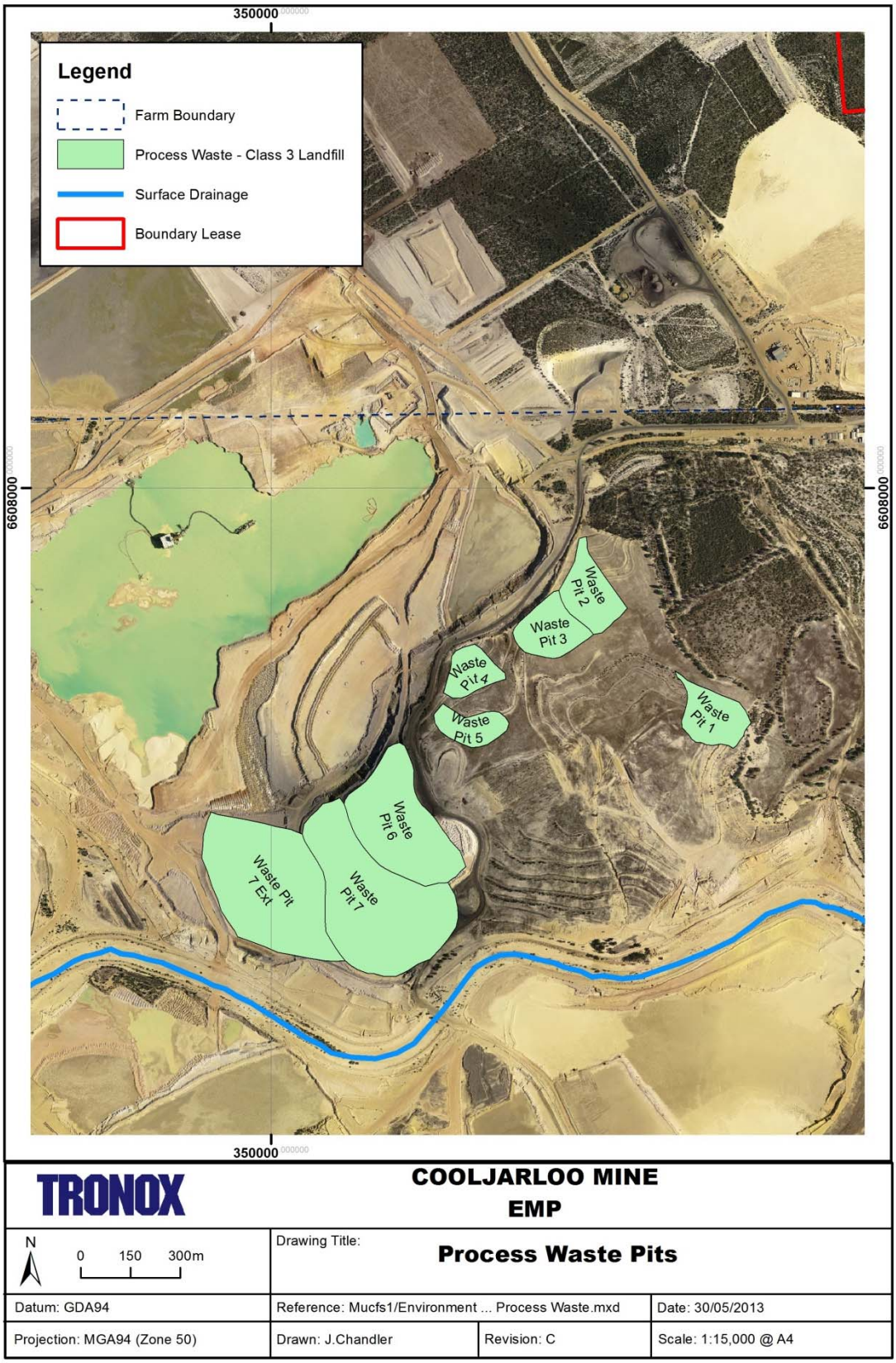


Figure 9: Process Waste Pits

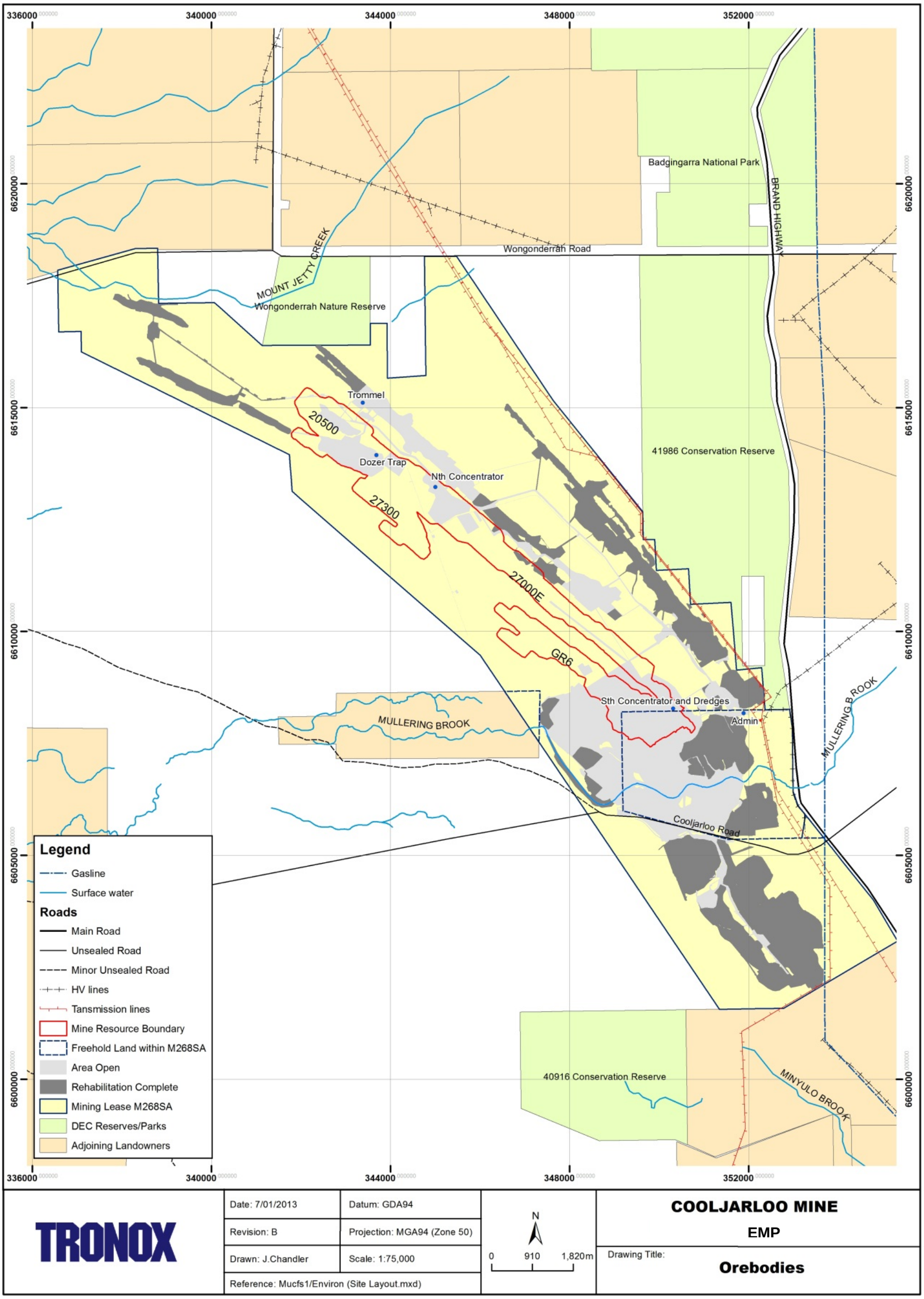


Figure 10: Orebodies

3 Environmental Context

3.1 Climate

Cooljarloo experiences a dry Mediterranean type climate consisting of hot, dry summers and cool, wet winters. Site specific climatic data has been collected at Cooljarloo since 1990, including various parameters relating to rainfall, evaporation, humidity, wind speed/direction and soil/air temperature.

The area receives an average annual rainfall of approximately 510 mm (5 year site average) with June and July typically the wettest months of the year. The dry summer months may be subject to infrequent but heavy, rainfall events. Temperatures range from a mean maximum of 34.9°C in January to a mean minimum of 9.0°C in July (5 year site average). Easterly winds are dominant in the morning throughout the year, particularly in summer. The afternoon wind pattern is variable with strong south-westerlies a feature during the summer months (Maunsell 1987).

Figure 11 shows the cumulative rainfall for the past three years and the five year average taken from the Cooljarloo weather station.

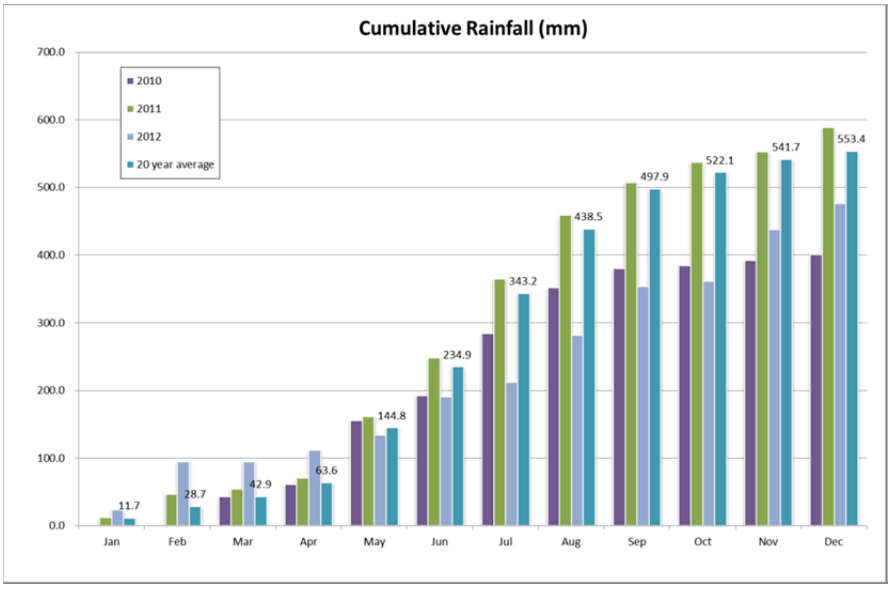


Figure 11: Cumulative Rainfall

3.2 Geology

Cooljarloo is located within the Swan Coastal Plain, a major geomorphologic division of Western Australia, to the west of the Gingin Scarp. Extensive geological survey and interpretation has been conducted on site by Tronox Geologists and consulting professionals as a part resource development, aquifer characterisation and environmental baseline surveys (Figure 12).

The mineral sand deposits occur at the top of a series of sedimentary deposits, within a sequence of relatively recent (Quaternary) unconsolidated sands (Maunsell et. al. 1987).

They generally originate from the adjacent Yilgarn Block, which has been eroded, transported by rivers and streams and deposited as beach sands along former coastlines (Maunsell et. al 1987).

The deposits now form successive north-south linear deposits well inland from the present coast. Upper level deposits that either outcrop or are covered by minimal amounts of non-mineralised material (overburden), occur in the northern half of the tenement. Mid-level deposits are covered with varying depths of overburden. The basement deposits occur below the mid-level deposits and are typically more weathered and of lower heavy mineral grade.

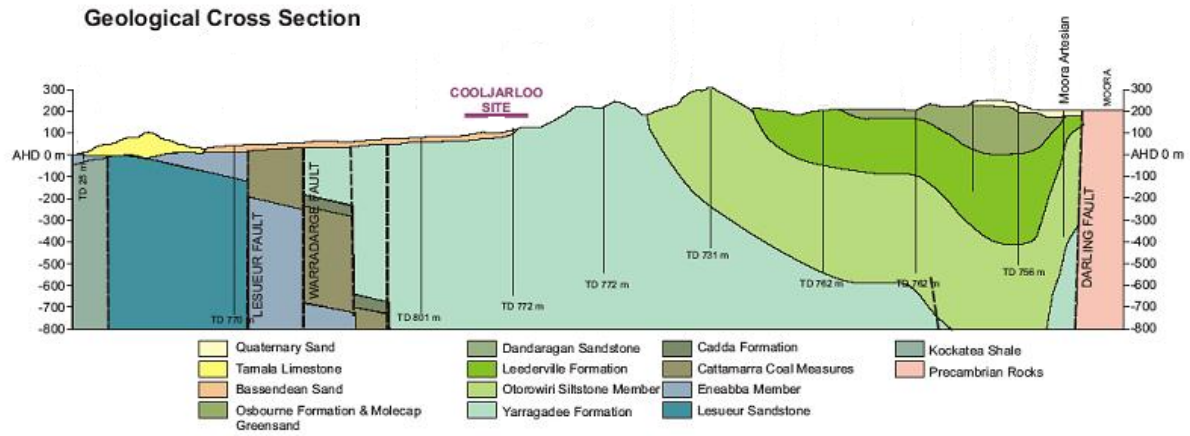


Figure 12: Regional Geological Cross Section (from Parsons Brinckerhoff, 2012)

3.3 Landforms

The site is bounded on the east by a distinctive terrain dominated by dissected remnant hills of the Ridge Hill Shelf where unconsolidated surficial deposits (colluvium) have built up and dominate slopes (Blandford 2011). Immediately to the west of the elevated terrain lies an extensive Bassendean sand complex comprising sand dunes, inter-dunal basins and sand plains with a gently undulating surface (Blandford 2004). The difference in elevation from the eastern ridge to the low-lying inter-dunal basins in the west is around 80 m.

Several surface drainage systems exist which appear to be older systems truncated by sand dunes and sheet sands that were deposited during the onset of aridity (Blandford 2004). Many of the contemporary drainage systems and wet areas have developed on materials with elevated clay and have impeded vertical infiltration (Blandford 2004). Two seasonal surface water channels exist which flow from the east to west (Mullering Brook and Mount Jetty Creek).

3.3.1 Soils

The Northern Sandplains are characterised by sandy surface soils, sometimes underlain by sandy material and sometimes by heavier soils and cemented materials (Blandford 2004). The Cooljarloo lease displays an accumulation of Tertiary ferricrete in the soil profiles of the

eastern uplands (Blandford 2004). In areas where the debris was weathered and transported down slope, secondary cementation has often occurred in depositional areas of the Western Lowlands sometimes resulting in massive ferricrete (Blandford 2004).

Several significant soil investigations have been undertaken at Cooljarloo to map the soil landscapes and to collect baseline reference data. Most notably Blandford and Associates surveyed the Cooljarloo Site in 2001 excavating over 300 soil pits to characterise the soil profiles across site. The resulting soil map is provided in Figure 14. Further interpretation has been undertaken using available drilling data to assess soil texture to depth in the profile.

Broadly speaking, there are two vertically distinct horizons over much of the Cooljarloo Lease - the upper sandy profile and a deeper horizon with higher clay content. Figure 13 shows a north-south cross section of the soil profile at Cooljarloo based on drilling data (fines content) and Figure 15 shows a plan view of the fines percentage in the top 6m of the soil profile. Further detail is provided below.

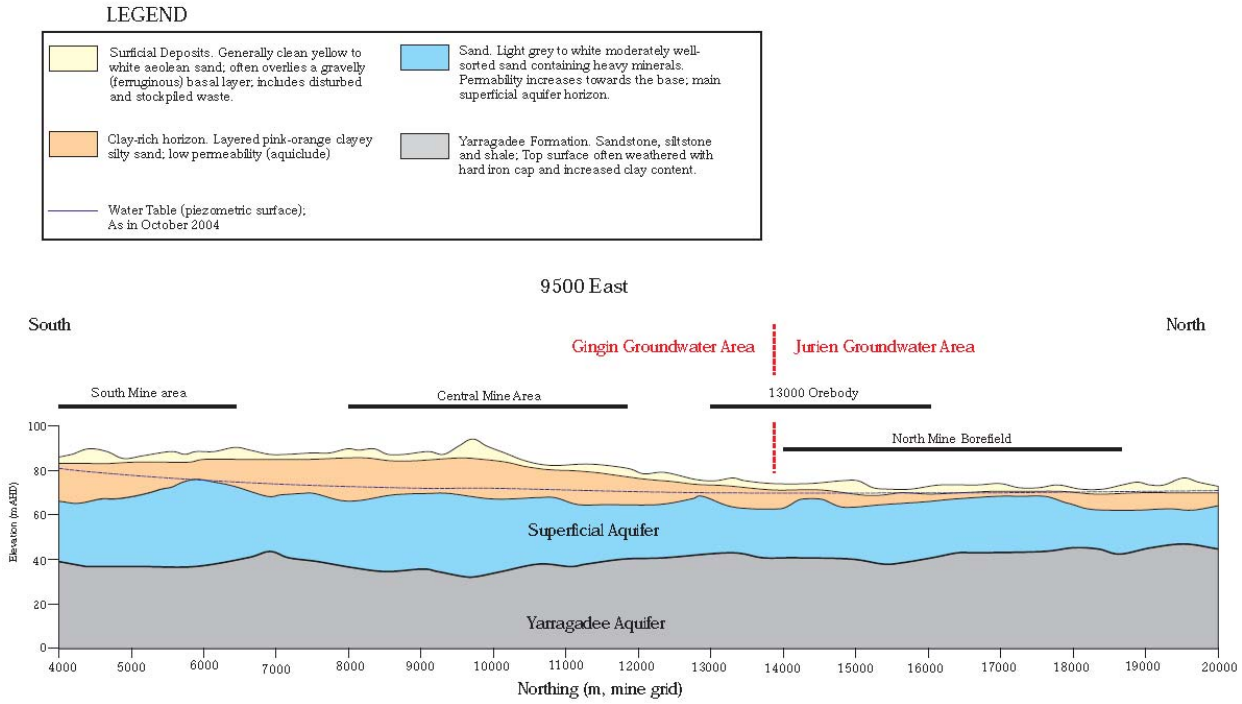


Figure 13: Cross Section Soil Profile

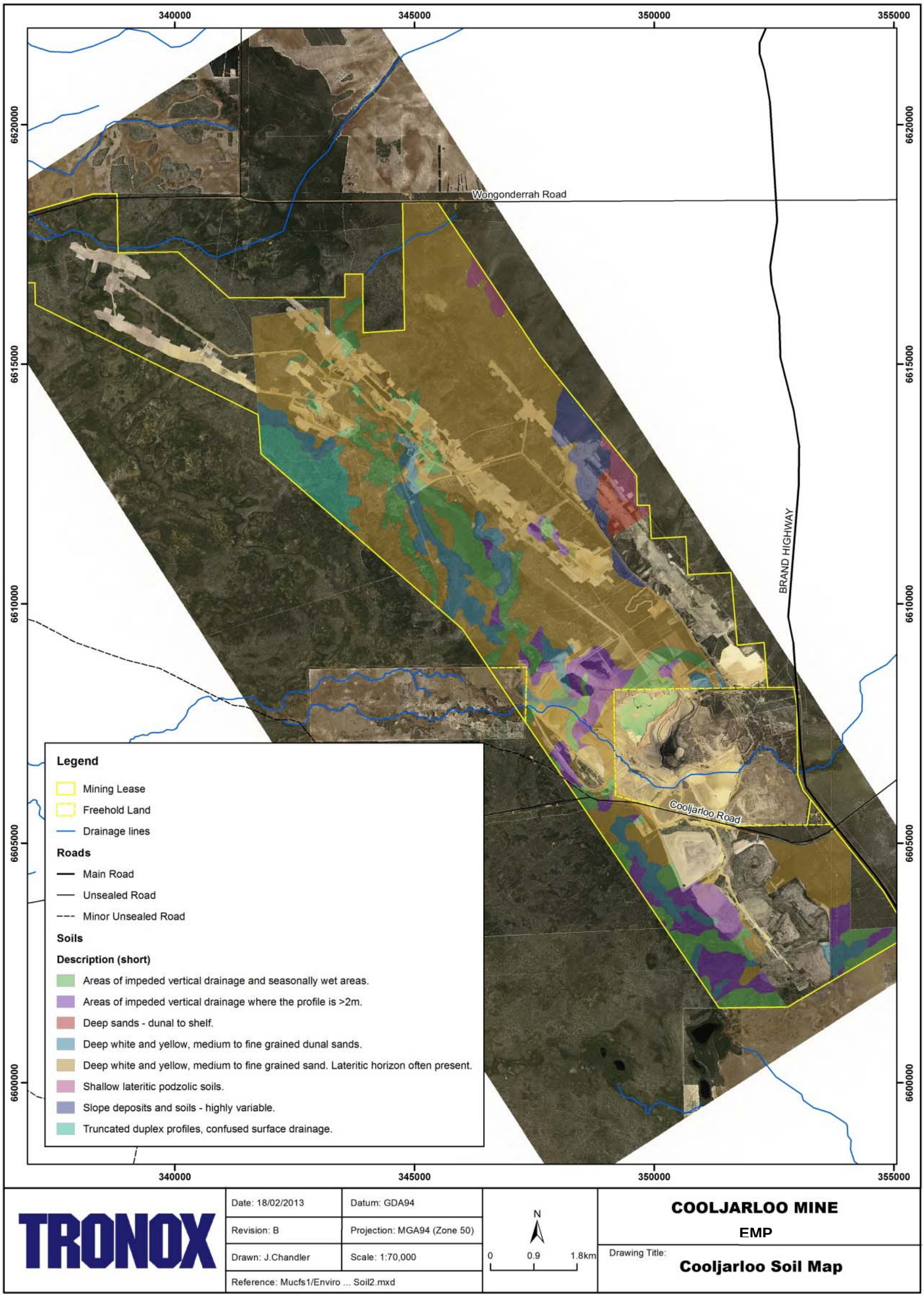


Figure 14: Cooljarloo Soil Map

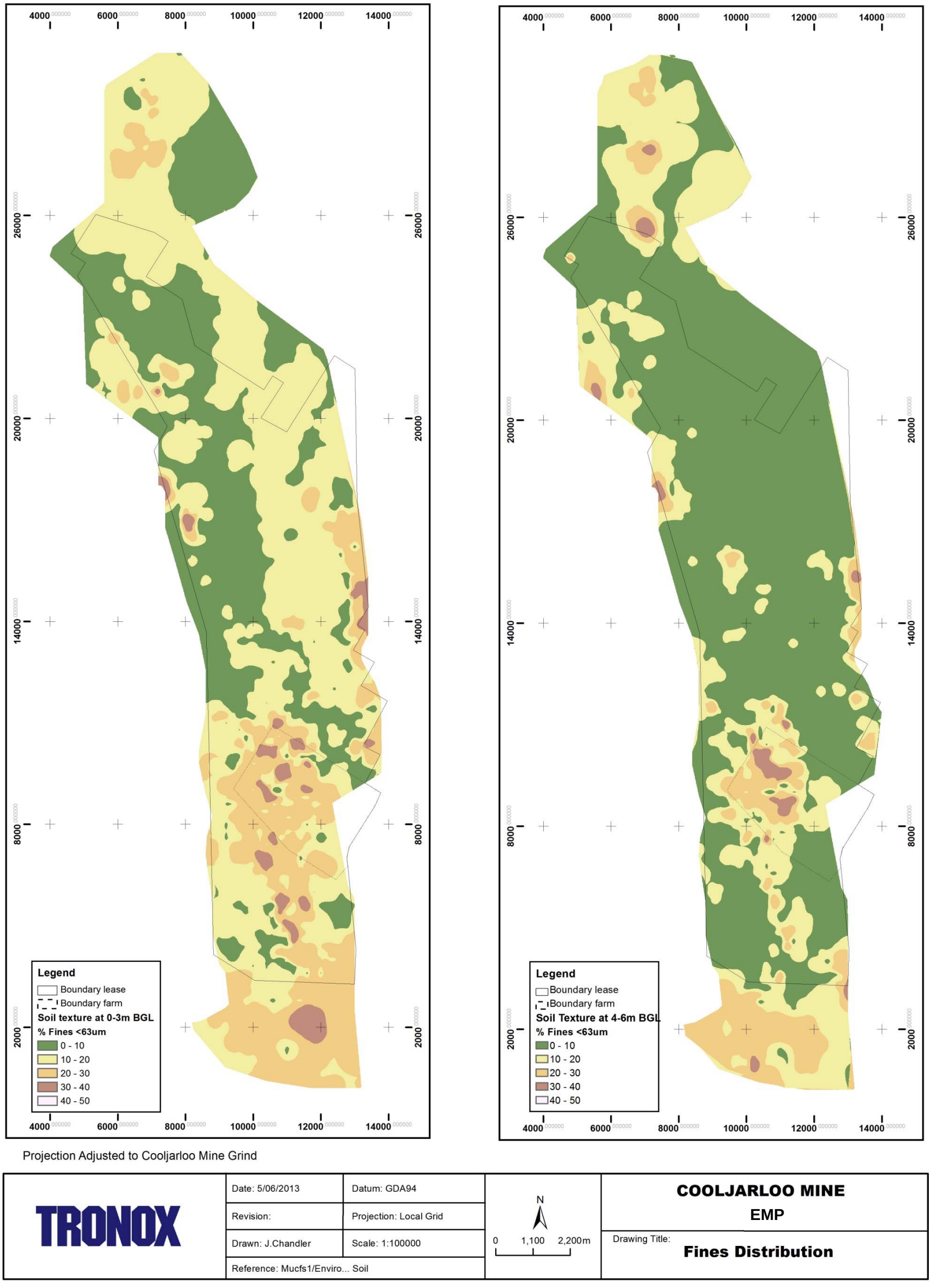


Figure 15: Fines Distribution

3.3.2 Surface Sands

Surface sands are characterised by range of properties that influence the vertical movement of water and the retention of moisture in the profile (Blandford 2004). These properties include (from Blandford 2004):

- Particle size ranging from very fine to coarse grain size sands which strongly influences profile permeability and soil moisture retention;
- Degree of sorting which influences permeability, soil moisture retention and erodibility; and
- Presence of fabric development generally found in finer grained sand, indicative of pedologic processes which can indicate increased soil moisture retention capabilities.

These surface sands typically have a clay content of approximately 1%, silt content between 1-2% and fine sand content of 18-26% (Blandford 2004). In situ bulk densities in reference sites have been measured ranging from 1.14 - 1.78 t/m^3 (1.54 t/m^3 average) and a soil strength average of 1.2 kg/cm^2 (Blandford 2012). The sand materials are generally non-sodic and nutrient deficient (Blandford 2004). Soil moisture retention in this sandy material is typically low with between 1- 4% plant available water. Surface infiltration rates are high, in excess of 1,000 mm/hr (Blandford 2004).

Figure 16 shows a typical surface sandy profile in a pit excavated to the north of the lease.

Figure 16: Sandy Upper Soil Profile

3.3.3 Deeper Clay zone

Underlying the sand sheet is a discontinuous layer of material with higher clay content than the overlying sands (Blandford 2004). This soil profile is often known as a "duplex soil". The layer varies in depth and thickness and contains sediments with variable clay content. In some areas this layer is absent and the upper sand layer continues to depth.

The clays at Cooljarloo are dominated by the kaolinite group however the smectite group have also been identified in the field in limited areas (Blandford 2004). Heavier clays exist in some areas close to the surface which have low permeabilities and impeded vertical drainage. These areas are typically associated with seasonally wet areas (Blandford 2004).

In places the clay horizon is associated with or overlain with ferricrette gravels of varying thicknesses (Blandford 2004). In some areas this gravel layer results in a zone of preferred lateral flowthrough due the high permeability of the materials. Where this gravel layer rests on the clay layer it can be associated with a zone of elevated soil moisture at depth (Blandford 2004).

This clay material can be sodic and dispersive in places. Its soil moisture retention varies greatly, closely linked to the proportions of clay and fine silt present (Blandford 2004). Figure 17 shows a typical clay profile overlain by the sandy upper layer.

Figure 17: Duplex Soil Profile

3.3.4 Soil Vegetation Associations

Woodman Environmental Consulting utilised the Blandford soils data to develop vegetation - soil associations for the purposes on rehabilitation planning in 2002 and later revised this in 2012. Table 3 below is based on the data taken from Woodman 2012. Further detail on the composition of each vegetation group is provided in Section 3.8.

Table 3: Landform and Soil Characteristics of Rehabilitation Vegetation Groups

Rehabilitation Vegetation Group	Landform Characteristics	Soil Type and Characteristics
Dry Woodland	Dune mid and upper slopes and crests where water table does not approach within 2 m of the surface.	Upper profile: Sand from 1m to deep sands >3 m. Lower profile: Impeding layer not always present. Generally a gradation to a mottled clayey matrix at depth, sometimes with a laterite component.
Dry Heath	Lower slopes and undulating country that remain dry all year.	Upper profile: Sand from 0.5 to 1.5 m, generally <1 m with deeper sands near edges of Vegetation Group. Lower profile impeding layer: Generally a gradation to a mottled clayey matrix, however lateritic/clay layers are common.
Wet Heath	Lower slopes and in wet basins that may become waterlogged or inundated seasonally.	Upper profile: Sand from 0.3 to 1 m, generally around 0.5 m to sandy loams and clays Lower profile impeding layer: Not always present. Generally a lateritic/clay layer and siliceous pans may occur, however the water table often acts as a barrier to root development.
Wetland	Wet basins with frequent inundation.	Upper profile: Sand from 0.6 m to deep sands. Sandy loams and clays in some areas. Lower profile impeding layer: Not always present. Generally a clay layer and siliceous pans may occur where wetlands are perched above the water table. Wetlands that are not perched may have no impeding layer.

3.4 Potential Acid Sulphate Soils

Acid Sulphate Soils are naturally occurring sediments that contain iron sulfide minerals, predominantly as the mineral pyrite. These materials are typically found below the water table and are benign when undisturbed, but have the potential to cause environmental problems due to the release of sulphuric acid when exposed to oxygen (due to dewatering or during the excavation of soils and sediments) (DEC 2011 in Prep).

Pre-mining surveys have been undertaken as a part of standard exploration and resource drilling at Cooljarloo. An Acid Sulphate Soil (ASS) assessment was most recently submitted to the DMP/DEC in 2007 relating to the Dry Mine Falcon Extension in 2007. The findings of this investigation indicated the presence of potentially acid sulfate soils within the soil profile were typically restricted to depths of more than 2 m below the proposed pit floor and would not be exposed disturbed in mining (Tiwest 2008).

Of the pre-mining soil data collected to date, less than 2% contain appreciable sulphides greater 0.03% (Chromium Reducible Sulfur (S_{cr})). These samples typically occur in isolated areas generally confined to the north and tend to be within a lithological unit represented by black/grey clays, which are generally located beneath the ore-body. The large majority of the black/grey clays encountered whilst mining to date are non-sulfidic and appear to consist of variably decomposed organics and peat (SWC 2012). Although Suspension Peroxide Oxidation Combined Acidity (SPOCAS) test work tends to suggest sulphides are present, with strong to extreme reactions following peroxide addition, the Chromium Reducible Sulphur results indicate in most cases the material is non-sulfidic with S_{cr} values <0.03% (SWC 2012).

3.5 Radiation

Mineral sands typically contain low level naturally occurring radioactive minerals including Monazite, a thorium bearing mineral (Tiwest 1989). Gamma radiation surveys were undertaken to characterise the baseline radiation levels at Cooljarloo (Terry 1989). Follow-up surveys were undertaken for ore-bodies in the Falcon Extension during 2007 (Calytrix 2007).

Baseline monitoring of radionuclides and absorbed dose rates were undertaken prior mining operations. The mean effective dose equivalent for radionuclides in air and absorbed dose rate in air, obtained for the baseline monitoring programme, was 0.27 mSv y^{-1} and 0.8 mSv y^{-1} respectively. This yielded a baseline background level of 0.83 mSv y-^{1} (Tiwest 1989). Baseline groundwater gross alpha activity was below the minimum detectable limits in most bores (Tiwest 1989).

3.6 Groundwater

An understanding of regional groundwater around Cooljarloo has been developed with a combination of regional investigation programmes by Government and site specific investigations completed by consulting specialists. A description of the key features as described in Parsons Brinkerhoff (PB 2012) is provided below.

From surface, a series of Middle to Late Tertiary Formations are collectively termed the Superficial deposits. The Superficial deposits host a predominantly unconfined regional groundwater flow system (superficial aquifer) which receives recharge over a broad area (PB 2012). Groundwater in the superficial deposits flow westward from the Gingin Scarp to discharge along the coast.

At depth, the Cooljarloo site is underlain by a thick layer of Jurassic age Yarragadee Formation. The Yarragadee formation is a significant groundwater resource that is generally greater than 50 m below surface at Cooljarloo. Groundwater flow in the Yarragadee aquifer is in a westerly direction and the recharge zone is between the Gingin and Dandaragan Scarps (PB 2012) (Figure 11).

Further detail on the two distinct aquifers is provided below.

3.6.1 Superficial Aquifer

Description

The Cooljarloo mineral sands deposit is an undifferentiated formation contained within the Guildford Formation, a Quaternary sequence of Pleistocene age (Darragh and Kendrick, 1971). The economic deposits of heavy minerals are associated with reworked coarser coastal sands, and occur at depths of approximately 15 to 30 m below the surface and above the Yarragadee Formation. These sands form the main aquifer unit in the Superficial deposits at Cooljarloo (PB 2012).

The overburden composition is fundamentally different in the North Mine and South Mine areas. The superficial formation profile in the South Mine area contains a significant thickness of clayey and silty, fine sand layers above the marine strand sands. These low permeability formations are either very thin or absent in the North Mine area. (PB 2012). The sequence is mantled by up to 6 m of aeolian Bassendean Sand which conformably overlies the Guildford Formation (PB 2012).

The clay-rich layer is thickest in the southern areas where the water table occurs within the clay-rich confining layer and accounts for the confined aquifer responses noted in some aquifer pump tests (PB 2012). There are also several areas where the clay layer is thin or absent. The water table is likely to be unconfined in these areas.

The Superficial aquifer is recharged primarily by direct infiltration of rainfall, supplemented by both seepage from runoff, and upward leakage from the Yarragadee Formation. Downward leakage from the Superficial deposits also occur in some locations. In cross sections generated from this work, Kern indicates an upward hydraulic gradient is present in the Yarragadee Formation in the vicinity of the Cooljarloo Mine site (PB 2012).

Recharge from direct precipitation has been estimated to be between 7.5% and 8% per annum over the coastal plain sands (PB 2012a), excluding upward flow from the Yarragadee Aquifer. This approximately corresponds to a recharge rate of 40 mm/yr.

Water Quality

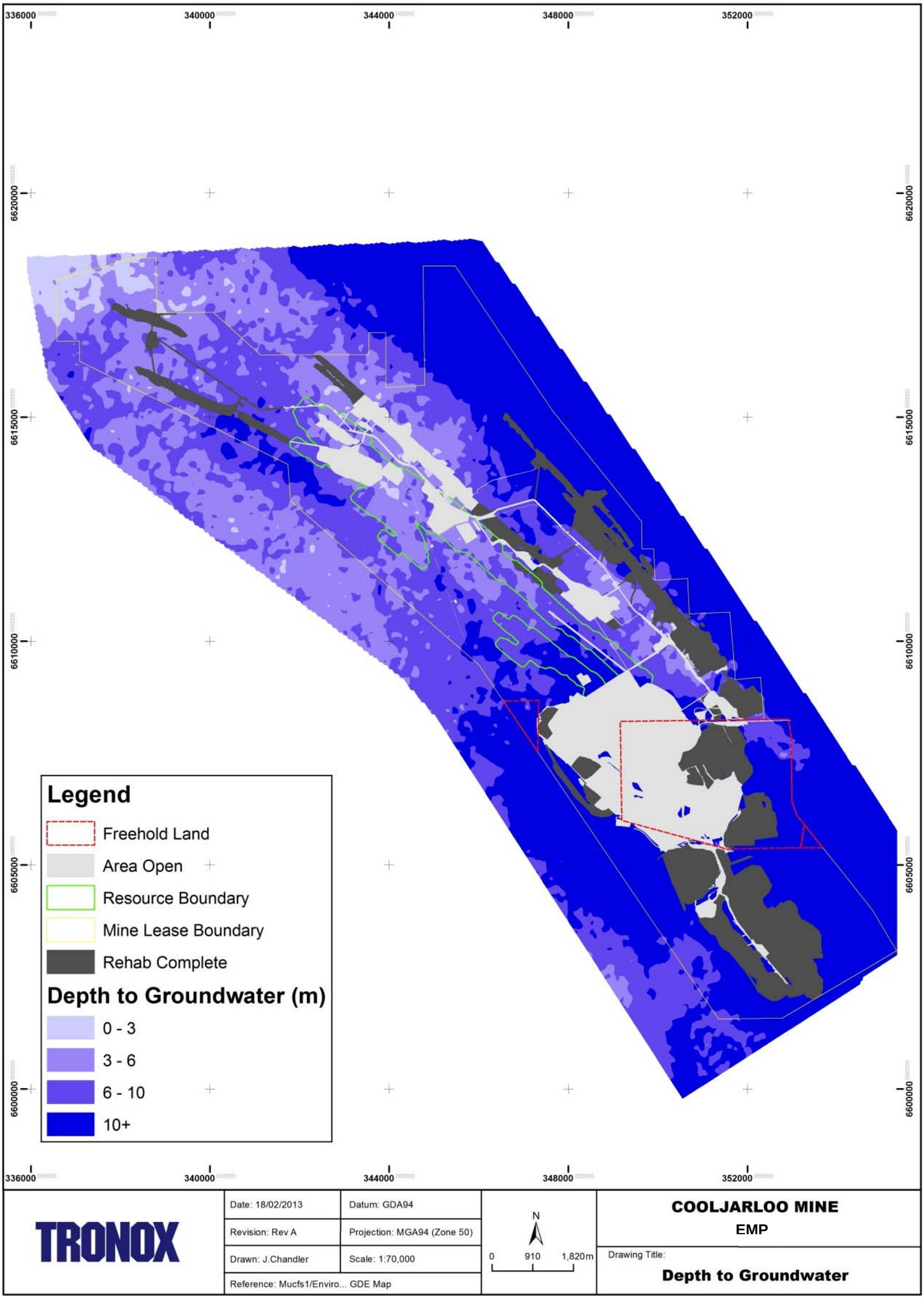
Pre-mining baseline data indicates that the water quality within the Superficial aquifer ranges from around pH 3.4 (10 year average MSB03) in the north mine to maximum pH 5.9 (10 year average MSB09) in the south of the mining lease. Seasonal variations are evident in the Total Dissolved Solids (TDS) levels in the Superficial Aquifer and are inherently higher towards the northwest of the site (Parsons Brinckerhoff, 2012). Baseline TDS levels range from a minimum of 514 mg/L (10 year average MSB05) in the south to 3,214 mg/L (10 year average MSB02) in the north. TDS levels increase further north in the Falcon Project area.

Water Levels

The seasonal variation in water levels observed in piezometers in the Superficial aquifer across Cooljarloo averages approximately 1.5 m, peaking in around October each year. Depth to groundwater ranges from >10 m in the south of the lease shallowing to the north to <3 m in some places as shown in Figure 18

Hydrological drawdown modelling has been conducted to assess the likely drawdown associated with mining operations (PB 2012). Local temporary drawdown around mining voids is common due to dewatering within the mining pit or pond. Drawdown has the potential to impact groundwater dependant vegetation and is managed in-line with established Groundwater Management Plans for specific locations.

Areas of groundwater dependant vegetation are generally confined to the northern areas of the lease where the depth to groundwater is relatively shallow. The degree to which vegetation is groundwater dependant decreases with depth to groundwater. For vegetation in areas where the water table is greater than 10 m from the surface the groundwater dependence is assumed to be negligible in terms of total plant water use (Froend & Zencich, 2002).



Note: Depth to water levels outside the mining lease is likely to be erroneous as the data available for this map was limited.

Figure 18: Depth to Groundwater

3.6.2 Yarragadee Formation

The Yarragadee Formation occurs between 30 m and 50 m below the surface over much of the Mining Lease, but outcrops in places to the east. Testing, numerical modelling and water level monitoring indicates that the Yarragadee and Superficial aquifers are in hydraulic continuity for the majority of the site (PB 2012).

The Yarragadee Aquifer varies in composition from thin shale and coal units, to clean siltstones and thick coarse grained sandstones with primary porosity and permeability. Fracturing and faulting are present but not prevalent, and the aquifer in the eastern portion of the site appears to be uncharacteristically low yielding (PB 2012).

Water quality in the Yarragadee tend to be slightly acidic (pH 6.4 - 6.7) and TDS from 565 - 750 mg/l (Tiwest 1997). Water quality measured in the Yarragadee at Cooljarloo typically has a higher pH and lower TDS that in the superficial aquifer.

3.7 Surface Water

The occurrence of surface water at Cooljarloo is limited by the generally permeable surface sands and dry climate. Two ephemeral waterways pass through the Cooljarloo Lease including:

- Mullering Brook which bisects the lease draining a catchment in Gingin Scarp into a series of ephemeral lakes and swamps to the west of Mullering Farm (Tiwest 2008) (Figure 19); and
- Mount Jetty Creek which crosses the north east lease boundary and drains a catchment to the east of Wongonderrah Nature reserve forming a tributary to Nambung River (Tiwest 2008).

Lesser drainage lines carry intermittent flows from the Gingin Scarp onto the lease area where they dissipate in the sandy terrain.

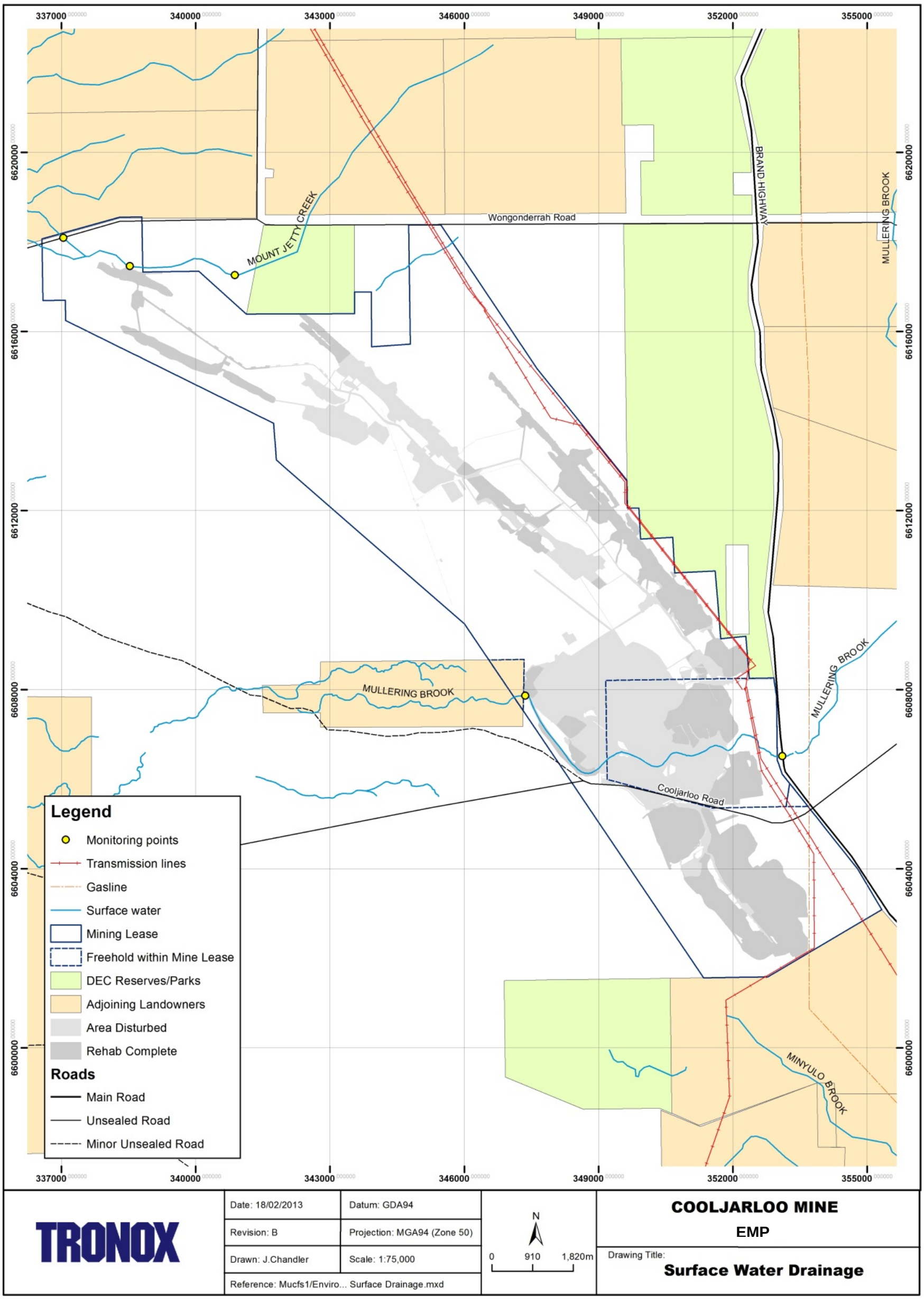


Figure 19: Surface Water Drainage

3.7.1 Mullering Brook

Mullering Brook streamflow and water quality has been measured since 1996 at the current two locations, one upstream and one downstream of the Cooljarloo operations (Figure 20). This data has been used to characterise various aspects of the watercourse as it enters and leaves the lease.

Flow is usually less than four months a year, typically during winter. Catchment flow modelling indicates a 10 year Average Reoccurrence Interval (ARI) is predicted to have a flow rate of up to 65 m^3/s (Golders 2003) in Mullering Brook. Flooding of the main Mullering Brook channel and across Cooljarloo Road has been recorded at flow rates of above 10 m^3/sec (Halpern Glick Maunsell 1996).

Water quality entering the lease has a Total Dissolved Solids (TDS) range of 200 to 6,600 mg/L and a Total Suspended Solids (TSS) range between <1 and 1,130 mg/L depending on the seasonal flow characteristics. Heavy metal concentrations are low and tend to be below detectable limits for most metals.

Figure 20: Mullering Brook Gauging Station

3.7.2 Mt Jetty Creek

Prior to mining the adjacent ore-bodies, flood modelling was conducted by Parsons Brinkerhoff to assess the characteristics of various flood events (PB 2006). Modelling results suggest that peak flow rates exceeding a 10 year ARI overtop the Mount Jetty Creek catchment and spill into the neighbouring catchment to the south (PB 2006).

Stream flow and water quality has been monitored since 2007 (prior to mining) at three locations. Stream flow was recorded in Mount Jetty Creek during 2007, 2009 and 2011 with

no flow recorded in the intervening years. Water quality indicators appear to vary considerably between monitoring locations and sampling dates with no discernible spatial or temporal trends evident in the water quality to date.

3.8 Vegetation and Flora

The sandplains of south-west Western Australia support vegetation communities generally referred to as Kwongan. Kwongan typically includes heath and woodland elements (Ekomin 1987) and is known for high species diversity and a high degree of endemism. Kwongan vegetation is adapted to the nutritionally impoverished sandy soils and the growth form of plants is principally determined by the availability of soil moisture.

Consistent with the native vegetation of the Northern Sandplains, UCL areas within the Mining Lease are considered to have a high biodiversity value (WEC, 2008). The area comprises a diverse range of upland and wetland communities and a very high rate of species turnover between sites.

Site surveys show there are up to 91 plant taxa per 80 m^2 in some heath communities within baseline reference plots at Cooljarloo (WEC 2012). Both wetland and wet heath communities have been shown to be the most diverse communities which include a large number of species at the ends of their ranges, especially in the wetland areas. The drier heath and woodland communities tend to show a greater level of homogeneity between sites (WEC 2012).

Numerous flora and vegetation studies have been undertaken within the Cooljarloo Mining Lease and surrounding areas including:

- Vegetation community mapping (Ekomin 1987, Mattiske 1996, 1997, Landcare Services 1999, 2002; Woodman 2007, 2009);
- Baseline reference plots for Rehabilitation Vegetation Types (Woodman 1999, 2002; 2012); and
- On-going routine Conservation Significant Species searches.

The following sections provide details relating to this work.

3.8.1 Vegetation Mapping

Baseline vegetation mapping at Cooljarloo is a composite of structural mapping conducted by Mattiske Consulting (1996 and 1997), habitat mapping conducted by Landcare Services in 2002 and floristic community type mapping conducted by Woodman Environmental Consulting during 2009.

This work has provided extensive flora species listing, detailed spatial vegetation maps and has provided data for the derivation of vegetation – soil associations. There are 27 different vegetation communities mapped at Cooljarloo.

There are no known Threatened or Priority Ecological Communities within the Cooljarloo Mining Lease (Nichols & Woodman, 2011).

3.8.2 Rehabilitation Vegetation Reference Plots

For the purposes of managing rehabilitation, the complex array of vegetation communities has been grouped into four Rehabilitation Vegetation Groups (RVG). The RVGs have been developed at Cooljarloo to broadly represent the baseline vegetation communities recorded within the Mining Lease. Rehabilitation Vegetation Groups are described below in Table 4 with the associated soil profiles discussed in Section 3.3.4.

Table 4: Rehabilitation Vegetation Groups

Rehabilitation Vegetation Group	Floristic Community Type (WEC 2009)	Vegetation Community Type (Landcare Services 2002)	Vegetation Community Type (Mattiske 1996, 1997)
Woodlands Dominant Species: *Banksia attenuatta, Melaleuca clavifolia, Hibbertia hypericoides*	9a; 9b; 10	BWT; BW; BWp; SH/BWT Complex; DSWp; 1b; 1f; SH/BW Mosiac	1a; 1c; 1a.1; 1a.2; 1d; 1e; 1g
Dry Heaths Dominant Species: *Banksia dallanneyi, Allocasuarina microstachya, Calytrix flavescens.*	11	DSLH; SLH; DSFH; LAT; 3a	3d; 3g; 3b; 2b; 3c; 2a
Wet Heaths Dominant Species: *Regelia ciliate, Banksia telmatiaea, Acacia lasiocarpa var. lasiocarpa*	2; 3; 4; 5; 6	SH; 3f	3e; 3h; 3k
Wetlands Dominant Species: *Melaleuca brevifolia, Melaleuca viminea subsp, Viminea, Kunzea micrantha subsp. petiolata*	1, 7; 8	SMT; DrW	3j; 3i; 4a; 4b; 4c

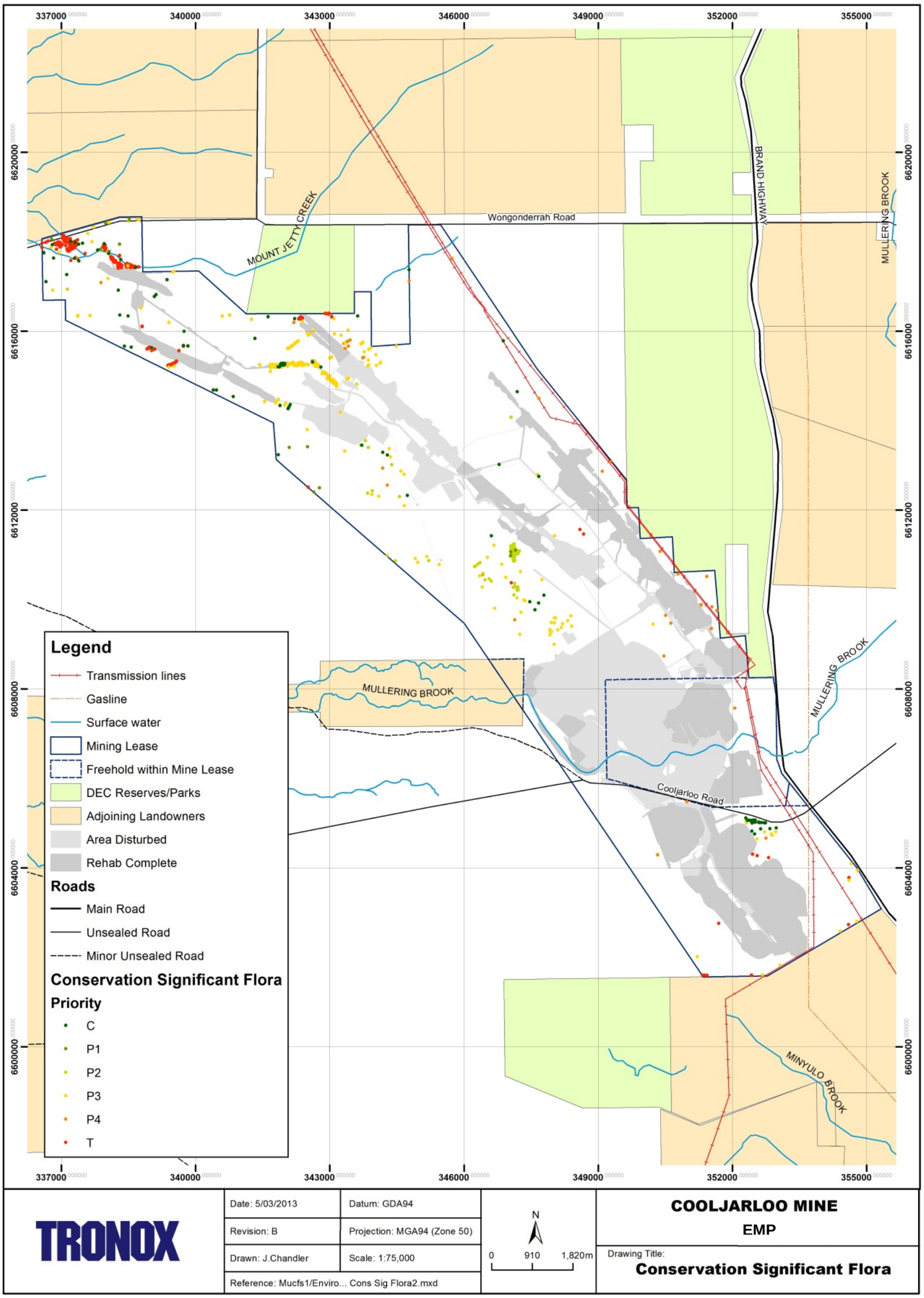
There are 44 baseline reference plots established in native UCL areas to collected data relating to a range of vegetation indices. Data from these plots are used to compare rehabilitation performance for each of the RVG established. It is expected that these plots will be monitored every 3-5 years to ensure the baseline reference plots remain current.

3.8.3 Conservation Significant Flora

Species listed as Threatened (T) under the *Wildlife Conservation Act* 1950 (also known as Declared Rare Flora (DRF)) are legally protected. Species that are poorly known are identified as Priority Flora (PF) and are also identified under the same Act.

Two species listed as Threatened are known to occur on the lease. These are *Andersonia gracilis* and *Anigozanthos viridis ssp. terraspectans*. Both of these species have been successfully established in rehabilitated areas at Cooljarloo.

Over 30 species listed as Priority Flora (PF) by the Department of Environment and Conservation (DEC) have been recorded within the Mining Lease. Tronox maintains a list of T and PF recorded on site (Table 5) and GIS records of known locations. The known populations of T and PF on the mining lease are shown in Figure 21.



Priority C relates to species that have been recently delisted.

Figure 21: Conservation Significant Flora

Table 5: Conservation Significant Species Surveyed at Cooljarloo

Species	Priority	Species	Priority
Chordifex reseminans	P1	*Lepidobolus densus ms*	P3
Schoenus pennisetis	P1	*Baeckea sp. Perth Region (R.J. Cranfield 444)*	P3
Calectasia palustris	P1	*Hypocalymma serrulatum*	P3
Grevillea thelemanniana subsp. Cooljarloo (B.J. Keighery 28 B)	P1	*Onychosepalum nodatum*	P3
Malleostemon sp. Cooljarloo (B. Backhouse s.n. 16/11/88)	P1	*Conospermum scaposum*	P3
Stylidium hymenocraspedum	P2	*Angianthus micropodioides*	P3
Isopogon panduratus subsp. palustris	P2	*Grevillea saccata*	P4
Banksia dallanneyi subsp. pollosta	P3	*Conostephium magnum*	P4
Lasiopetalum lineare	P3	*Eucalyptus macrocarpa subsp. elachantha*	P4
Jacksonia carduacea	P3	*Thysanotus glaucus*	P4
Platysace ramosissima	P3	*Boronia tenuis*	P4
Schoenus griffinianus	P3	*Verticordia lindleyi subsp. lindleyi*	P4
Melaleuca clavifolia	*P3*	*Banksia platycarpa*	P4
Schoenus griffinianus	*P3*	*Stylidium aeonioides*	P4
Hensmania stoniella	P3	*Anigozanthos viridis subsp. terraspectans*	*T*
Beaufortia bicolor	P3	*Andersonia gracilis*	*T*

3.8.4 Weeds

Baseline weed populations are routinely assessed as a part of the standard rehabilitation baseline reference plots. Results from this monitoring indicate cover throughout native vegetation on UCL is low. Targeted weed surveys of the northern end of the lease in 2009 (on UCL) by Woodman Environmental Consulting concluded that weed cover through native areas is minimal with greater cover present adjacent to roads and tracks (WEC 2010). No weed species declared under the *Agriculture and Related Resources Protection Act* 1976 (WA) were recorded in UCL areas.

Agricultural activities within the region over the past thirty years have contributed to the large number of introduced species on and around Mullering Farm. The majority of introduced species are seasonal and can be controlled using herbicides. There are around 40 introduced species recorded on Mullering Farm. Two (common) species declared under the *Agriculture and Related Resources Protection Act 1976 (WA)* are present including *Echium plantagineum* (Paterson's curse) and *Emex australis* (Double gee).

3.9 Dieback

Extensive dieback surveys have been conducted at Cooljarloo since the commencement of mining including Hart, Simpsons and Associates (1998-1999); Woodman Environmental (2004) and most recently Glevan consulting (2008, 2010). A number of *Phytophthora* species have been recorded at the Cooljarloo Mine mostly in the area surrounding Mullering Farm. Of these species *Phytophthora cinnamomi* (Pc) is considered to pose the greatest risk to native vegetation communities. Many local species are susceptible to Pc and as such, the disease threatens the biodiversity values of the area. Tronox undertakes soil sampling, water baiting and regular interpretation/mapping across the lease. Figure 22 shows the recoveries of Pc recorded on site.

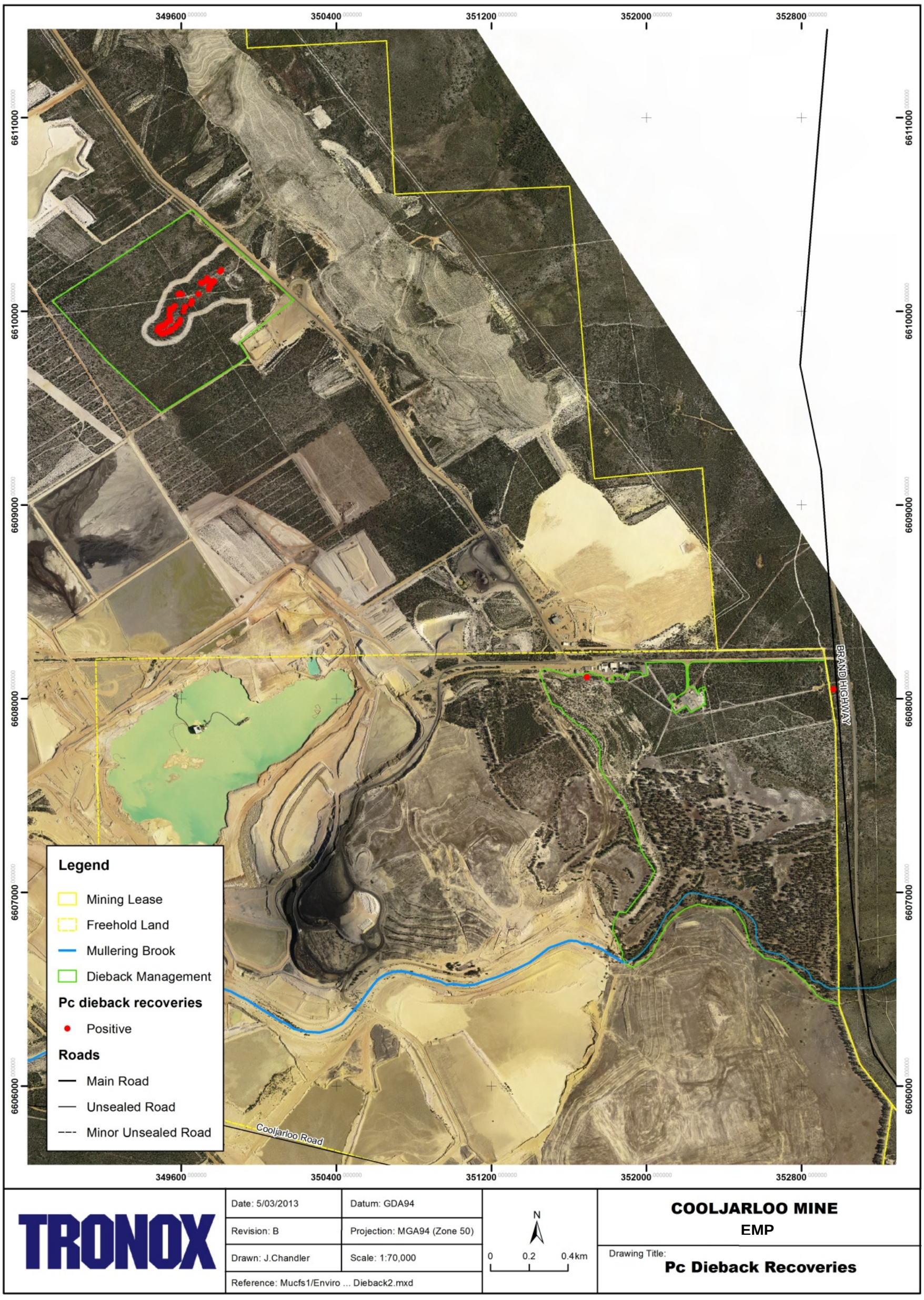


Figure 22: ***Phytophthora cinnamomi*** **Dieback Recoveries**

3.10 Fauna

Fauna studies at Cooljarloo began with preliminary surveys in 1986, followed by intensive studies from 1989 to 1992 and monitoring studies annually thereafter (Bamford 2004). Standard annual monitoring of baseline reference plots include pitfall trapping, bird census and invertebrate searches.

These studies have focused on native vegetation at Cooljarloo and have identified 10 frog species, 43 reptile species, 132 bird species and 21 mammal species. Species listed as protected under State and/or Commonwealth Acts include:

- *Morelia spilota* (Carpet Python);
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle);
- *Merops ornatus* (Rainbow Bee-eater);
- *Actitis hypoleucos* (Common Sandpiper); and
- *Calyptorhynchus latirostris* (Carnaby`s Black-Cockatoo).

Common introduced species have also been recorded in these surveys including (but not limited to):

- *Oryctolagus cuniculus* (Rabbits);
- *Vulpes vulpes* (Red Fox);
- *Felis catus* (Cats); and
- *Mus musculus* (House Mouse).

Aquatic biology baseline studies were conducted in Mullering Brook by Streamtec 1990 and 1991 (Streamtec 1992). The vertebrate fauna collected within the mining lease and adjacent areas included:

- *Galaxias occidentalis* (Native Minnow);
- *Chelodina oblonga* (Long Necked Tortoise); and
- *Neobatrachus pelobatoides; Psuedophryne guentheri; Helioporus sp* (Tadpoles).

None of the aquatic species above are listed under State and/or Commonwealth Acts.

3.11 Land Use

Prior to mining there were two distinct areas within Cooljarloo Mining Lease:

- Cleared freehold title used for agricultural purposes; and
- Unallocated Crown Land comprising native vegetation.

The native UCL areas within ML268SA were used for the following purposes on an *ad hoc* basis;

- Beekeeping, Wildflower harvesting;

- Recreation (off road vehicles and bushwalkers); and
- Camping grounds.

Native vegetation at Cooljarloo includes species of plants, plant communities and fauna that supports the activities identified in the list above.

Several sites of cultural significance to the Yued Aboriginal community are also present within the Mining Lease (section 3.12).

The agricultural land was cleared during the early 1970's and has been predominantly used for cattle and sheep grazing until mining commenced in 1988. In surrounding areas there is occasional cropping or intensive agriculture consistent with the sandy surface soils (such as lupins, olives).

Approximately 13 ha of freehold land was ceded to the Billinue Aboriginal Community in 1994. This land is currently used to facilitate the seed picking/processing business and dwellings for the community. There is one other third party stakeholder owned parcel of land of 45 ha which is located on the western boundary and has been used at times for agricultural grazing (Figure 23).

3.12 Heritage

3.12.1 Aboriginal Heritage

Detailed ethnographic surveys of the Mining Lease were completed as part of the original project approvals for Cooljarloo and as a part of the Falcon approval. Mullering Brook is registered as an ethnographic site and an archaeological site has been surveyed on Mullering Farm (Figure 23).

3.12.2 European Heritage

No European heritage sites relevant to the closure of Cooljarloo are known.

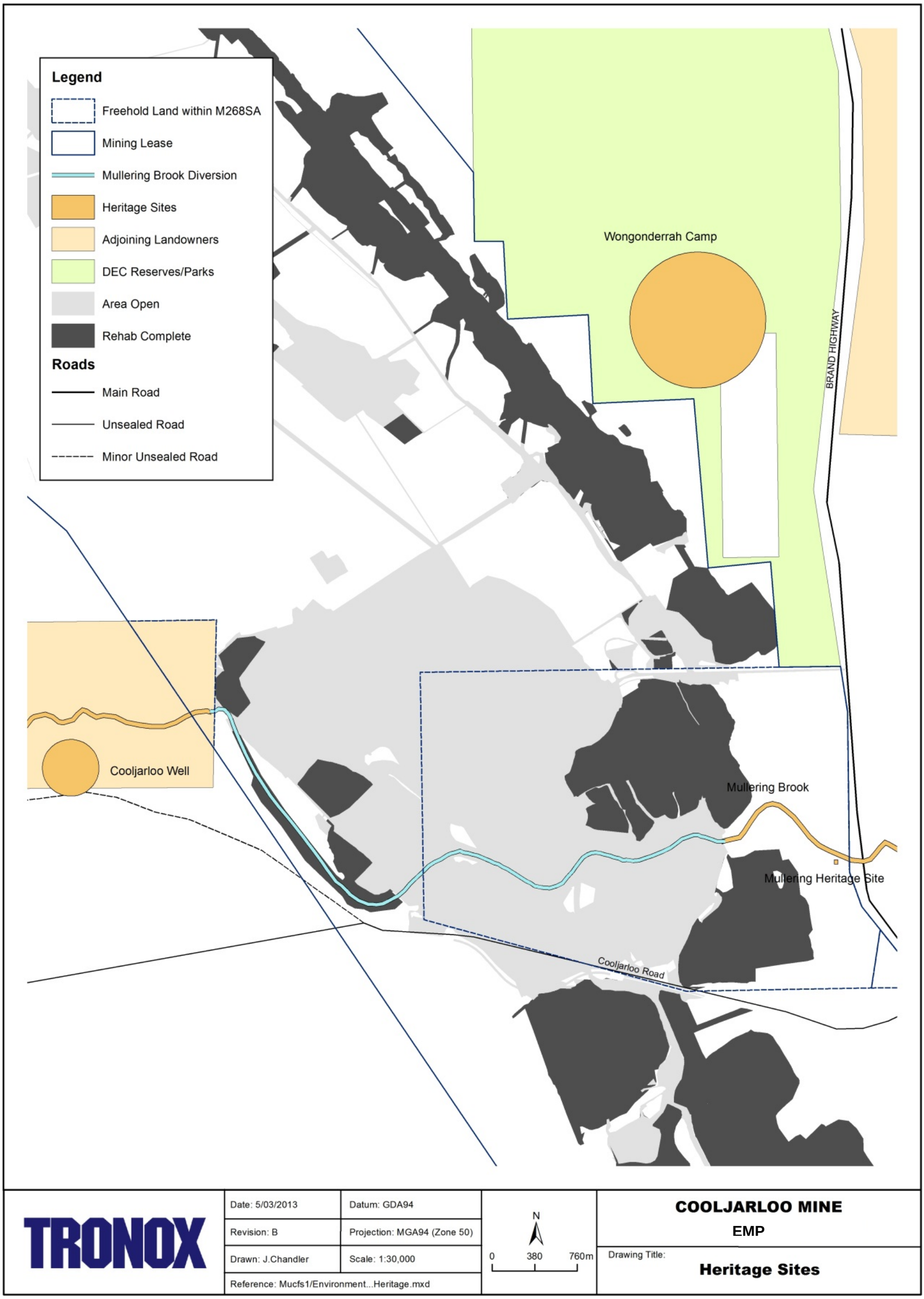


Figure 23: Heritage Sites

4 MANAGEMENT SYSTEMS AND IMPLEMENTATION

4.1 Overview

Cooljarloo is certified to the ISO 14001:2004 Standard for Environmental Management Systems. The EMS has been developed to be consistent with Tronox Corporate SHE Systems Standards and to support the attainment of the Tronox Corporate SHE Performance Standards. The framework for the EMS is shown in Figure 24. The system ensures that continual improvement of environmental performance is driven by the sequential and ongoing setting and achievement of performance targets. Performance targets are set annually by the Senior Management team in order to:

- Improve previous performance;
- Meet environmental and community relations policy commitments;
- Meet legal requirements; and
- Mitigate significant environmental and community relations risks.

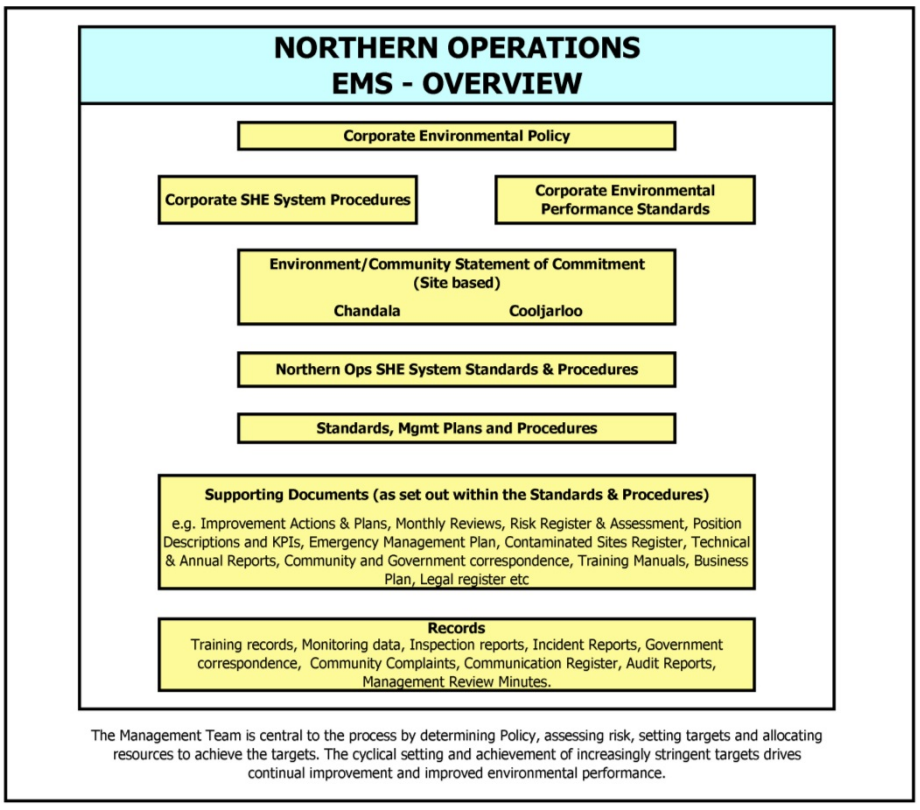


Figure 24: Tronox Northern Operations EMS framework

4.1.1 Corporate Standards

The EMS includes the following corporate system standards:

- Policy, leadership and commitment;
- Risk and opportunity management;
- Change management;
- Legal and other requirements;
- Objectives, targets and improvement plans;
- Operational control;
- Communication and consultation;
- Training and competency;
- Structure and responsibility;
- Crisis and emergency management ;
- Contractor selection and management;
- Document and records management;
- Incident management;
- Monitoring, measurement and reporting;
- Action management; and
- Management review.

Furthermore Tronox maintains Environmental Performance Standards (EPS) which set a minimum standard for the environmental performance of operating sites, including Cooljarloo. These standards, which are addressed within the EMS and this EMP include:

- Air Emissions (EPS21);
- Biodiversity (EPS22);
- Greenhouse Gas / Energy (EPS23);
- Housekeeping (EPS24);
- Hydrocarbons (EPS25);
- Process Waste (EPS26);
- Rehabilitation (EPS27);
- Stakeholder Management (EPS28);
- Waste Management (EPS29); and
- Water Management (EPS30).

4.1.2 Site Plans and Programmes

Tronox maintains a number of site plans and programmes which define additional site standards and activities. This EMP is the key document which describes environmental management at Cooljarloo and is supported by the following detailed plans:

- Cooljarloo Mine Closure Plan;
- Northern Operations Radiation Management Plan;
- Groundwater Drawdown Management Plan; and
- Cooljarloo Mulch Harvesting Strategy and Plan.

4.1.3 Procedures

The site plans and programmes are supported by standard operating procedures. These procedures are utilised to describe the safe implementation of activities undertaken to fulfil the requirements of the plans, programmes and standards. It is this level of documentation that provides step by step actions to complete tasks in a safe and environmentally responsible manner.

Detailed procedures are available to the workforce via the in-house Tronox intranet.

4.2 Policy

Tronox is committed to the principle of sustainable development and recognises the benefits of integrating economic, social and environmental considerations in its business planning and practices. These principles are reflected in the Tronox Corporate Environmental Policy. All personnel employed by Tronox either directly or as agents, consultants and contractors are required to comply with Tronox policies so as to maintain the company's reputation as a trusted and responsible corporate citizen.

Cooljarloo has a site specific Environmental and Community Relations Statement of Commitment (see Appendix B). This statement is consistent with the requirements of the overarching Tronox Corporate Environmental Policy and includes specific commitments to:

- Comply with legal requirements;
- Prevent pollution of land and water;
- Protect sites of cultural heritage;
- Protect flora and fauna;
- Conserve resources and minimise waste;
- Undertake targeted environmental research to improve performance;
- Progressively rehabilitate disturbed areas to a high standard;
- Respond quickly and effectively to stakeholder concerns; and
- Communicate openly with employees, the community and regulatory.

4.3 Obligations

Tronox maintain a legal register and regularly reviews changes (proposed and implemented) to relevant legislation, standards and other guidance information in accordance with Tronox systems procedure "Legal and other requirements" (NO0020). Legislation generally applicable is identified in Table 6.

Table 6: Commonwealth and State Legislation generally applicable to Cooljarloo operations.

Legislation/Regulation	Application
Commonwealth	
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Recognition and protection of Aboriginal and Torres Strait Islander Heritage
Energy Efficiency Opportunities Act 2006	Energy use reporting
Environment Protection and Biodiversity Conservation Act 1999	Protects matters of National Environmental Significance
National Greenhouse and Energy Reporting Act 2007	Greenhouse gas emissions reporting
Native Title Act 1993	Recognition and protection of native title
State	
Aboriginal Heritage Act 1972	The protection of Aboriginal sites
Agriculture and Related Resources Protection Act 1976	Management, control and prevention of certain plants and animals and protection of agriculture and related resources
Bush Fires Act 1954	Prevention, control and extinguishment of bushfires
Conservation and Land Management Act 1984 (CALM Act)	Impact on public land and on specially listed flora and fauna
Contaminated Sites Act 2003 (CS Act)	Identification, recording, management and remediation of contaminated sites
Dangerous Goods Safety Act 2004	Risks associated with dangerous goods and the responsibilities when storing, handling and transporting dangerous goods, including explosives
Electricity Act 1945	Licensing of persons carrying out works relating to electricity
Environmental Protection Act 1986 (EP Act)	Environmental impact assessment and pollution control
Explosives and Dangerous Goods Act 1961	Relating to the storage and handling of explosives or dangerous goods
Health Act 1911	Regulations concerning emissions, disposal of sewage
Heritage of Western Australia Act 1990	An act to provide for the conservation of places which have cultural heritage significance to the state
Land Administration Act 1997	Management of Crown Land
Land Drainage Act 1925	Drainage of land, use of drainage water, and the constitution of drainage districts
Local Government (Miscellaneous Provisions) Act 1960	Provides a system for building licences and other related matters
Main Roads Act 1930	The construction of roads
Mining Act 1978	Relating to the establishment of mines and regulation of associated matters through the Mining Regulations 1981

Legislation/Regulation	Application
Mineral Sands (Cooljarloo) Mining and Processing Agreement Act 1988	Specifies various conditions to mining and processing including the requirement for Annual Environmental Reporting
Mines Safety and Inspection Act 1994	Provides for the safe operations of mines in the state including regulation under the Mines Safety and Inspection Regulations 1985
Native Title (State Provisions) Act 1999	Provides alternative provisions to the Australian Government Native Title Act 1993 in relation to the protection of Aboriginal sites
Occupational Safety and Health Act 1984	Determination and promotion of occupational health and safety standards
Planning and Development Act 2005	Relating to land use planning and development in the state
Poisons Act 1964	Possession, sale, and use of poisons and other substances
Rights in Water and Irrigation Act 1914 (RIWI Act)	Interference with watercourse bed and/or banks, abstraction of water
Soil and Land Conservation Act 1945	Conservation of soil and land resources
Waste Avoidance and Resource Recovery Act 2007	Avoidance of waste generation, and recovery of resources from 'waste'
Waterways Conservation Act 1976	Conservation management of designated waterways and environments
Wildlife Conservation Act 1950	Listed threatened species

Site specific legal obligations (e.g. Ministerial Statements, Site Environmental Licences) are described in the Tronox system document "Environmental responsibilities and obligations" (NO036) (refer to Appendix D).

4.4 Aspects and Impacts

The EMS requires that an Aspects and Impacts register be developed and maintained. As a key part of the site EMS, Tronox maintains an environmental aspects and impacts register. Aspects are identified, impacts considered and risks assessed by teams responsible for the management of each work area, supported by site Environmental personnel. The register is reviewed on a regular basis.

The key environmental aspects relevant to each environmental factor are presented in the individual management plans within Part B of this EMP.

The main environmental challenges at Cooljarloo are:

- Progressive rehabilitation of native bushland;
- Protection of regional biodiversity values;
- Sustainable management of water resources; and
- Management of process wastes returned to Cooljarloo from Chandala and Kwinana.

The complete Aspects and Impacts register is provided in Appendix C.

4.5 Responsibility

Tronox believes that the responsibility for sound environmental performance resides with all personnel and contractors. Ultimately, responsibility for operational environmental management rests with the General Manager Northern Operations. Site performance is the the responsibility of the Operations Manager (who is also the Registered Mine Manager). The Manager: Safety, Health, Environment (SHE) is responsible for both advising and assisting the General Manager and Operations Manager in meeting their environmental accountabilities.

More specifically these include:

- Ensuring the dissemination and understanding of Tronox's environmental philosophy and commitment to all employees;
- Ensuring the adherence to and review of the Cooljarloo Environmental Management Programme;
- Ensuring the preparation and implementation of site specific Business Plans (which include an environmental component);
- Ensuring the preparation and maintenance of the Cooljarloo Environmental Management Systems; and
- Ensuring the monitoring of compliance with environmental regulations.

Environmental specialists within the environmental department assist the SHE Manager to ensure effective and proactive environmental management for the Project.

The current management structure of Tronox Northern Operations is shown in Figure 25 below.

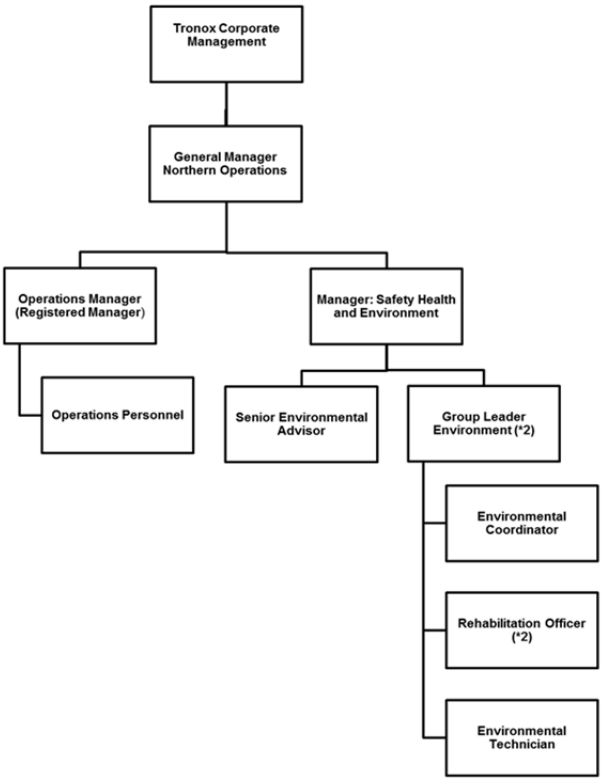


Figure 25: Tronox Organisation Structure

4.6 Communication

Internal communications are used to address concerns and questions raised by construction and mining personnel and any incidents (environmental and general) that may occur. In addition, these mechanisms will be used to communicate any new environmental management procedures or information to ensure effective implementation. Internal communications methods include:

- Business plans;
- Meetings (Routine mine management meetings, Site Environmental Committee and SHE Leadership meetings);
- Briefings (Site Operations Manager and SHE);
- Performance reports;
- Notice boards;
- Onsite personnel inductions, training and toolbox sessions (as required); and
- Contractor coordination meetings.

All community complaints are recorded on a complaints register and investigated. A summary of the complaint and the subsequent investigation, including any monitoring

results and corrective action (proposed mitigation measures) are prepared and reported in the Annual Environmental Report (AER).

4.7 Training and Induction

All employees (including contractors) accessing the Cooljarloo site receive environmental training, to ensure they are aware of their responsibilities and are competent to carry out their work in an environmentally acceptable manner. Environmental requirements are explained to all onsite personnel during a site induction. Ongoing instruction is provided via issue specific / targeted training, toolbox meetings and day to day procedural instructions.

The site induction includes the following items:

- Explanation of the purpose and objectives of the Environmental Management Programme;
- Key environmental factors, aspects, impacts and environmental risk management requirements;
- Roles and functions of personnel onsite in relation to environmental management;
- Incident reporting procedures; and
- Emergency procedures and responses.

4.8 Incidents and corrective actions

Cooljarloo maintains an environmental incident reporting system. Incident reporting is a management tool that helps to promote continuous improvement performance by:

- Identifying where incidents and near misses occur;
- Ensuring relevant people are notified in order to take necessary responsive and remedial action;
- Ensuring Department of Environment and Conservation (DEC) and other Government agencies are notified in accordance with regulatory requirements; and
- Involving the workforce in developing systematic ways of avoiding future failures by developing appropriate preventative measures.

All internal environmental reporting is conducted using the "Incident Report Form", which is made available to all on-site personnel and contractors. The form is used to raise any environmental concern, and also provides reporting guidelines and time frames. An Environmental Incident Register is maintained by the Environmental Administrator, recording each report with an allocated report number. The register is used to track the progress and closure of each incident report.

All incidents are reviewed to determine if they require reporting to an appropriate authority. An Incident Report is not closed until the involved parties (including the Environmental Group Leader and Site Operations Manager) have indicated their satisfaction with the

outcome of the report. A follow up system is applied to ensure that actions arising from the incident investigation are implemented.

4.9 Emergency response

Emergency response procedures are a component of the EMS and have been established for a range of significant emergency scenarios including major hydrocarbon spills, tailings dam wall or pipe failures, and spillage / contamination from waste disposal activities.

The emergency response plan details:

- Potential environmental emergencies;
- Personnel to assume roles in the event of an emergency;
- Associated measures required to mitigate environmental harm; and
- Communication procedures and emergency contact details.

Basic emergency response training is provided to personnel, and selected emergency response personnel undergo further training to form an Emergency Response Team. Appropriate emergency response equipment is available on site, including earthworks machinery, communications equipment, spill kits and a fire tender.

4.10 Auditing

External environmental audits are conducted at Cooljarloo in accordance with regulatory requirements, Corporate Auditing Schedules and requirements to maintain ISO14001 certification. Annual compliance audits against site environmental Licence (issued under Part V of the *Environmental Protection Act, 1986* (the EP Act) and relevant Ministerial Conditions (issued under Part IV of the EP Act) undertaken. Corporate and EMS audits investigate compliance with the key performance indicators and management actions within this EMP; environmental policies; and legal requirements, conditions and commitments. Where auditing finds environmental management actions are not being effective, recommendations for changes to procedures and / or management actions are implemented.

4.11 Monitoring

A comprehensive environmental monitoring and internal audit programme has been established for the Cooljarloo Site to verify compliance with environmental conditions and commitments, satisfy regulatory and reporting requirements, track environmental performance against targets and gauge the effectiveness of environmental management measures. Key monitoring and audit outcomes are presented to senior management.

4.12 Reporting

Tronox submits an Annual Environmental Report to the Department of Mines and Petroleum, Department of State Development, Department of Environment and Conservation and Office

of Environmental Protection Authority. The AER covers the requirements of the SAA and EP Act (Ministerial Statements, licences and permits) and includes details of:

- Mining and environmental management activities completed during the reporting period;
- The status of rehabilitation activities against corresponding approvals and commitments (Programme of Works, clearing permits etc.);
- Significant species affected during work programmes (listing of numbers "removed" based on pre-works survey);
- Compliance with the requirements of relevant approval conditions, commitments, licences and permits including any issues or incidents and corresponding preventative and corrective actions; and
- Any other items of environmental significance.

Other statutory reporting is undertaken in in-line with the relevant legal instruments.

4.13 Document Management

This EMP document for the Cooljarloo site is owned by the SHE Manager Northern Operations.

All environmental management documentation is electronically controlled in accordance with document control and records management procedures for all Tronox Northern Operations. This relies on a centralised database for storing and accessing site documents (procedures and plans etc.). When updates are required, the database is amended and all relevant personnel are notified. Previous versions are retained for records but are no longer accessible.

Review processes consider the need to update this document (EMP) at least once every three years. Amendments to detailed procedures are completed on an as needs basis. A summary of the outcomes of the triennial review will be provided as part of Cooljarloo's Triennial Report as required under the SAA. Where the review identifies the need for significant changes to the EMP, the document will be updated and distributed.

PART B: MANAGEMENT PLANS

This section of the Environmental Management Programme provides the management plans relevant to the operations and activities within the Cooljarloo Mining Lease. The management plans prepared to address key the environmental factors listed below:

- Air emissions;
- Greenhouse gas and energy;
- Flora and Vegetation;
- Fauna;
- Dieback and weeds;
- Rehabilitation;
- Process waste;
- Waste;
- Radiation;
- Water;
- Fire;
- Acid sulfate soils;
- Hydrocarbon and hazardous materials; and
- Stakeholder management.

Each management plan is structured to briefly describe the factor, identify relevant aspects (from the Tronox Aspects and Impacts register), objectives and targets, operational controls, associated relevant monitoring and contingency actions.

5 AIR EMISSIONS MANAGEMENT PLAN

5.1 Description

The key air emission requiring environmental management is the emission of dust from mining activities and areas. Dust emissions have the potential to cause environmental impacts such as vegetation smothering, sand creep and land contamination. Emissions can also cause nuisance to neighbouring stakeholders and the general community. The Billinue Aboriginal Community and Brand Highway are sufficiently close to mining operations that during adverse conditions they could be impacted by nuisance dust generated from mining operations and ancillary activities. Key management strategies implemented at Cooljarloo include the stabilisation of open areas, progressive rehabilitation and watering of roads and trafficable areas.

5.2 Environmental aspects

The following aspects have been identified as potential sources of dust that require management:

- Mining operations, including traffic on unsealed roads;
- Topsoil stripping and placement operations;
- Process waste facility operation; and
- Exposure of soil to wind erosion, particularly freshly rehabilitated areas.

5.3 Performance management

Objectives, performance targets and associated assessment methods relating to air emissions are detailed in Table 7 below.

Table 7 Air emission management objectives, targets and assessment methods

Objective	Performance Targets	Assessment Method
Minimise the generation of dust from mining and ancillary operations	No public complaints from nuisance dust generated from mining or ancillary operations	Review Community Complaints Register
	Full compliance with the Dust Management Plan (DMP) as detailed in the site Environmental Licence	Audit DMP requirements
	Operate within internal targets for depositional dust at the lease boundary and process waste pits	Monitor depositional dust fallout
Monitor and report the effectiveness of dust controls	Performance against internal targets to be reported to relevant government agencies and community stakeholders	Audit reporting requirements

5.4 Implementation

Key operational controls to support the air emissions objectives are summarised in Table 8.

Table 8 Air emissions operational controls

Aspect	Operational Controls	Reference
Mining operations	Traffic is restricted to established roads, tracks or operational areas and to a maximum speed of 60 km/h on unsealed roads.	C0785 - Dust Management Procedure
	Water trucks are used on haul roads and pit areas to minimise dust generation	C0785 - Dust Management Procedure
Rehabilitation and Open Areas	Annual Stabilisation Plan is developed and implemented to minimise dust from open areas	C0785 - Dust Management Procedure
	Progressive rehabilitation of disturbed areas is undertaken to minimise the total area open	C0785 - Dust Management Procedure

Aspect	Operational Controls	Reference
Topsoil Handling	Dust generating activities such as topsoil stripping and placement are avoided during high winds conducive to excessive dust generation	C0785 - Dust Management Procedure
Process Waste Disposal Facility	Process waste is progressively capped to minimise the area of waste exposed	C0785 - Dust Management Procedure
	Active suppression of dust on haul roads is undertaken using water trucks	C0785 - Dust Management Procedure
Plant and Equipment	Haulage trucks are clean (e.g. using wheel washes) on entry to and exit from the site, during winter, to minimise the material tracking onto internal and external roads	TJV203 – Environmental Performance Standard
Transport	Haulage trucks are covered on public roads during transport to minimise dust	TJV203 – Environmental Performance Standard

5.5 Monitoring

The monitoring programme for air emissions (Table 9) has been developed to measure performance against established targets and key operational controls.

Table 9 Air emissions monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Record climatic trends on site	Monitor meteorological data (C0960)	Within Mining Lease	Ongoing (Monthly review)	Rainfall, wind speed and direction
Qualitatively assess visible nuisance dust on site	Site inspections and ongoing observations (C0029)	All open areas	Ongoing	Qualitative dust assessment (i.e. visibility distance)
Quantify depositional dust and assess performance against internal targets	Dust deposition monitoring (C0889)	Lease boundary and Process Waste Facility	Quarterly	Depositional dust fallout (g/m^2/month) including total solids, inorganic solids, soluble solids and organic solids.
Assess the implementation of the DMP	Audit DMP	Within Mining Lease	Annually	Conformance to requirements in the DMP

5.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 10.

Table 10 Air emissions contingency actions

Trigger	Action
Nuisance dust generated which impacts visibility on haul roads	1. Implement immediate corrective actions to mitigate the dust issue (change operational activity or apply dust suppression) 2. Assess the significance of the issue and raise an incident report if deemed necessary 3. Develop corrective actions as required 4. Monitor the effectiveness of implemented controls
Complaints received from the public	1. Implement immediate corrective actions to mitigate dust issue (change operational activity or apply dust suppression) 2. Register complaint with the Community Liaison Coordinator and raise an incident report 3. Develop corrective actions as required 4. Monitor the effectiveness of implemented controls 5. Provide feedback to complainants and the DEC for substantiated community complaints
Dust levels exceed internal targets	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required (e.g. amend stabilisation plans) 3. Monitor the effectiveness of implemented controls

6 GREENHOUSE GAS AND ENERGY MANAGEMENT PLAN

6.1 Description

Greenhouse gas emissions produced by the combustion of fuels and energy have the potential to contribute to human induced climate change. Approximately 800,000 GJ of energy is consumed annually at Cooljarloo primarily through the combustion of diesel power heavy vehicles and electricity to pump material around site and operate the dredge. This energy consumption is the primary contributor to the sites carbon emissions which average around 100,000 CO_2^{-e} per annum. Other minor contributions are made by land clearing in native areas which is in part offset by progressive rehabilitation efforts.

Although the duration and magnitude of emissions at Cooljarloo is such that the resulting contribution to human induced climate change is very low, the nature of the problem is such that a multitude of small scale contributions may add up to produce significant combined contribution on a national or global scale. As such, it is important to maintain management systems to track and improve efficiency and decrease emissions.

6.2 Environmental aspects

The environmental aspects requiring management to minimise energy use and/or greenhouse gas emissions are:

- Combustion of fuels by mobile plants, equipment and onsite vehicles;
- Clearing of native vegetation; and
- Electrical power usage by processing plants, pumps and utilities.

6.3 Performance management

Objectives, performance targets and associated assessment methods relating to energy and greenhouse gas emissions are detailed in Table 11 below.

Table 11 Greenhouse gas emissions management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Maintain a system to identify and evaluate energy efficiency and carbon pollution reduction opportunities	Compliance with established internal EEO procedure	Audit established systems (TJV322)
Optimise energy efficiency and minimise carbon pollution	Energy use and carbon emissions within internal targets	Monitor and report internally energy and carbon emissions
Report as per the requirements of the Energy Efficiency Opportunities (EEO) and National Greenhouse and Energy Reporting (NGERS) legislation	Report submitted to relevant government agencies within designated timeframes and to the required quality	Audit reporting requirements

6.4 Implementation

Key operational controls to support the energy and greenhouse gas objectives are summarised in Table 12.

Table 12 Greenhouse gas and energy operational controls

Aspect	Operational Controls	Reference
Energy Efficiency	Opportunities to reduce carbon emissions and increase energy efficiency are identified and evaluated	TJV322
	Performance is measured against internal targets for carbon emissions and energy efficiency	TJV322
	Energy consumption and identified efficiency opportunities are reported in line with the requirements of the EEO	TJV322
Vegetation clearing	Cleared areas of unallocated Crown Land are progressively rehabilitated to native vegetation as they become available after mining	Mine Closure Plan (2013)
Greenhouse Gas Reporting	Greenhouse gas emissions are reported in line with the NGERS Act	NO0117

6.5 Monitoring

The monitoring programme for greenhouse gas emissions and energy efficiency (Table 13) has been designed to measure performance against established targets and key operational controls.

Table 13 Greenhouse gas emissions monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Quantify energy use/carbon emissions and assess performance against internal targets	Monitor energy use and greenhouse gas emissions	Within Mining Lease	Monthly	Greenhouse gas emissions and energy consumption
Assess the implementation of the EEO procedures	Audit EEO procedure	Within Mining Lease	Every 3 years	Conformance to requirements in the EEO procedure

6.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 14.

Table 14 Greenhouse gas emissions contingency actions

Trigger	Action
Greenhouse gas emissions exceed annual target	1. Investigate cause and amend practices if possible 2. Review assumptions of the internal targets if they are consistently not being met

7 FLORA AND VEGETATION MANAGEMENT PLAN

7.1 Description

The large majority of area mined at Cooljarloo is within uncleared native Unallocated Crown Land (UCL) with the remainder being freehold land cleared in the early 1970's. Consistent with the native vegetation of the Northern Sandplains, UCL areas within the mining lease are considered to have a high biodiversity value (WEC, 2008). Several Threatened Flora species are known to exist in the area and a number of endangered fauna species utilise vegetation for foraging and habitat.. For this reason, the flora and vegetation at Cooljarloo has been identified as a key environmental factor. Key management considerations include minimising the area of clearing for mining and ancillary operations, progressively rehabilitating native areas (Section 11) and managing the risks associated with *Phytophthora* dieback and weeds (Section 10). General vegetation health is also identified as potentially impacted by groundwater levels and hence discussed under water management (Section 15).

7.2 Environmental aspects

The following aspects have been identified as requiring management to minimise impacts to flora and vegetation:

- Clearing and soil stripping activities;
- Drill line and power corridor clearing;
- Off-road vehicle movements; and
- Protection and/or management of conservation significant species.

7.3 Performance management

Objectives, performance targets and associated assessment methods relating to flora and vegetation are detailed in Table 15 below.

Table 15 Flora and vegetation management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Minimise the impact of mining operations on flora and vegetation communities	Screening for Threatened Flora Species and Threatened Ecological Communities is undertaken prior to clearing to determine the need for survey.	Review areas disturbed against relevant spatial dataset
	No disturbance of Threated Flora Species without approval from the DEC	Review areas disturbed against survey outcomes
	Monthly reconciliation of areas cleared and disturbed to aligned with internal approvals	Reconcile areas open monthly
Monitor and report impacts of mining on flora and vegetation communities	All areas disturbed to be surveyed and reported to relevant government agencies and community stakeholders	Audit reporting requirements

7.4 Implementation

Key operational controls to support the flora and vegetation objectives are summarised in Table 16.

Table 16 Flora and vegetation operational controls

Aspect	Operational Controls	Reference
Clearing native vegetation	Pre-disturbance surveys are undertaken to identify significant species or communities	C0070 - Vegetation Survey
	Clearing activities are controlled and monitored to minimise the risk of unauthorised clearing	C0068 - Vegetation Clearing
	An internal permitting system is maintained to manage and record clearing activities	C0068 - Vegetation Clearing
Conservation significant species	A spatial dataset of significant flora species is maintained to include records of site surveys and other reliable data sources (e.g. State and Federal databases)	C0066 - Herbarium
	A plant herbarium is maintained to facilitate accurate species identification	C0066 - Herbarium
Vehicle movement	Vehicles and machinery are kept to established roads, tracks or otherwise approved under a clearing permit	C0068 - Vegetation Clearing

7.5 Monitoring

The monitoring programme for flora and vegetation (Table 17) has been developed to measure performance against established targets and key operational controls.

Table 17 Flora and vegetation monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Monitor adherence to clearing procedures	Site inspection (C0029)	Within Mining Lease	Quarterly	Conformance to procedural requirements
Reconcile and track area open	Reconcile area open against (survey data) planned and actual disturbance	Within Mining Lease	Monthly plus Annual reconciliation against Aerial Photo	Area Disturbed

7.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 18.

Table 18 Flora and vegetation contingency actions

Trigger	Action
Conservation significant flora species surveyed within disturbance footprint	1. Assess if the surveyed plant/s can be avoided 2. If clearing is necessary apply for a 'Permit to Take' from the DEC 3. Target the return of threatened species into rehabilitation

8 FAUNA MANAGEMENT PLAN

8.1 Description

Clearing of native vegetation for agriculture has resulted in a large reduction in areas of native vegetation throughout the South West of WA. This has resulted in a restriction of available habitat for a range of species, some of which are species of conservation significance. Fauna species of high conservation significance are legally protected (Threatened Fauna), these are identified under State (*WA Wildlife Conservation Act 1950*) and Federal (*Environment Protection and Biodiversity Conservation Act 1999*) legislation.

Mining and ancillary operations can impact fauna primarily through the clearing of native vegetation (refer to Section 9), introduction or refuge for feral animals and interactions with vehicles and machinery. Cooljarloo operations seek to; minimise impacts to fauna; and to rehabilitate areas capable of supporting sustainable native habitats similar to that which occurs in adjacent UCL areas (Refer to Section 11).

8.2 Environmental aspects

The following aspects have been identified as requiring management to minimise impacts to native fauna:

- Clearing of vegetation and disturbance of topsoil for mining and ancillary activities;
- Introduction or increased presence of feral species;
- Movement of vehicles and equipment on-site; and
- Drill line clearing and drill hole capping/closure.

8.3 Performance management

Objectives, performance targets and associated assessment methods relating to fauna are detailed in Table 19 below.

Table 19 Fauna management objectives, targets and verification methods

Objective	Performance Targets	Assessment
Minimise the impacts of mining operations on local fauna populations	Implement feral animal control programmes	Review implementation of feral animal control programmes
Monitor impacts of mining and ancillary operations on fauna populations	Report outcomes of monitoring and incidental impacts to fauna to the relevant government agencies and Community stakeholders	Audit reporting requirements

8.4 Implementation

Key operational controls to support the fauna objectives are summarised in Table 20.

Table 20 Fauna operational controls

Aspect	Operational Controls	Reference
Feral species	Control programmes are implemented for feral species observed to be significantly impacting native fauna, rehabilitation or operations	C0027 – General Protection of Native Fauna
	Feral cat trapping is undertaken in response to reported sightings	C0027 – General Protection of Native Fauna
	Domestic animals are not permitted on site	C0027 – General Protection of Fauna
Native fauna egress from dams	Fauna egress matting is provided lined dams and ponds	
Fauna road strike	Traffic speed is limited to a maximum of 80km/h on internal roads	C0785 – Dust Management
Drilling	Drill holes are capped and backfilled	
Biodiversity investigations	Research and investigations are completed to improve understanding of local native fauna	

Monitoring

The monitoring programme for fauna (Table 21) has been developed to measure performance against established targets and key operational controls.

Table 21 Fauna monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Quantify fauna abundance and diversity in reference sites and rehabilitation	Pit fall trapping, bird surveys and targeted invertebrate searches (C0919)	At selected representative sites	Annually	Species trapped using pit traps, bird species observed, opportunistic searches
Assess the implementation of relevant procedures	Audit conformance to relevant reporting and feral animal control procedures.	Within Mining Lease	Annually	Conformance to procedures

8.5 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 22.

Table 22 Fauna management contingency actions

Trigger	Action
Observed death of threatened species	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required 3. Report incident via the Annual Environmental Report
Increased prevalence of feral species	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required (e.g. amend the feral control programme) 3. Monitor the effectiveness of implemented controls
Failure of fauna to re-colonise rehabilitation areas	1. Assess the significance of the issue and initiate research if necessary 2. Incorporate findings into the Rehabilitation Improvement Plan 3. Monitor the effectiveness of implemented actions

9 DIEBACK AND WEEDS MANAGEMENT PLAN

9.1 Description

Dieback refers to the plant disease caused by a microscopic 'water mould' *Phytophthora cinnamomi* (*P. cinnamomi*), which survives on the root and stem tissue of living plants. Dieback is spread through the movement of contaminated vegetation or soil on vehicles, equipment, fauna and footwear. It can also be spread through the movement of soil caused by water erosion or through soil root zones. *P. cinnamomi* requires moist warm conditions to survive, thrive and spread. Dieback does not kill all native plant species but can detrimentally affect the structure, abundance and diversity of native vegetation communities, which in turn, has the potential to ultimately impact native fauna through the reduction in suitable food availability and quality habitat.

There are two *P. cinnamomi* infestations known within the boundaries of the Cooljarloo Mining Lease, which require stringent management to control further spread of the disease. Tronox has a well-established history in regards to dieback management, infestation control and investigation through collaborative research conducted with Murdoch University, the Centre for Phytophthora Science and Management (CPSM).

Weeds are grouped together with dieback for management purposes, as one of the key mechanisms for weed introduction is the movement of contaminated vegetation or soil on vehicles, equipment, fauna and footwear. Hence, most of the key controls for both dieback and weeds are the same.

Agricultural activities within the region have contributed to the introduction of weeds on and around the cleared land on Mullering Farm. Weed penetration into native vegetation has to date been largely limited to disturbed areas, particularly areas adjacent to cleared farmland, roads and tracks. Weeds can occur within rehabilitation (particularly during vegetation establishment), however, they tend to be outcompeted by native plants as rehabilitation matures.

9.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential spread of dieback or weeds into un-infested areas:

- Vehicles and equipment entering site;

- Vehicles and equipment leaving dieback or weed infested areas;
- Movement of topsoil, mulch or fill from dieback or weed infested areas; and
- Alterations to drainage lines or subsurface flow providing areas for establishment or further spread of dieback.

9.3 Performance management

Objectives, performance targets and associated assessment methods relating to dieback and weed management are detailed in Table 23 below.

Table 23 Dieback and weeds management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Prevent the introduction of new Declared Weed species	No Declared weed infestations in undisturbed UCL areas	Inspect areas of high risk within Mining Lease
Minimise the spread of weed species into native vegetation and rehabilitation areas	Full compliance with relevant hygiene procedures	Audit relevant systems (C0773 & C0060)
Prevent the introduction of new *P. cinnamomi* infestations to the Cooljarloo Mine Lease	No new *P. cinnamomi* infestations identified on the Cooljarloo lease	Monitor high risk areas
Minimise the spread of Phytophthora species occurring on the Cooljarloo Mine Lease	Full compliance with hygiene procedures	Audit relevant systems
Improve the knowledge relating to the control and eradication of *P. cinnamomi* through targeted research and development	Annual Research Plan relating to Dieback developed and implemented	Audit relevant systems

9.4 Implementation

Key operational controls to support the dieback and weeds objectives are summarised in Table 24.

Table 24 Dieback and weeds hygiene operational controls

Aspect	Operational Controls	Reference
Controlling Access	All vehicles/machinery are to be clean of soil and vegetation upon entry or exit from site. Vehicles pass through the hygiene wash bay or are inspected by an authorised person	C0773 - Dieback Management
	Access to the mining lease is restricted by way of fencing and/or signage	C0773 - Dieback Management
	Access to known *P cinnamomi* infestation areas is restricted to essential services and must be approved by the Group Leader Environment prior to entry	C0773 - Dieback Management
	The importation of soil and vegetation matter to site is restricted to low risk material and must be approved by the Group Leader Environment	C0773 - Dieback Management
Site operations	All internal clearing permits are assessed for *Phytophthora* risk and topsoil materials are stockpiled accordingly	C0773 - Dieback Management
	Drainage is managed to minimise the spread of dieback particularly around known infestations.	C0773 - Dieback Management
Infestations	Site specific Management Plans are developed for known *P cinnamomi* infestations within the Mining Lease	C0773 - Dieback Management
Research	Research programmes are undertaken to investigate cost effective methods to contain and/or eradicate *P cinnamomi*	C0773 - Dieback Management

9.5 Monitoring

The monitoring programme for dieback and weeds (Table 25) has been developed to measure performance against established targets and key operational controls.

Table 25 Dieback and weed monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Assess site-wide status of *Phytophthora cinnamomi*	Baiting of water bodies and sampling of root/soil in high risk areas (C0773)	High risk areas	Annually (spring)	Presence/absence of *P. cinnamomi*
	Phytophthora survey and interpretation across site (C0773)	Within Mining Lease	Triennially	Presence/absence of *P. cinnamomi*
Monitor adherence to Dieback procedures	Audit relevant items within the Dieback Management Procedure	Within Mining Lease	Annually	Conformance to procedural hygiene requirements
Quantify abundance and significance of weed infestations in rehabilitation areas	Monitor weed infestation in rehab (C0919)	Rehabilitation	Annually	Abundance of weeds
Identify weed infestation present across site	Inspection (C0063)	High risk areas	Annually	Presence/absence of weed species

9.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 26.

Table 26 Dieback and weed contingency actions

Trigger	Action
Introduction of new weed species within uncleared native vegetation areas	1. Assess the significance of the issue and raise an incident report if deemed necessary. 2. Develop corrective actions as required (e.g. amend weed eradication programme). 3. Monitor the effectiveness of implemented controls.
Increase in distribution, abundance or density/cover of previously recorded weed species on-site	1. Assess the significance of the issue and raise an incident report if deemed necessary. 2. Develop corrective actions as required (e.g. amend weed eradication programme). 3. Monitor the effectiveness of implemented controls.

Trigger	Action
Breach of hygiene procedure	1. Raise an incident and investigate system failure 2. Develop corrective actions as required (e.g. amend training requirements) 3. Monitor the effectiveness of implemented controls
Confirmed new *P. cinnamomi* infestation	1. Identify potential vectors for *P. cinnamomi* and determine likely cause of the infestation 2. Map the distribution of *P. cinnamomi* affected areas 3. Review treatment and control methods, seeking further advice from relevant authorities if required - control methods may include quarantining areas and/or establishing containment boundaries. 4. Implement revised *P. cinnamomi* control methods and continue monitoring.

10 REHABILITATION MANAGEMENT PLAN

10.1 Description

Cooljarloo Mine operates primarily on Unallocated Crown Land (UCL), with smaller areas of freehold land owned by Tronox and third party stakeholders. Areas disturbed for mining are progressively rehabilitated as they become available upon completion of backfill and landforming activities. Although it is not possible to return the site to its original state, this Management Plan, the Mine Closure Plan (MCP) and associated completion criteria aim to restore the Native UCL areas to a sustainable native ecosystem similar to that which occurs in adjacent areas. In areas to be returned to agricultural land use, Tronox aim to establish productive agricultural land that is consistent with the surrounding region in terms of production levels and land capability. In both cases, the rehabilitation aims to be resilient to natural perturbations and able to be managed consistent with accepted land management practices.

This management plan sets out the framework within which Tronox plans and undertakes rehabilitation at Cooljarloo. In doing so it summarises the objectives of rehabilitation and references the completion criteria that have been developed for the site. Detailed objectives and completion criteria are documented in the Cooljarloo Mine Closure Plan (Tronox 2013), which has been prepared in accordance with DMP and EPA Mine Closure Guidelines (DMP and EPA 2011).

10.2 Environmental aspects

The following aspects have been identified as requiring management to meet the identified rehabilitation objectives and minimise the potential for substandard rehabilitation outcomes:

- Characterisation and appropriate use of soil profile materials;
- Preservation of resources for including topsoil, mulch and native seed;
- Appropriate management of propagule resources;
- Stabilisation of rehabilitation areas to minimise loss of resources;
- Continuous development and improvement of rehabilitation techniques and outcomes; and
- Capture of suitable data to ensure rehabilitation outcomes can be measured and completion criteria assessed.

10.3 Performance management

Details on the post-closure land uses for Cooljarloo are contained within the Cooljarloo Mine Closure Plan (2013). Tronox's overarching closure objective is to establish safe and stable landforms capable of supporting sustainable native ecosystems similar to that which occurs in adjacent UCL areas and productive agricultural land on Mullering Farm, which:

- Fulfils designated land uses including conservation, protection of water quality and, where appropriate, provides for use by apiarists, native wildflower and seed pickers (UCL Native areas only);
- Can be achieved using mining industry current leading practice;
- Returns vegetation groups appropriate to the post mining land capabilities and are broadly representative of unmined reference sites (UCL Native areas only);
- Establishes soil profiles that have the capacity to provide sufficient plant available water to support mature plant communities in a similar manner to native reference sites.
- Targets re-establishment of significant flora species such as *Andersonia gracilis* (DRF) (UCL Native areas only);
- Provides habitat for local endemic native fauna species with particular focus on species listed under the *Wildlife Conservation Act* 1950 (WA) and the *Environmental Protection and Biodiversity Conservation Act* 1999 (Cth), as of conservation significance (i.e. rare or threatened) (UCL Native areas only);
- Targets the return of productive mixed agriculture land on existing freehold land commensurate with the surrounding areas (Freehold Agriculture only);
- Is based on the findings of relevant research into the establishment of biodiversity, ecosystem function, and sustainability for native areas and agricultural productivity and sustainability for farm areas;
- Is aligned with Tronox's whole-of-lease management approach including initiatives such as support for regional feral animal control, Phytophthora dieback management, flora study and other offset activities;
- Takes into account the views of regulatory authorities, neighbours and all other relevant stakeholders;
- Results in no unacceptable off-site impacts; and

- Management requirements (e.g. maintenance of access tracks, fire control) are not greater than those of areas prior to mining, or where extra management actions may be required, a mechanism has been put in place for addressing these.

For native rehabilitation within UCL, completion criteria have been developed in consultation with Mineral Sands Agreement Rehabilitation Coordination Committee (MSARCC). Completion criteria for Mullering Farm have been developed with consideration to the principles upon which the native UCL criteria were established.

To meet the above overall rehabilitation objectives detailed criteria and assessment methods have been developed. These criteria are applied in a staged manner with specific criteria applying to each development.

These criteria are defined with the Cooljarloo Mine Closure Plan which is submitted to MSARCC on a triennial basis for review and update.

10.4 Implementation

The planned actions that will be taken prior to closure are detailed in the Cooljarloo MCP and the relevant procedures and documents that are integrated into the Tronox's Environmental Management System. The key strategies that have been identified to assist in achieving rehabilitation objectives are presented within Table 27 below.

Table 27 Rehabilitation management actions

Aspect	Operational Controls	Reference
Planning	A Mine Closure Plan is maintained as per relevant DMP/EPA guidelines[1]	C0058 - Rehabilitation Planning
	A Conceptual Rehabilitation Plan is updated on an annual basis to detail site specific landform/soil profile prescriptions for the coming 2-5 years	C0058 - Rehabilitation Planning
	Site specific Works Management Plans are developed to manage contractors during the annual rehabilitation programme	C0058 - Rehabilitation Planning
	Rehabilitation landform plans are developed to: • Ensure appropriate characterisation of materials and use in landform construction; • Minimise the risk of upper profile surface saturation and erosion during high rainfall events; and • Provide suitable growing conditions for a range of sustainable plant communities	C0735 – Characterisation of Materials used in Landforming

[1] Refer to EMP/EPA *Guidelines for Preparing Mine Closure Plans*, June 2011

Aspect	Operational Controls	Reference
Planning	A programme is maintained targeting the establishment of recalcitrant species and conservation significant flora within rehabilitation	
	Material balances are maintained to avoid unplanned residual mine voids	C0058 - Rehabilitation Planning
	A baseline reference data set is maintained for flora and fauna species against which rehabilitation performance can be compared	
Ground Disturbance	Prior to native vegetation clearing areas are harvested to provide mulch for rehabilitation wherever possible	C0068 – Vegetation Clearing
Topsoil	Topsoil from native and agricultural areas is stripped, stockpiled and returned separately	C0068 – Vegetation Clearing
	First cut topsoil (upper 50 mm) is stripped, stockpiled and selectively managed according to vegetation type	C0061 – Topsoil Stripping
	First cut topsoil stockpiles do not exceed 2 metres in height	C0061 - Topsoil Stripping
	A minimum of 10% fresh cut topsoil is returned to native areas and planning processes are in place to maximise direct return	C0058 - Rehabilitation Planning
	Topsoil is preferentially stripped dry and dust is managed in accordance with the Dust Management Plan[2]	C0785 – Dust Management Plan
	Characterisation of soil and overburden materials is undertaken during overburden removal and landform construction	C0061 - Topsoil Stripping
Mulch	Native vegetation mulch is sourced either from the mine path area, or off-path in accordance with the requirements of the Mulch Harvesting Strategy[3] agreed with DEC	C0750 – Off Mine Path Vegetation Harvesting
	Where available, mulch is applied to rehabilitation areas to stabilise the soil surface and reduce the extent of topsoil loss during vegetation establishment	C0058 - Rehabilitation Planning
	Where native vegetation mulch is utilised, the vegetation type of the mulch sourced is matched, where practical, with the target vegetation group in the rehabilitation area	C0058 - Rehabilitation Planning
	Logs and wood material, were available and not required as mulch, will be distributed in rehabilitation areas to provide habitat for fauna	C0058 - Rehabilitation Planning
Seed	Cover crops are sown to assist with stabilisation of the soil surface and minimise topsoil loss during vegetation establishment where appropriate	C0058 - Rehabilitation Planning

[2] Refer to the Dust Management Plan (C0785)

[3] Refer to the Mulch Harvesting Strategy (2012)

Aspect	Operational Controls	Reference
	Native vegetation seeding regimes (species and quantities) used in rehabilitation contain local provenance seed and representative keystone species	C0058 - Rehabilitation Planning
	Keystone species are defined for each vegetation group and targeted for return into rehabilitation via a systematic management of propagules sources	C0058 - Rehabilitation Planning
	Trees/shrub species are included in native seed mixes at targeted densities to provide a feeding resource for Carnaby's Black-Cockatoo and other native bird species	C0058 - Rehabilitation Planning
	Agricultural seed mixes, fertilisers and application methods are undertaken in accordance with good agricultural practice within the region	
Landforming Works	Reconstructed landforms and drainage lines are tied into pre-disturbed topography	C0058 - Rehabilitation Planning
	Reconstructed soil profiles are designed to plan	C0058 - Rehabilitation Planning
Procedures and records	Records relating to rehabilitation works undertaken are maintained and formally signed off prior to completion	C0057 – Rehabilitation Operation Recording and Signoff
Financial Provision	A financial provision for rehabilitation is maintained based on area open (i.e. disturbed)	C0067 – Rehabilitation Provision Management

10.5 Monitoring

The monitoring programme for rehabilitation (Table 28) has been developed to measure performance against established targets and key operational controls.

Table 28 Rehabilitation monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Verify that landforming and rehabilitation activities are undertaken in accordance with the approved plans, procedures and completion criteria	Rehabilitation operations signoff (C0057)	All rehabilitation	During rehabilitation implementation	Landform, topsoil, earthworks, seeding, mulching
Monitor the success of rehabilitation establishment and the identification of any required remedial works	Condition monitoring (C0919)	All rehabilitation	Within 2 years after establishment.	Abundance ratings, mulch cover, species richness ranking, erosion, surface stability and bare areas
Monitoring vegetation establishment and compare against established targets	Rehabilitation performance monitoring (C0919)	All rehabilitation	3, 5, 7 and 10 years after establishment	Vegetation species counts (alive/dead), litter cover, foliar cover, erosion and slumping
Assess conformance against all completion criteria prior to relinquishment	Relinquishment signoff (C0919)	All rehabilitation	Prior to relinquishment	Operations signoff register, early establishments monitoring, rehabilitation performance monitoring, remedial actions records and site inspection
Quantify fauna abundance and diversity in reference sites and assess relative performance in rehabilitation	Pit fall trapping, bird surveys and targeted invertebrate searches (C0919).	At selected representative rehabilitation sites	Annually	Species trapped using pit traps, bird species observed

10.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 29.

Table 29 Rehabilitation contingency actions

Trigger	Action
Rehabilitation fails to meet completion criteria	1. Identify cause and significance of the issue 2. Review rehabilitation systems and implement corrective actions to minimise the risk of reoccurrence if required 3. Determine if remediation is required to meet the rehabilitation objectives 4. Develop and implement remediation plan and consult MSARCC as required 5. Monitor outcomes
Insufficient provenance seed volumes or plants collected and propagated	1. Determine if additional seed and plants can be obtained from other seed collectors and native nurseries 2. Review rehabilitation systems and implement corrective actions to minimise the risk of reoccurrence 3. Review ecological risk/benefit of incorporating non provenance species into the seed mix or postponing rehabilitation 4. Monitor outcomes
Insufficient topsoil or mulch resources available on site	1. Source appropriate material from offsite or investigate alternatives such that the rehabilitation objective will be met 2. Review ecological risk/benefit of sourcing material offsite 3. Develop and implement a plan in consultation with MSARCC 4. Monitor outcomes
Soil and groundwater contamination	1. Determine location of contamination source and assess the significance of the issue 2. Implement corrective actions in accordance with the requirements of the *Contaminated Sites Act 2003* and in consultation with the DEC to remediate and prevent further contamination of the surrounding environment.

11 PROCESS WASTE MANAGEMENT PLAN

11.1 Description

Within Mullering Farm, Tronox operates a licenced Class III waste disposal facility at Cooljarloo. This facility receives waste products from processing facilities at Chandala and Kwinana. The Cooljarloo site is approved to accept up to 500 000 wet tonnes of process waste each year. The major constituents of the process waste include filter cake (neutralised acid effluent), pugged waste (iron oxide and char), coarse sand rejects (small amounts of monazite) and pre-screen tailings. The Cooljarloo waste facility has been designed, constructed and operated to minimise pollution. Designs for each pit are reviewed and approved by the DEC prior to commissioning.

11.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential for process waste contamination:

- Design and construction of process waste pits to prevent the leaching of constituents into groundwater / soil and sensitive environmental receptors including Mullering Brook;
- Transportation of process waste from Chandala to Cooljarloo; and
- Management of the process waste pits and vehicle wash bay to prevent uncontrolled contaminated runoff.

11.3 Performance management

Objectives, performance targets and associated assessment methods relating to process waste management are detailed in Table 30 below.

Table 30 Process waste management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Manage Class III Landfill as per Licenced Conditions and other Statutory Requirements	Blended process waste constituents meet the criteria for Class III Landfill prior to disposal	Analysis of waste constituents
	Process waste facilities are constructed as per Environmental Licence conditions, relevant guidelines and are approved by the relevant government agencies prior to commissioning	Assess survey and construction details against plan
	Process waste is covered during transport to minimise dust emissions	Audit truck cover use
	Contaminated stormwater drainage is managed to prevent discharge into Mullering Brook	Inspect relevant areas and monitor water quality
	Volume of Class III waste disposal within licence Limits	Audit waste disposal records

11.4 Implementation

Key operational controls to support the process waste objectives are summarised in Table 31.

Table 31 Process waste operational controls

Aspect	Operational Controls	Reference
Washdown facilities	Truck wash facilities are situated at the site entrance/exit to enable wheel washing and thereby minimise process waste tracking on public roads during winter	C0777 - Waste Management Procedure
Transportation	Haulage trucks are covered on public roads during transport to minimise dust	TJV203 - Environmental Performance Standard
Process waste	Process waste coarse rejects disposed of at the Class III Landfill are covered and or blended	C0777 - Waste Management Procedure
	The volume of process waste disposed of on site is within Licence limits	C0777 - Waste Management Procedure

11.5 Monitoring

The monitoring programme for process waste (Table 32) has been developed to measure performance against established targets and key operational controls.

Table 32 Process waste monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Assess if process waste constituents meet relevant standards and guidelines for Class III Landfill	Waste sampling and analysis (CH0154; C0777)	Chandala and Kwinana	Biannually	Defined in Site Environmental Licence
Track the volume of waste dispatched to Cooljarloo	Waste volume tracking (CH0154; C0777)	Cooljarloo weighbridge	Ongoing (Monthly Report)	Volumes of each component of process waste
Monitor the effectiveness of containment liner	Monitored by means of surface and groundwater monitoring (refer to relevant sections)	Class III landfill facility	Defined by site environmental licence	Defined in site environmental licence
Monitor adherence to process waste management procedures	Audit relevant items within the waste management Procedures (C0777) and Works Approval	Class III landfill facility	Annually	Conformance to relevant site procedures and Works Approval

11.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 33.

Table 33 Process waste contingency actions

Trigger	Action
Incorrect disposal of process waste	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required and/or address the issue directly if possible 3. Monitor the effectiveness of implemented controls
Stormwater drainage from the process waste pits enters Mullering Brook	1. Initiate immediate response to control and contain the source 2. Assess the significance of the issue and raise an incident 3. Develop corrective actions as required 4. Report significant/reportable incidents to the relevant regulator 5. Monitor the effectiveness of the implemented controls
Blended Class lll material does not meet DEC landfill guidelines	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required 3. Notify the relevant regulator of all reportable incidents 4. Monitor the effectiveness of implemented controls

12 WASTE MANAGEMENT PLAN

12.1 Description

The mining operations at Cooljarloo create a number of waste streams that require active management to minimise the risk of land contamination. The key wastes are well understood and include: sewage; hydrocarbon waste; tyres; putrescible wastes and other general inert mining wastes (refer to Section 12 for Process Waste). Controlled wastes are a group defined as having physical, chemical or other properties that make them an environmental or health hazard. These wastes are required to be managed and tracked to minimised the risk of inappropriate disposal.

12.2 Environmental aspects

The following waste streams have been identified as requiring management to minimise the potential contamination of land and water;

- Effluent waste from treatment facilities;
- Municipal and putrescible waste;
- Controlled wastes including hydrocarbons and tyres; and
- Mechanical and other mining waste including batteries, lubricants, coolant; scrap metal and plastics.

12.3 Performance management

Objectives, performance targets and associated assessment methods relating to waste management are detailed in Table 34 below.

Table 34 Waste management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Maintain records of controlled waste transfers	Appropriate records maintained relating to the disposal of controlled wastes and hazardous substances as per the *Controlled Waste Regulations* 2004	Audit controlled waste records
Manage contaminated sites according to the *Contaminated Sites Act* 2003	Potential and suspect contaminated sites to be reported according the *Contaminated Sites Act* 2003	Audit against *Contaminated Sites Act* 2003
	Contaminated Sites to be managed in line with *Contaminated Sites Act* 2003 and site specific management plans	Audit against *Contaminated Sites Act* 2003

12.4 Implementation

Key operational controls to support the waste management objectives are summarised in Table 35.

Table 35 Waste operational controls

Aspect	Operational Controls	References
Waste characterisation	All waste streams to be described, risk assessed and disposal method approved internally prior to disposal	C0777 - Waste Management
Waste segregation	Waste streams are segregated to facilitate re-use and recycling where appropriate	C0777 - Waste Management
Controlled wastes	Controlled wastes are removed from Site by a licenced carrier	C0777 - Waste Management
Onsite disposal	The volume of waste disposed in Class I Landfill areas is within approved amounts	C0777 - Waste Management
Waste tracking	Material balances are maintained for regulated wastes to enable the reconciliation of materials received on site against materials leaving or stored	TJV203 - Environmental Performance Standard
	Waste quantities to be reported in the AER	C0777 - Waste Management
Waste tyres	Waste tyres are disposed of according to licence conditions	C0777 - Waste Management

Aspect	Operational Controls	References
Wastewater treatment	Waste water treatment plants managed according to Tronox procedures	C0777 - Waste Management
Waste reduction	Periodic reviews are undertaken to identify opportunities for more effective means of reducing waste generation or waste disposal	
Recyclable materials	Recyclable and reusable materials (such as some steel and batteries) are stored in designated areas and made available for re-use or periodic collection	C0777 - Waste Management
Contaminated sites	New contaminated sites are reported to the DEC and Management Plans are implemented as required under the *Contaminated Sites Act* 2003 for known contaminated sites.	

12.5 Monitoring

The monitoring programme for waste management (Table 36) had been developed to measure performance against established targets and key operational controls.

Table 36 Waste monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Track the volume of waste disposed in-pit and compare against licence limits	Track waste volumes (C0777)	Class 1 in-pit disposal sites	Monthly	Volume waste (m^3)
Record the location of disposal sites for Class 1 waste material	Survey in-pit disposal locations (C0777)	Class 1 in-pit disposal sites	Monthly	GPS survey location
Ensure controlled waste is managed appropriately	Audit of controlled waste records	Within Mining Lease	Quarterly	Conformance to procedures
Monitor adherence to waste management procedures	Site inspection (C0029)	Within Mining Lease	Quarterly	Conformance to procedures
Assess conformance to the *Contaminated Sites Act* and associated internal Management Plans	Audit relevant documents	Within Mining Lease	Triennially	Conformance to legal requirements and Management Plans

12.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 37.

Table 37 Waste contingency actions

Trigger	Action
Incorrect disposal of waste	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required 3. Monitor the effectiveness of implemented controls
Spills/leaks observed	1. Initiate spill response (control; contain; clean-up) 2. Assess the significance of the issue and raise an incident report if deemed necessary 3. Develop corrective actions as required 4. Report significant/reportable incidents to the relevant regulator 5. Monitor the effectiveness of implemented controls
Poor water quality from the waste water treatment plant	1. Initiate spill response (control; contain; clean-up) if applicable 2. Assess the significance of the issue and raise an incident report if deemed necessary 3. Develop corrective actions as required 4. Notify the relevant regular of reportable incidents 5. Monitor the effectiveness of implemented controls

13 RADIATION MANAGEMENT PLAN

13.1 Description

Naturally occurring radioactive materials (NORM) occur in mineral sands deposits throughout Western Australia. The sources, risks and controls for these low level radioactive materials are well understood and implemented by the industry. This section outlines the management of NORM at Cooljarloo which include course rejects from the Chandala site (containing up to 0.5% monazite) and low level radiation from the HMC mining product. In addition to NORM, this section covers the gauges and monitors on site that utilise radioactive sources.

13.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential for unacceptable levels of radiation exposure;

- Management of process waste materials returned to the mine from Chandala;
- Transport of HMC to Chandala;
- Return of materials to rehabilitation areas; and
- Radioactive sources in gauges and monitoring devices used on site.

13.3 Performance management

Objectives, performance targets and associated assessment methods relating to radiation management are detailed in Table 38 below.

Table 38 Radiation management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Comply with the *Mine Safety Inspection Act* 1994 and Regulations	Accepted Radiation Management Plan and conformance to the contained targets and commitments	Acceptance letter from DMP and an annual review and reporting against the RMP.

13.4 Implementation

Key operational controls to support the radiation management objectives are summarised in Table 39.

Table 39 Radiation operational controls

Aspect	Operational Controls	Reference
Process waste materials with low level radioactivity from Chandala	All Process Waste loads covered for transport between sites	NO0198 - Radiation Management Plan
	Waste materials are disposed of according to licence conditions and the Radiation Management Plan	NO0198 - Radiation Management Plan
	Radiation assessments of coarse rejects are conducted before leaving site	NO0198 - Radiation Management Plan
	Process wastes containing radioactive materials are disposed of in the Cooljarloo Class lll landfill facility	NO0198 - Radiation Management Plan
Ore transported to Chandala	All HMC loads covered for transport between sites	NO0198 - Radiation Management Plan
On site handling of radioactive materials	Performance against commitments in the Radiation Management Plan are reported annually to the DMP	NO0198 - Radiation Management Plan
	Radioactive material is transported off-site according to the *WA Transport Regulations 2002*	NO0198 - Radiation Management Plan
	Class lll process waste facilities are capped with at least 2m off overburden or tailings prior to rehabiliation	NO0198 - Radiation Management Plan

13.5 Monitoring

The monitoring programme for radiation management (Table 40) has been developed to measure performance against established targets and key operational controls.

Table 40 Radiation monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Assess adherence to the RMP	Audit relevant documents	Within Mining Lease	Annual	Conformance to the RMP
Ensure rehabilitation areas meet closure requirement	Survey	Rehabilitation areas	Once after landforming	Gamma radiation
Ensure groundwater radiation levels are acceptable at lease boundary	Monitoring of groundwater radioactivity	Lease boundary, waste monitoring bores and water supply bores	Quarterly	Alpha and gamma activity (corrected for Potassium^{40})
Ensure mining activity does not impact upon baseline radiation levels	Survey	Lease boundary – selected locations	Bi-annual	Gamma radiation

13.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 41.

Table 41 Radiation contingency actions

Trigger	Action
Exceedence of any applicable standard in monitoring	1. Assess the significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required 3. Monitor the effectiveness of implemented controls
Breach of Radiation Management Plan requirements	1. Assess the significance of the issue and raise an incident 2. Develop corrective actions as required 3. Monitor the effectiveness of implemented controls 4. Notify the relevant stakeholders if necessary

14 WATER MANAGEMENT PLAN

14.1 Description

The occurrence of surface water at Cooljarloo is limited by the generally permeable surface sands and dry climate. Two ephemeral waterways pass through the Cooljarloo Lease. The main waterway is Mullering Brook which bisects the central lease area. Mount Jetty Creek crosses the north east lease boundary and is further from mining operations. Lesser drainage lines carry intermittent flows from the Gingin Scarp onto the lease area where they dissipate in the sandy terrain. Mullering Brook has been diverted a number of times to access ore for the Dredge Mine while Mount Jetty creek sits outside the mine disturbance.

Groundwater at Cooljarloo is generally separated into two systems - the Superficial and Yarragadee aquifers. The Superficial aquifer hosts a predominantly unconfined regional groundwater flow system which receives recharge over a broad area. Groundwater in the superficial deposits are of generally good quality and flow westward from the Gingin Scarp to discharge toward the coast. The Yarragadee formation is a significant fresh groundwater resource that is a confined aquifer in places and is generally greater than 50 m below surface at Cooljarloo. Groundwater flow in the Yarragadee is in a westerly direction and is largely recharged between the Gingin and Dandaragan Scarps.

The mining of mineral resources at Cooljarloo involves pit and pond dewatering to access ore from the north and south (Dredge) mining operations. In addition water abstracted from bores in the Superficial and Yarragadee aquifers is used to supplement water sourced from dewatering to enable the processing of ore and pumping of material (slimes/tails/ore) around the site. These activities have the potential to impact groundwater levels and quality if not managed appropriately.

14.2 Environmental aspects

The potential impacts on groundwater and surface water values and the aspects requiring management are as follows:

- Dewatering of mine voids or groundwater abstraction resulting in groundwater drawdown and potential impacts on Groundwater Dependant Vegetation or groundwater quality;
- Groundwater mounding due to water storage in dams or ponds;
- Pipe and seal failure during tailing transfer (slimes/sand tails); and
- Spills from mining or ancillary activities resulting in contamination.

14.3 Performance management

Objectives, performance targets and associated assessment methods relating to water management are detailed in Table 42 below.

Table 42 Groundwater and surface water management objectives, targets and performance indicators

Objective	Performance Targets	Assessment Method
Protect groundwater and surface water quality	Groundwater quality within the range of pre-mining background values	Monitor water quality
Comply with legislative requirements for water abstraction	Full compliance with groundwater licence conditions	Audit against licence conditions
Maintain the capacity of Mullering Brook to flow through the lease.	Flow capacity maintained through the Mining Lease	Monitor surface flow and water quality
Minimise the impacts of groundwater drawdown on Groundwater Dependant Ecosystems	No significant decline in vegetation health as a result of bore abstraction activities	Monitor vegetation health
	Drawdown risks associated with threatened flora or restricted FCTs[1] are assessed and site specific Drawdown Management Plans developed to mitigate impacts	Monthly assessment against relevant Drawdown Management Plan

[1] FCT Floristic Community Type

14.4 Implementation

Key operational controls to support the water management objectives are summarised in Table 43.

Table 43 Groundwater and surface water operational controls

Aspect	Operational Controls	Reference
Risk Assessment	A review of water related aspects and statutory obligations is conducted on an annual basis to assess the potential for water related environmental impacts and community concerns	TJV203 – Environmental Performance Standards
	A risk assessment is conducted for all new water sources prior to use - existing water sources are reviewed on a monthly basis with consideration to the most recent monitoring results	
Water Use	A Site water balance is maintained to assess groundwater use, including water abstracted from bores, mining voids, water dams and with consideration to water return via tailing discharge	
	The water balance is reviewed on a regular basis to ensure use is within the limits stated in the DoW Groundwater Licence	
	Groundwater abstraction is conducted as per the conditions in the DoW Ground Water Licence	
	A Strategic Water Plan is maintained which considers risks and controls associated with maintaining mine water supply while maintaining environmental values	
Water Quality	A water quality monitoring programme is undertaken that is commensurate with the risks associated with mining and associated water use/discharge	C0040 - Groundwater Quality Monitoring; C0042 - Surface Water Management
	Equipment used to monitor groundwater quality is calibrated and associated records maintained	C0040 - Groundwater Quality Monitoring
Tailings	Tailing storage facilities are managed in line with established DMP guidelines[4] and site procedures	C0348 – Tailing Storage Facility Manual
	Required freeboard is marked in the field and is regularly monitored	C0348 – Tailing Storage Facility Manual
	Tailing pipelines are contained within designated cleared/stripped corridors	C0348 – Tailing Storage Facility Manual

[4] DMP Guidelines for *Safe Design and Operating Standards for Tailings Storage*, Originally Released May 1999

Aspect	Operational Controls	Reference
Groundwater Drawdown	A site specific Management Plan is maintained to minimise the impact of mine related drawdown on Groundwater Dependant Ecosystems (GDEs) The plan includes: • An assessment of GDE's within the drawdown zone; • Targets for groundwater drawdown and vegetation health; • A monitoring schedule that is reflective of the risks associated with each drawdown zone; • Site specific prevention, mitigation and remediation management controls. This plan is reviewed and updated in response to risks identified from water level monitoring results and/or changes in the mine plan.	
	Drawdown modelling is conducted on a regular basis such that the likely drawdown scenarios are assessed in-line with the current mine plan	
	Where possible excess clean water from mineral processing activities is returned to the aquifer via ponds, dams or other impoundments; or during tailing activities	
Surface water	Surface water monitoring is conducted at Mount Jetty Creek and Mullering Brook to assess water chemistry and sediment loads	
	Prior to any operational discharge to Mullering Brook the DEC and DoW are consulted and provision put in place to monitor discharge quality and rate	
	Mullering Brook Diversions are designed and maintained (e.g. bed and bank erosion is prevented / repaired and sediment traps maintained) such that erosion and sedimentation issues are considered and minimised	
	Stormwater released to Mullering Brook meets the quality specifications in the Site Environmental Licence	
	An exclusion zone between Mt Jetty Creek and mining operations is maintained to minimise impacts on water quality and flow	
Reporting	A monthly report is distributed internally outlining performance against groundwater thresholds and management controls	
	Groundwater use and water levels are reported annually via the Annual/Triennial Aquifer review in line with the requirements of relevant Groundwater Abstraction Licences	NO0117 – Communications and Reporting

14.5 Monitoring

The monitoring programme for water management (Table 44) has been developed to measure performance against established targets and key operational controls.

Table 44 Groundwater and surface water monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Monitor groundwater levels and compare results to the predicted drawdown extent and ecological thresholds	Monitor water levels (C0039).	Areas of predicted or actual groundwater drawdown	As per Operating Strategy and Site Monitoring Schedule	Depth to groundwater
Monitor groundwater chemistry to assess performance against relevant targets	Sample and analyse water quality (C0040)	Areas of predicted or actual groundwater drawdown	As per Operating Strategy and Site Monitoring Schedule	Groundwater chemistry as outlined in the Operating Strategy and Site monitoring schedule. Refer to CO040
Monitor abstraction from Production Bores	Record meter readings from all operational Production Bores (C0038)	Abstraction bore	Monthly	Meter readings
Monitor water transfers from dewatering locations	Record run hours and determine flow rate for all pumps	Pits, dams and ponds	Monthly	Run hours according to C0038
Detect changes in surface water quality or flow in Mullering Brook, Mount Jetty Creek and Emu Lakes.	Take samples from surface water bodies and capture flow data from Mullering Brook and Mount Jetty Creek according to (C0042)	Mount Jetty Creek and Mullering Brook	Water samples taken monthly when flowing and flow rates continuously	As outlined in the monitoring schedule. Total dissolved solids, total suspended solids, water quality, radiation and flow rate where applicable
Assess Compliance to the groundwater abstraction licences.	Audit compliance against licence conditions	Within Mining lease	Annual	Conformance to Licence conditions

Purpose	Activity	Location	Frequency	Parameters
Assess changes in foliage cover and biomass using hyperspectural aerial imagery	Capture data to enable the analysis of foliage cover and/or biomass	Within Mining Lease	As required	Percentage foliage cover change
Monitor vegetation composition in permanent plots to assess change over time	Monitor vegetation within permanent plots every 3 to 5 years	Areas of predicted or actual groundwater drawdown and baseline reference plots	Every 3-5 years	Species composition, abundance and projected foliage cover
Assess vegetation health within high risk areas to determine if groundwater drawdown is impacting vegetation	Assess vegetation health in high risk areas around groundwater observation bores (C0039)	Areas of predicted or actual groundwater drawdown	As per groundwater monitoring frequency	Percentage foliage alive/dead and plant mortality

14.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 45.

Table 45 Groundwater and surface water contingency actions

Trigger	Action
Groundwater levels are lower than predicted and/or vegetation condition has declined more than predicted	1. Investigate the cause/significance of the issue and raise an incident report if deemed necessary 2. Determine if operational activities have diverged from plan resulting in greater drawdown impacts than expected or if the assumptions in the ground water modelling and risk assessment are flawed 3. Review operational management measures, escalate where possible and review groundwater modelling and risk assessment if deemed necessary 4. Upon completion of the required investigations determine if the impacts to GDE's are likely to be significantly more than predicted and if these impacts are acceptable or further operational management measures are required 5. Consult the relevant government regulator if there is likely to be any significant change to predicted impacts so that an adequate management/remediation strategy can be agreed
Water quality or flow regimes are outside acceptable ranges	1. Investigate the cause/significance of the issue and raise an incident report if deemed necessary 2. Review operational management measures, escalate where possible and necessary 3. Review systems and implement corrective actions to minimise the risk of reoccurrence 4. Determine if remediation is required to maintain ecological values 5. Develop and implement remediation plan if necessary and consult with the relevant government regulator as required 6. Monitor outcomes

15 FIRE MANAGEMENT PLAN

15.1 Description

Fire is part of the natural regime within vegetation communities in south-west of Western Australia. Many plant species are well adapted to fire and recover after burning and some require fire to stimulate germination. As such periodic burning promotes a diversity of vegetation communities, habitats and food resources for fauna within native areas. At Cooljarloo prescribed burns within UCL areas are managed by the DEC, in consultation with Tronox and in accordance with an agreed site specific Fire Management Plan. Uncontrolled bushfires have the potential to severely impact the environment and threaten lives, property and agricultural resources. It is important that fuel loads are managed and prescribed burns are conducted in a controlled manner.

15.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential for uncontrolled fires:

- Storage and use of flammable materials (Section 13);
- Operations in high risk fire conditions;
- Machinery operation particularly in or close to uncleared areas;
- Hot works such welding as grinding; and
- Maintenance of effective fire containment and control resources.

15.3 Performance management

Objectives, performance targets and associated assessment methods relating to fire management are detailed in Table 46 below.

Table 46 Fire management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Prevent uncontrolled wildfires caused by Mining Operations	No uncontrolled wildfires caused by mining and ancillary operations	Review Incident Reports
Contain and control any fires such that damage to the environment, property or people are minimised	Prescription burning is conducted in accordance with relevant internal procedures	Audit Fire Management Procedure
	Firebreaks are maintained in accordance with relevant internal procedures	Inspection of fire breaks

15.4 Implementation

Key operational controls to support the fire management objectives are summarised in Table 47.

Table 47 Fire operational controls

Aspect	Operational Controls	Reference
Planning	Maintain an agreed Fire Management Plan in consultation with DEC	
Containment and control resources	Firebreaks are maintained annually	C0028 - Fire Management Procedure
	A fire unit is on standby and available for local fires	C0028 - Fire Management Procedure
Hot work	Hot work (work with a high risk of fire, use of electrical tools, etc) is only undertaken following the granting of a hot work permit. The permit will include measures for fire prevention and the requirement for a fire spotter during high risk works	NO0008 – Hot Work Procedure
Communication	Consult the relevant government and community stakeholders prior to any prescribed burn	C0028 - Fire Management Procedure
	Relevant Tronox personnel are registered with the Dandaragan Shire Council's system to advise of Harvest and Vehicle Movement Bans	C0028 - Fire Management Procedure

15.5 Monitoring

The monitoring programme for fire management (Table 48) has been developed to measure performance against established targets and key operational controls.

Table 48 Fire monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Determine if fire breaks are being maintained adequately	Area inspection (C0029)	Firebreaks	Annually, prior to summer	Condition of fire breaks
Identify potential onsite fire risks	Area inspection (C0029)	All areas	Quarterly	Presence/absence of flammable materials

15.6 Contingencies

Contingency measures have been developed to address the trigger outlined in Table 49.

Table 49 Fire contingency actions

Trigger	Action
Uncontrolled fire starts onsite	1. Respond to fire in accordance with Emergency response procedures 2. Raise an incident 4. Develop corrective actions as required 3. Report to the relevant regulatory authority

16 ACID SULFATE SOIL MANAGEMENT PLAN

16.1 Description

Potentially acid sulphate soils are generally found in low-lying land bordering the coast (DEC, 2011). They are naturally occurring sediments that contain iron sulfide minerals, predominantly as the mineral pyrite. These materials are typically found below the water table and are benign when undisturbed, but have the potential to release sulfuric acid when exposed to oxygen.

Potentially acid forming material (PASS) are found in discrete locations, generally toward the north of the Cooljarloo Lease. The material is generally confined to a discontinuous dark grey/black clay layer found at depth below the water table. Pre-mine screening and active management of material is undertaken to minimise the risk these materials pose. While no significant issues have been identified to date there is a potential for sensitive environmental receptors to be impacted by the released acids and associated heavy metals and sulphate salts if the PASS material is not identified and managed effectively.

16.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential for acid sulfate soil related contamination:

- Ground water drawdown due to pit dewatering and bore abstraction; and
- Excavation and mining of materials from below the water table.

Both aspects have the potential to expose PASS material and result in groundwater and land contamination if not managed appropriately.

16.3 Performance management

Objectives, performance targets and associated assessment methods relating to acid sulfate soils are detailed in Table 50 below.

Table 50 Acid sulfate soils management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Minimise potential for acid sulfate soil exposure to oxygen	Material characterisation and risk assessment completed prior to mining new areas	Audit risk assessment
Prevent impacts to sensitive environmental receptors due to contamination from Acid Sulfate Soils (ASS)	Post mining water quality within the baseline pre-mining range	Monitor water quality

16.4 Implementation

Key operational controls to support the acid sulphate soil objectives are summarised in Table 51.

Table 51 Acid sulfate soil contingency actions

Aspect	Operational Controls	Reference
Risk Assessment	Acid sulfate soil field screening is conducted within the resource boundary and area of groundwater drawdown to assess if potentially acid forming materials are present	NO0372 - Identification of Acid Sulphate Soils
Management	Area specific management plans are developed for those areas where the disturbance of ASS could potentially impact sensitive environmental receptors	NO0372 - Identification of Acid Sulphate Soils
	Performance against site specific management plans and related monitoring programmes are regularly reviewed and reported	NO0372 - Identification of Acid Sulphate Soils

16.5 Monitoring

The monitoring programme for acid sulphate soils (Table 52) has been developed to measure performance against established targets and key operational controls.

Table 52 Acid sulfate soil monitoring programme

Purpose	Activity	Location	Frequency	Parameters
Identify ASS materials during mining	Pit inspection as conducted (C0927)	Active mining pit in areas of ASS risk	As required in areas of risk	Characteristics of lithology; and pH_f and pH_{fox} in soils samples.
Monitor water quality and assess against relevant criteria	Groundwater quality monitoring (in pit and surrounds) (C0040; C0972)	Bores within surrounding ASS risk vicinity	As per monthly monitoring schedule	Groundwater quality including but not limited to pH; Alkalinity; Ec; Heavy metals (Al and Fe), SO_4;Cl ratio
Monitor tailing waste and assess against relevant criteria	Monitor soil and water quality at tailings discharge points (C0927)	Active mining pit in areas of ASS risk	Weekly during mining of pits with identified areas of risk	Field screening using pH_{fox} in high risk areas and laboratory analysis as required.

16.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 53.

Table 53 Acid sulfate soils contingency actions

Trigger	Action
Water quality results above internal targets	1. Investigate the cause/significance of the issue and raise an incident report if deemed necessary 2. Review operational management measures, escalate control where possible and necessary 3. Review systems and implement corrective actions to minimise the risk of reoccurrence 4. Determine if remediation is required to maintain ecological values 5. Develop and implement a remediation plan if necessary and consult the relevant government regulator as required 6. Monitor outcomes
Field screening results are above the threshold criteria for pH_{fox} or S_{cr}	1. Incorporate field screening results into the Geologists Conceptual Model and assess the risk to sensitive environmental receptors 2. Where required (as determined by risk) develop a management response with consideration the internal procedures and the relevant DEC guidelines

17 HYDROCARBON AND HAZARDOUS MATERIALS MANAGEMENT PLAN

17.1 Description

For the purposes of this management plan, hazardous materials refer to any solid or liquid material (other than waste), which if released into the environment, has the potential to cause direct or indirect alteration to the environment, to its detriment or degradation. This may include some classes of dangerous goods as defined by the *Dangerous Goods Safety Act 2004*, including hydrocarbons. Cooljarloo has very few hazardous materials of any significant volume. The greatest volume of material present is diesel fuel used for earthmoving equipment/vehicles and hydraulic oils for the South Mine dredges. Spillage to land and water can cause contamination of sensitive environmental receptors if the materials not stored and managed appropriately.

Management of waste is described in the Waste Management Plan (Section 8).

17.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential for hydrocarbon or hazardous material contamination:

- Operation and refuelling of vehicles/machinery;
- Transportation and storage of hydrocarbons and hazardous materials;
- Operation of processing facilities including the dredges and concentration plants;
- Management of workshop areas and wash-down facilities; and
- Management of the hydrocarbon bioremediation areas and other suspected/known contaminated sites.

17.3 Performance management

Objectives, performance targets and associated assessment methods relating to hydrocarbons and hazardous materials are detailed in Table 54 below.

Table 54 Hydrocarbon and hazardous material management objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Prevent contamination of the surrounding environment from the release of hydrocarbons and hazardous materials	No significant or reportable environmental incidents relating to hydrocarbons and hazardous materials	Review Incident Reports
	Oil-water separator water discharge quality < 15 mg/L TPH	Monitor water quality
	Stored hydrocarbon containers >205L are to be bunded according to AS1940-2004	Inspect bulk storage facilities

17.4 Implementation

Key operational controls to support the hydrocarbon and hazardous material objectives are summarised in Table 55.

Table 55 Hydrocarbon and hazardous material operational controls

Aspect	Operational Controls	Reference
Hazardous materials	Material requisition follows a process to ensure that hazardous materials are subject to a risk assessment and approval by an authorised person prior to being received on site	NO0120 – Hazardous Materials Management
	Material Safety Data Sheets (MSDS) to be retained on site in a register	NO0120 – Hazardous Materials Management
	Incompatible materials are physically isolated when stored	NO0120 – Hazardous Materials Management
	A register of hazardous materials is maintained on site	NO0120 – Hazardous Materials Management
Operation of vehicles/machinery	Hydrocarbon transfers are controlled to minimise the risk of pollution and impacts to sensitive receptors	C0409 – Refuelling of Equipment in the Field
	Refuelling vehicles are equipped with the spill response kits to clean up accidental loss of hydrocarbons	
	Plant, vehicles and equipment are adequately maintained and serviced to prevent leaks	
Transportation	Hydrocarbon containers are appropriately secured to prevent spillage during transportation	
Storage	All storage facilities for bulk hydrocarbons meet Australian Standard AS1940:2004 and are licenced and operated in accordance with the requirements of the *Explosives and Dangerous Goods Act* 2004.	C0784 – Hydrocarbon Management

Aspect	Operational Controls	Reference
	All bulk fuel tanks and mobile refuelling vehicles to be fitted with auto shut-off valves or other appropriate devices to prevent overfilling	
	Hydrocarbon storage containers > 205 L drums are stored within a bunded areas to contain 110% of the largest container and 25% of the total volume of the total storage volume in the bund	C0784 – Hydrocarbon Management
	All hydrocarbon and hazardous material storage areas display the relevant signage (e.g. dangerous classification) and basic hazard information (e.g. flammability, corrosiveness)	
	Bulk storage vessels are tested and labelled as required by legislation	
Emergency response	Spill containment and recovery equipment is located in high risk areas to enable rapid response in the instance of accidental loss of hydrocarbons	C0784 – Hydrocarbon Management
	Response to emergencies involving hydrocarbons are included in the site Emergency Response Plans. Emergency exercises, involving hydrocarbon related incidents, are to be held periodically	C0788 – Emergency Response Procedures
Oil / water separators	All potentially hydrocarbon contaminated wash-water from wash-pads and workshops floors are treated using oil water separators to prevent pollution. Such devices are subject to appropriate inspection, testing and maintenance regimes	C0784 – Hydrocarbon Management
	Non-solvent (quick break) degreasers are used for all cleaning tasks wherever practicable to avoid the creation of untreatable emulsions	
Spill Response	Containment of any spillages or leakage will be a priority and spills will be cleaned as soon as practicable	
	An Emergency Response Plan will be prepared and implemented to enable a rapid response in the event of a significant spill or loss of potentially contaminating material.	C0788 – Emergency Response Procedures

17.5 Monitoring

The monitoring programme for hydrocarbon and hazardous materials (Table 56) has been developed to measure performance against established targets and key operational controls.

Table 56 Hydrocarbon and hazardous material monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Identify spills and leaks	Area inspection (C0029)	All site	Ongoing according to EMS	Spills, leaks and conformance to relevant procedures
Check that areas are being appropriately maintained and managed	Area inspection (C0029)	All site	Ongoing according to EMS	Audit conformance to applicable standards and procedures

17.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 57.

Table 57 Hydrocarbon and hazardous material contingency actions

Trigger	Action
Hazardous material spill or unauthorised discharge.	1. Initiate spill response (control; contain; clean-up) 2. Assess the significance of the issue and raise an incident report if deemed necessary 3. Develop corrective actions as required 4. Report significant/reportable incidents to the relevant regulator 5. Monitor the effectiveness of implemented controls
Review of incident register or risk register reveals increased risks or frequencies/severity of hydrocarbon or hazardous material incidents	1. Report issue to site management 2. Investigate issue to determine potential causes 3. Review and revise procedures as appropriate 4. Monitor the effectiveness of implemented controls

18 STAKEHOLDER MANAGEMENT PLAN

18.1 Description

Tronox is committed to ensuring that Cooljarloo operations effectively consider key stakeholder concerns and engage with key stakeholders to evaluate and address concerns. Furthermore Tronox is committed to openly communicate environmental performance to stakeholders, consistent with statutory requirements.

The key environmental state government agency stakeholders are consulted predominantly through the Mineral Sands Agreement Rehabilitation Coordinating Committee (MSARCC). MSARCC is an important coordinating body providing a forum to discuss environmental management, permitting and approvals, completion criteria, rehabilitation outcomes and research. MSARCC effectively supports a whole of government approach to the environmental management of Cooljarloo.

Cooljarloo has two immediate neighbouring properties, the Billinue Community to the east and a neighbouring farm residence to the west (Duffy's Farm). Aboriginal heritage surveys have been undertaken across the mining lease revealing one archaeological and one ethnographic site (Mullering Brook). The archaeological site is remote from the active mining areas and has been fenced, signposted and declared to be out of bounds to personnel on site. The location of the site is made known to key personnel.

18.2 Environmental aspects

The following aspects have been identified as requiring management to minimise the potential impacts on stakeholders:

- Noise from mining and ancillary operations;
- Management of Aboriginal heritage sites; and
- Ongoing stakeholder and regulator consultation.

18.3 Performance management

Objectives, performance targets and associated assessment methods relating to stakeholder management are detailed in Table 58.

Table 58 Stakeholder management, noise management and aboriginal heritage objectives, targets and verification methods

Objective	Performance Targets	Assessment Method
Protect aboriginal sites of significance and comply with the *Aboriginal Heritage Act (1972)*	No disturbance of the Mullering Farm Aboriginal Site	Inspect relevant areas
	Rehabilitation of Mullering Brook includes the development of water features representing seasonal ponds	Inspect relevant areas with Traditional Owners
Ensure noise from mining operations does not affect the public and neighbouring premises	No substantiated community noise complaints	Audit against community complaints records
Openly report environmental performance	Submit Annual Environmental Reports on time and to the required quality	Performance reports made available to key stakeholders
Maintain good relationships with key stakeholders	All substantiated community complaints and concerns are resolved	Review incident investigations
	Pro-actively engage with key stakeholders on relevant environmental matters	Audit Stakeholder Management Plan

18.4 Implementation

Key operational controls to support the stakeholder management objectives are summarised in Table 59.

Table 59 Stakeholder management, noise management and aboriginal heritage actions

Aspect	Operational Controls	Reference
Noise	Regular environmental noise compliance surveys are undertaken in line with the *Protection (Noise) Regulations* 1997	C0045 – Environmental Noise Survey
Report environmental performance	Environmental performance is reported to community stakeholders via the Annual/Triennial Environmental Report	
Aboriginal heritage sites	Exclusion zones are in place (including fencing, signposting and prohibition of access) for existing known archaeological sites	C0022 – Aboriginal Sites
Complaint management	All community complaints and concerns are reported as incidents and investigated	
	Complainants are advised of the outcomes of investigations into the complaint received	
	The relevant Government Regulator is notified of substantiated complaints with the results of investigations and future preventative actions where appropriate	C0023 – Community Complaints
	A summary of community complaints are provided in the Annual/Triennial Environmental Report.	

18.5 Monitoring

The monitoring programme for stakeholder management (Table 60) has been developed to measure performance against established targets and key operational controls.

Table 60 Stakeholder management, noise management and aboriginal heritage monitoring programme

Purpose	Activity	Location	Frequency	Parameter
Assess compliance with *Environmental Protection (Noise) Regulations* 1997	Noise survey	Sensitive receptors	Every 5 years	Environmental noise levels
Assess the integrity of the fence and signs prohibiting access to the aboriginal sites	Site inspection (C0029)	Aboriginal site on Mullering Farm	Bi-annually	Integrity of fencing and signage
Assess the reputation of the Company in the community and to develop strategies to improve performance where required	Community Survey	Local Community	Periodic	Community perceptions
Record number and details of community concerns and complaints	Incident reporting and investigation	Cooljarloo	At all times	Concerns and complaints

18.6 Contingencies

Contingency measures have been developed to address the triggers outlined in Table 61.

Table 61 Stakeholder management, noise management and Aboriginal heritage contingency actions

Trigger	Action
Environmental noise criteria exceeded at sensitive receptor	1. Investigate the cause/significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required 3. Monitor the effectiveness of implemented controls
Aboriginal site protection fence or signage damaged	1. Investigate the cause/significance of the issue and raise an incident report if deemed necessary 2. Develop corrective actions as required 3. Monitor the effectiveness of implemented controls 4. Notify relevant stakeholders
Review of incident register or risk register reveals increased risks or frequencies/severity of community complaint incidents	1. Report issue to site management 2. Investigate issue to determine potential causes 3. Review and revise procedures as appropriate 4. Monitor the effectiveness of implemented controls

19 GLOSSARY

Acronym / Item	Definition
Agreement Act	*Mineral Sands (Cooljarloo) Mining and Processing Agreement Act, 1988*
AER	Annual Environmental Review. Report on annual environmental management activities and outcomes provided in response to all environmental reporting requirements for Cooljarloo Operations.
ANZECC	Australia and New Zealand Environment and Conservation Council
ASS	Acid Sulfate Soils
Aggregate Stability	Soil aggregates are groups of soil particles that bind to each other more strongly than to adjacent particles. Aggregate stability refers to the ability of soil aggregates to resist disintegration and has a standard test procedure and classification system. Class I materials are the least stable, and Class VI are the most stable. Aggregate stability is critical for infiltration, root growth, and resistance to water and wind erosion.
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency.
Cooljarloo	Cooljarloo Mineral Sands Mine Site.
Completion Criteria	Standards against which closure activities can be measured to determine whether or not specific closure objectives have been met to achieve completion
DAFWA	Department of Agriculture and Food
DEC	Department of Environment and Conservation
Declared weed	Weed that is subject to control or eradication policy under the *Agriculture and Related Resources Protection Act 1976*
Dieback	Phytophthora – An introduced microscopic soil-borne fungus, which has an adverse impact on the health of native plants.
Direct return topsoil	Topsoil stripped and placed into rehabilitation without stockpiling
Disturbed	Area where vegetation has been cleared and/or topsoil (surface cover) removed
DIA	Department of Indigenous Affairs.
DMP	Department of Mines and Petroleum.
DoW	Department of Water.

Acronym / Item	Definition
DRF	Declared Rare Flora
DRDL	Department of Regional Development and Lands
DSD	Department of State Development
Duplex soil	Soil type with a layer of sand over a deeper and distinct layer of clay.
EEO	The Energy Efficiency Opportunities Act 2006 (EEO Act) took effect on 1 July 2006 (with an amendment in March 2007). It aims to improve the identification and evaluation of energy efficiency opportunities by large energy using businesses and, as a result, to encourage implementation of cost effective energy efficiency opportunities.
EMP	Environmental Management Programme
EMS	Environmental Management System
Endemism	The state of being being unique to a defined geographic location (eg. SW of Western Australia
ERMP	Environmental Review and Management Programme
EPBC Act	*Environmental Protection Biodiversity Conservation Act 1999* (Cth)
EPA	Environmental Protection Authority.
EP Act	*Environmental Protection Act* 1986.
ESP	Exchangeable Sodium Percentage - the degree of saturation of the soil exchange complex with sodium. It may be calculated by the formula: $ESP = \frac{\text{Exchangeable sodium (me / 100 g soil)}}{\text{Cation exchange capacity (me / 100 g soil)}} x100$
Fresh-cut topsoil	Topsoil that has been stockpiled for less than nine months and not through winter.
GDE	Groundwater Dependant Ecosystem
GW	Groundwater
Heavy Minerals	Minerals characterised by high specific gravity (SG above 2.9). Heavy minerals in this report include ilmenite, leucoxene, rutile, zircon, monazite and xenotime
Heavy Mineral Concentrate (HMC)	A mixture of heavy minerals that has been extracted from mineral sands ore by means of wet gravity separation. Ilmenite and zircon typically constitute that majority of the HMC, respectively.

Acronym / Item	Definition
	HMC is a feedstock for the dry mineral separation process. (Note: synthetic rutile, does not constitute part of the HMC)
HSE	Health, Safety and Environment
International Organization for Standardization (ISO)	The world's largest developer and publisher of International Standards
Life of Mine (LOM)	Expected duration of mining and processing operations
MRWA	Main Roads Western Australia.
MSARCC	Mineral Sands Agreement Rehabilitation Coordinating Committee – coordinating body to consider rehabilitation of Cooljarloo operations.
MCP	Mine Closure Plan (Cooljarloo)
MS	Ministerial Statement
MSDS	Material Safety Data Sheet
NAE	Neutralised Acid Effluent
NGERS	The *National Greenhouse and Energy Reporting Act 2007* is a federal legislation that was introduced by the Federal Government in 2007 to provide data and accounting in relation to greenhouse gas emissions and energy consumption and production
Obligations Register	A register of legally binding conditions and commitments relevant to rehabilitation and closure at a given mine site
OEPA	Office of Environmental Protection Authority
Project	The total integrated mining operations in which a number of sites contribute to the overall operation to supply ore, processing facilities and disposal of waste products
Provenance	Plants whose native origin is close to where they are going to be planted (e.g. in the same local area) and the individuals all have a similar genetic make-up. In Tronox's Cooljarloo's specific case, this means that while seed is preferentially sourced from the immediate locality (i.e. notionally the region bounded by the Moore River to the South and Wongonderrah Road to the North), it can be from anywhere on the northern Swan Coastal Plain providing it is of a species that is known from the Cooljarloo tenement area (i.e. has been recorded in surveys of the area). In practice seed is picked outside the immediate locality of the mine site only in times of short supply locally. At no times will Tronox

Acronym / Item	Definition
	intentionally introduce non-local species into native rehabilitation (with the exception of stabilising cover crops).
PASS	Potentially Acid Sulfate Soils – soils that have potential to acidify due to changes in soil conditions exposing soil to oxygen.
Pc	*Phytophthora cinnamomi*
Priority Ecological Community (PEC)	Plant communities on a list maintained by the DEC that may be rare or threatened but for which there are insufficient survey data to accurately determine status, or are regarded as rare but are not currently threatened.
Priority Flora (PF)	Species on a list of taxa maintained by the DEC that may be rare or threatened but for which there are insufficient survey data to accurately determine their status, or are regarded as rare but are not currently threatened.
PSD	Particle size distribution - a particle size distribution analysis is a measurement designed to determine and report information about the size and range of a set of particles representative of a material.
Rehabilitation Area	The planning process relies on the Mining Lease being broken down into logical units to manage rehabilitation. As mining progresses, areas are identified where rehabilitation can commence. A contiguous area that is revegetated in a single season is usually referred to as a "rehabilitation area".
Rehabilitation Vegetation Groups	Rehabilitation Vegetation Groups that simplify and broadly represent baseline vegetation communities recorded within the Mining Lease. Four RVGs have been developed for Cooljarloo: dry heath, wet heath, wetland and woodland.
Rehabilitation	The return of disturbed land to a stable, productive and/or self-sustaining condition, consistent with the post-mining land use
Revegetation	Establishment of self-sustaining vegetation cover after earthworks have been completed, consistent with the post-mining land use
SHEHR	Safety, Health, Environment and Human Resources
SHE Systems	Safety, Health and Environment Systems
Stakeholder	A person, group or organisation who have an interest in a particular decision, either as individuals or representative of a group, with the potential to influence or be affected by the process of, or outcome of, mine closure
S_{CR}	Chromium Reducible Sulfur – a soil assay method for the determination of reduced inorganic sulphur (sulphides + sulphur).

Acronym / Item	Definition
SEWPaC	Federal Department of Sustainability, Environment, Water, Population and Communities.
Slimes	Reject clay slurry from the mineral separation process conducted in the concentrator. The material is characteristically made up of undifferentiated clay particles.
SPOCAS	Suspension Peroxide Oxidation Combined Acidity - is a self-contained acid base accounting test. It provides a measurement of the maximum oxidisable sulphur, Titratable Actual Acidity (TAA) and Titratable Peroxide Acidity (TPA) present in the soil sample (Department of Environment 2004).
Superficial Aquifer	The mineral sands deposits occur within the Guildford Formation of Pleistocene age which in turn forms the major aquifer unit in the superficial formations on the site.
Superficial deposits	Overlying the Yarragadee Formation is a series of Middle to Late Tertiary Formations collectively termed the Superficial deposits.
SWALSC	South West Aboriginal Land and Sea Council
TDS	Total Dissolved Solids - a measure of the combined content of all inorganic and organic substances contained in a liquid in: molecular, ionized or micro-granular suspended form.
Threatened (T)	Threatened species as identified under the *Wildlife Conservation Act* 1950 (WA) or *Environmental Protection and Biodiversity Conservation Act* 1999 (Cth)
Threatened Fauna	Threatened fauna species as identified under the Wildlife Conservation Act 1950 (WA) or Environmental Protection and Biodiversity Conservation Act 1999 (Cth)
Threatened Ecological Community (TEC)	Threatened Ecological Communities as defined under the *Wildlife Conservation Act* 1950 (WA). The DEC maintains a list of communities which are threatened with extinction.
Tubestock	Seedlings of (usually native) species of plants grown in a nursery and transplanted into rehabilitation areas.
UCL	Unallocated Crown Land – land held by the Crown and jointly managed by the Department of Regional Development and Lands and the DEC.
WA Mine Closure Guidelines	Western Australian *Guidelines for Preparing Mine Closure Plans* released by DMP and EPA (WA) in June 2011.
Weed	A plant, often a self-sown exotic species, growing where it is not

Acronym / Item	Definition
	wanted
WWTP	Waste Water Treatment Plant
Yarragadee Aquifer	Deeper, confined and semi-confined aquifer system underlying the Cooljarloo site. The Yarragadee is a regional scale feature.

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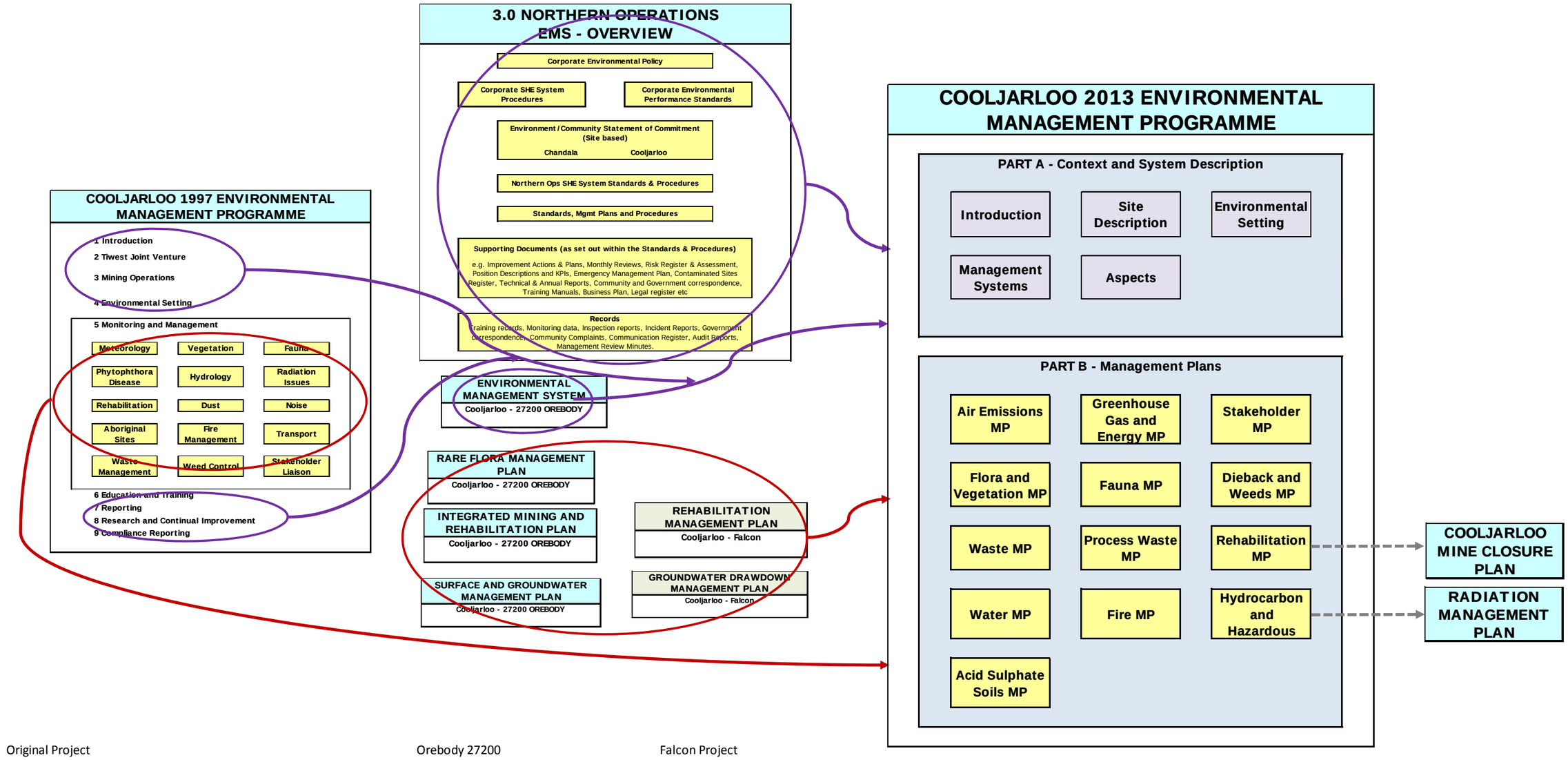
APPENDIX A: DETAILED DOCUMENT MAP



Original Project
ERMP + MS#37
1988

Orebody 27200
PER + MS#557
2000

Falcon Project
EPS + MS#790
2009

EMP last submitted to EPA
1997

Completion Criteria agreed with MSARCC
2013

APPENDIX B: COOLJARLOO ENVIRONMENTAL AND COMMUNITY STATEMENT OF COMMITMENT

Site: Cooljarloo
Document Title: Environment and Community Relations Statement of Commitment

TRONOX

COOLJARLOO

Environment and Community Relations Statement of Commitment

We will abide by the principles of the Tronox Environmental Policy and add value to the Cooljarloo environment and the local community through a shared commitment to continual improvement in every facet of our business. We will specifically:

- Comply with all legal and other requirements as a minimum by ensuring current and anticipated legal requirements are reflected in set annual targets.
- Maintain a robust environmental management system that drives continual improvement and ensures risks are mitigated, legal requirements are fulfilled and the expectations of the community are met.
- Establish environmental targets as part of each site's Business Plan and review performance on a regular basis.
- Seek to prevent the pollution of land and water through the provision of facilities that contain emissions and the management of activities to prevent spillage of fuels and process wastes and, the generation of dust.
- Protect sites of cultural heritage by ensuring that all areas are thoroughly checked prior to disturbance and that no disturbance occurs without approval.
- Protect our flora and fauna by:
  - minimising areas of disturbance
  - progressively rehabilitating disturbed areas to a high standard
  - preventing the introduction of the die-back pathogen *Phytophthora cinnamomi* to the active mining leases
  - contributing to the Western Shield regional fox baiting programme
  - undertaking targeted environmental research
- Conserve resources and minimise greenhouse emissions by operating efficiently and minimising waste.
- Manage our abstraction of ground-water to avoid adverse impacts on vegetation.
- Respond quickly and effectively to stakeholder concerns.
- Communicate openly with employees, the community and regulatory authorities and capitalise on opportunities that benefit the environment and the community.

RUSSELL AUSTIN
General Manager
Northern Operations

PAUL GILMAN
Operations Manager
Cooljarloo

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Revision: 5 | Owner: Russ Austin | Last Review Date: 18 Jun 2013
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APPENDIX C: ASPECTS AND IMPACTS REGISTER

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Air Emissions	Process was pits generating dust emissions from open pits and adjacent roads.	Impacts to biodiversity and visual amenity.	Moderate	Likely	High	Capping to reduce dust; Water carts to suppress dust on haul roads; Cover crop and slimes stabilisation where appropriate.	Insignificant	Likely	Low
Air Emissions	Heavy vehicle wash-down (near Sth Mine concentrate stockpile) and surrounding wash-down facility generating airborne visible dust.	Impacts to biodiversity and visual amenity.	Moderate	Likely	High	Routine clean out of sump and surrounding area (disposed of within the landfill). Road sweeping.	Insignificant	Likely	Low
Air Emissions	Heavy machinery movement around site resulting dust emissions (OB movement, Topsoil stripping/placement etc.).	Impacts to biodiversity and visual amenity.	Moderate	Likely	High	Water carts to suppress dust on haul roads; Cover crop and slimes stabilisation where appropriate.	Insignificant	Likely	Low
Air Emissions	Light vehicle movement around site resulting in dust emissions on unsealed roads.	Impacts to biodiversity and visual amenity.	Moderate	Likely	High	Water carts to suppress dust on haul roads; Cover crop and slimes stabilisation where appropriate.	Insignificant	Likely	Low
Biodiversity	Movement of machinery around site resulting in the transfer of weed propagules.	Impacts to biodiversity.	Moderate	Likely	High	Hygiene controls/inspections; Monitoring; Regular eradication (spraying) programs.	Minor	Unlikely	Low
Biodiversity	Drill holes not appropriately capped resulting in capture and death of fauna.	Impacts to biodiversity.	Moderate	Likely	High	Drill hole capping.	Minor	Unlikely	Low
Biodiversity	Funding to biodiversity projects inadequate resulting in failure of local programs.	Impacts to biodiversity.	Moderate	Likely	High	Funding to Western shield.	Minor	Unlikely	Low
Biodiversity	Feral animal or excessive native breeding on site resulting in damage to the environment/rehabilitation.	Impacts to biodiversity.	Moderate	Likely	High	Feral animal trapping; Baiting; Routine culling were appropriate.	Minor	Unlikely	Low

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Biodiversity	Spread of Pc Dieback via root to root contact or surface water movement within infestation areas.	Impacts to biodiversity.	Major	Likely	High	Drainage Control and Containment Buffers; Pc surveys/monitoring; Research into eradication methods.	Moderate	Moderate	Medium
Biodiversity	Rake and blade clearing resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Heavy machinery movement around site resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Mobilisation and demobilisation of high risk heavy machinery to and from site resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Carry grader topsoil stripping/placement resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Road construction, maintenance and other miscellaneous civil works resulting in a transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Movement of topsoil resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested	Moderate	Moderate	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
						areas; Pc surveys/monitoring.			
Biodiversity	Movement of vehicles off main roads resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Staff light vehicles in admin car park transferring Pc Dieback to from site.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Movement of overburden around site resulting in transfer of Pc Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Road drainage not appropriately managed resulting in transfer of Dieback.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Road construction blocking drainage ways resulting in water ponding/shadowing increasing risk of Dieback infestation.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium
Biodiversity	Heavy Vehicle inspection inadequate resulting in transfer of Pc Dieback onto site.	Impacts to biodiversity.	Major	Likely	High	Hygiene controls/inspections; Quarantine of infested areas; Pc surveys/monitoring.	Moderate	Moderate	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Energy	Excavation, hauling and dumping poorly planned resulting in excessive diesel use.	Emission contributing to greenhouse gas generation.	Minor	Likely	Medium	EEO systems including the Capital Review, PCR process and Business Improvement identification sessions; annual Maine Planning processes.	Insignificant	Likely	Low
Energy	Inefficient electric pumps or motors using excessive energy to move material (slimes, tails, slurry, water).	Emission contributing to greenhouse gas generation.	Minor	Likely	Medium	EEO systems including the Capital Review, PCR process and Business Improvement identification sessions.	Insignificant	Unlikely	Low
Energy	Inefficient diesel pumps or motors using excessive energy to move material (slimes, tails, slurry, water).	Emission contributing to greenhouse gas generation.	Minor	Likely	Medium	EEO systems including the Capital Review, PCR process and Business Improvement identification sessions.	Insignificant	Unlikely	Low
Energy	Planning pump locations incorrectly resulting in inefficient transfer of materials around site.	Emission contributing to greenhouse gas generation.	Minor	Likely	Medium	EEO systems including the Capital Review, PCR process and Business Improvement identification sessions.	Insignificant	Likely	Low
Fire	Storage of dangerous good not conducted as per standard resulting in fire.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles; Harvest Ban notifications; Management of dangerous good conducted as per regulations.	Moderate	Unlikely	Medium
Fire	Vegetation harvesting resulting in fire due to build up of material adjacent moving parts.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles;	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
						Harvest Ban notifications; Water carts present.			
Fire	Drilling in uCL resulting in fire due to build up of material adjacent moving parts.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles; Harvest Ban notifications; Water carts present.	Moderate	Unlikely	Medium
Fire	Light vehicle movement in uCL resulting in fire.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles; Harvest Ban notifications.	Moderate	Unlikely	Medium
Fire	Hot work resulting in fire due to stray embers.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles; Harvest Ban notifications; Hot works supervision procedures.	Moderate	Unlikely	Medium
Fire	Machinery/or plant starting bushfire; Bushfire leading to loss of biodiversity.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles; Harvest Ban notifications.	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Fire	Power lines pole-top sparks resulting in fire.	Impacts to biodiversity.	Major	Likely	High	Fire Breaks; Controlled burns as agreed with DEC; Fire Tender; ERT, Prestart checks, Vehicle maintenance; Fire extinguishers in vehicles; Harvest Ban notifications.	Moderate	Unlikely	Medium
Housekeeping	General housekeeping poor resulting in impacts to visual amenity and/or environment.	Visual amenity.	Moderate	Likely	High	Training and awareness; Work place SEIMS inspections.	Minor	Unlikely	Low
Hydrocarbons	Central Fuel Facility and bunding failure resulting in spillage to land.	Soil and water contamination.	Major	Moderate	High	Bunds designed to relevant standard (including jetting); Regular inspections.	Minor	Unlikely	Low
Hydrocarbons	Drilling Rig hydraulic failure resulting in spills to land/water.	Soil and water contamination.	Minor	Likely	Medium	Regular maintenance checks; Prestart checks (vehicles); Regular Inspections; Training and awareness; Spill kits (land and water).	Minor	Unlikely	Low
Hydrocarbons	Fuel transfer from north or south fuel farms resulting in spills to land.	Soil and water contamination.	Major	Unlikely	Medium	Regular maintenance checks; Prestart checks (vehicles); Regular Inspections; Training and awareness; Spill kits (land and water).	Minor	Unlikely	Low
Hydrocarbons	Pumps and motors (tails/water/slimes) leaking hydrocarbons to land/water.	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Minor	Unlikely	Low
Hydrocarbons	Oily / water separator failure resulting in contaminated water discharge to land/water (Piacentini).	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Regular Inspections; Training and	Minor	Unlikely	Low

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
						awareness; Spill kits (land and water).			
Hydrocarbons	Service area/motor wash-down using inappropriate degreasers (e.g. not quick break) resulting in discharge to hydrocarbons to land/water.	Soil and water contamination.	Minor	Likely	Medium	Training and Awareness; Product approval required.	Minor	Unlikely	Low
Hydrocarbons	Oily / water separator failure resulting in discharge to land/water (Washday and HMC stockpile).	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Minor	Unlikely	Low
Hydrocarbons	Hydraulic Power Packs (trommel, scrubber, belt feeder, winches) failure resulting in spillage to Pond 1 (3000L in Coolj1, others much lower quantities).	Soil and water contamination.	Major	Moderate	High	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Moderate	Medium
Hydrocarbons	Hydrocarbon field storage tank (1000L) failure resulting in discharge to land/water.	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Prestart checks (vehicles); Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Unlikely	Medium
Hydrocarbons	Servicing of diesel engines in the field resulting in spills to land/water.	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Prestart checks (vehicles); Regular Inspections; Training and awareness; Spill kits (land and water).	Minor	Moderate	Medium
Hydrocarbons	Dredge excavator gearbox failure resulting in spillage to Pond 1.	Soil and water contamination.	Major	Moderate	High	Regular maintenance; Prestart checks (vehicles); Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Moderate	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Hydrocarbons	Heavy machinery hydraulic failure resulting in spillage to land/water.	Soil and water contamination.	Major	Likely	High	Regular maintenance checks; Prestart checks (vehicles); Regular Inspections; Training and awareness; Spill kits (land and water).	Minor	Moderate	Medium
Hydrocarbons	Pelican dredge hydraulic failure resulting in spillage to Pond 1.	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Moderate	Medium
Hydrocarbons	Hydrocarbon storage facility (stores) bunding failure resulting in spill to land.	Soil and water contamination.	Moderate	Moderate	Medium	Bunds designed to relevant standard (including jetting); Regular inspections.	Moderate	Unlikely	Medium
Hydrocarbons	Hydrocarbon disposal area inappropriately used resulting in hydrocarbon waste going to wrong refuse site.	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Moderate	Medium
Hydrocarbons	Service truck leaking/spilling hydrocarbons to land/water.	Soil and water contamination.	Moderate	Likely	High	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Moderate	Medium
Hydrocarbons	Transformers leaking hydraulic fluid to land/water.	Soil and water contamination.	Moderate	Moderate	Medium	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Unlikely	Medium
Hydrocarbons	Bulk oil transfer via tanker to Cooljarloo 1 excavator gearbox resulting in spillage to land/water.	Soil and water contamination.	Moderate	Moderate	Medium	Regular maintenance checks; Regular Inspections; Training and awareness; Spill kits (land	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
						and water).			
Hydrocarbons	North Mine Fuel Facility and bunding failure resulting in spillage to land.	Soil and water contamination.	Moderate	Likely	High	Bunds designed to relevant standard (including jetting); Regular inspections.	Moderate	Moderate	Medium
Hydrocarbons	Bioremediation areas not adequately decommissioned resulting in land contamination.	Soil and water contamination.	Moderate	Likely	High	Sampling and monitoring; Investigate contamination as per contaminated sites Regs.	Moderate	Moderate	Medium
Hydrocarbons	Fuel facilities not adequately decommissioned resulting in land contamination.	Soil and water contamination.	Moderate	Likely	High	Sampling and monitoring; Investigate contamination as per contaminated sites Regs.	Moderate	Moderate	Medium
Hydrocarbons	Dangerous/hazardous goods stored incorrectly resulting in fire/explosion.	Soil and water contamination.	Minor	Likely	Medium	Regular Inspections; Training and awareness; Spill kits (land and water).	Moderate	Moderate	Medium
Process Waste	Heavy Vehicle Wash-down (process waste) design/management inadequate resulting in runoff into sensitive areas.	Soil and water contamination.	Moderate	Likely	High	Drainage design; Inspections.	Minor	Unlikely	Low
Process Waste	Process waste pit design/management inadequate resulting in leaching of constitutes into groundwater.	Soil and water contamination.	Major	Likely	High	Agreed DEC design standards applied; Verification of design standards; Groundwater monitoring.	Minor	Likely	Medium
Process Waste	Process waste pit landform design/management inadequate resulting in runoff into Mullering Brook.	Soil and water contamination.	Moderate	Likely	High	Road design and maintenance; Road side clean-up; Progressive capping.	Minor	Moderate	Medium
Rehabilitation	Topsoil ripping is not conducted to plan/standard impacting rehab outcomes (soil compaction/strength).	Rehabilitation outcomes.	Moderate	Likely	High	Rehabilitation Plan; Works Scheduling; Supervision.	Minor	Unlikely	Low

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Rehabilitation	Topsoil placement not conducted to plan (e.g. veg type, 1st or 2nd cut) resulting in impacts to rehab outcomes.	Rehabilitation outcomes.	Moderate	Likely	High	Rehabilitation Plan; Survey control, Supervision; Operator competency.	Minor	Unlikely	Low
Rehabilitation	Topsoil placement conducted during wet conditions resulting in compaction to topsoil and upper soil profile.	Rehabilitation outcomes.	Moderate	Likely	High	Ripping second cut; Placement during dry season.	Minor	Unlikely	Low
Rehabilitation	Topsoil inventory inadequately maintained resulting in loss of information relating to source material.	Rehabilitation outcomes.	Moderate	Likely	High	Clearing and stripping application process; Survey; Supervision; Regular inspections.	Minor	Unlikely	Low
Rehabilitation	Rehabilitation monitoring procedure inadequate resulting in the inability to identify rehab success and remedial works.	Rehabilitation outcomes.	Moderate	Likely	High	Completion criteria and agreed SOPs review by consultants and MSARCC stakeholders.	Minor	Unlikely	Low
Rehabilitation	Rehabilitation monitoring/signoffs recording inadequate resulting in loss of information.	Rehabilitation outcomes.	Moderate	Likely	High	Established procedures and systems in place and reviewed as part of the Improvement Plan.	Minor	Unlikely	Low
Rehabilitation	Topsoil placement conducted at an inappropriate time of year resulting in poor plant establishment.	Rehabilitation outcomes.	Moderate	Likely	High	Timing of rehabilitation season specified; Knowledge gaps addressed in the 5 Year Improvement Plan.	Minor	Unlikely	Low
Rehabilitation	Native seed cleaning/processing inadequate leading to unknown seed purity (% of seed in product supplied).	Rehabilitation outcomes.	Moderate	Likely	High	Terms and conditions established in scope of works; Seed Lab testing.	Minor	Unlikely	Low
Rehabilitation	Native seed inappropriately stored impacting seed viability.	Rehabilitation outcomes.	Moderate	Likely	High	Refrigerated Storage available.	Minor	Unlikely	Low

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Rehabilitation	Native seed mixed/placed at inappropriate rates.	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection; Contract for Seed supply.	Minor	Unlikely	Low
Rehabilitation	Native seed inappropriately spread resulting poor coverage (patchy or not at appropriate rates).	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Minor	Unlikely	Low
Rehabilitation	Native seed not treated prior to placement resulting in poor germination.	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Minor	Unlikely	Low
Rehabilitation	First cut topsoil stripped incorrectly resulting in loss/dilution of resource for rehabilitation.	Rehabilitation outcomes.	Moderate	Likely	High	Carry Graders used; Clearing and stripping application process; Survey; Supervision; Regular inspections	Minor	Moderate	Medium
Rehabilitation	Clearing/stripping areas beyond the extent required for operations resulting in unnecessary disturbance.	Rehabilitation outcomes.	Moderate	Likely	High	Clearing and stripping application process; Survey; Supervision; Regular inspections.	Moderate	Moderate	Medium
Rehabilitation	Clearing drill lines, pipe corridors and stockpile areas excessively (i.e. disturbance of topsoil) resulting in poor regrowth.	Rehabilitation outcomes.	Moderate	Likely	High	Clearing and stripping application process; Survey; Supervision; Regular inspections.	Moderate	Moderate	Medium
Rehabilitation	Clearing/stripping within areas of potential significant threatened species resulting in unintentional impacts to population.	Rehabilitation outcomes.	Major	Likely	High	Clearing and stripping application process; Survey; Supervision; Regular inspections; Spatial datasets maintained.	Major	Unlikely	Medium
Rehabilitation	Clearing prior to harvesting resulting in loss of mulch resources for rehabilitation.	Rehabilitation outcomes.	Moderate	Likely	High	Clearing and stripping application process; Survey; Supervision; Regular inspections.	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Rehabilitation	Design criteria for rehabilitation areas is inadequate resulting in landform failure (i.e. assumptions relating to max slope, class 1 thickness etc.).	Rehabilitation outcomes.	Major	Likely	High	Design criteria established; Research and development (5 year Improvement Plan).	Moderate	Moderate	Medium
Rehabilitation	Design Criteria for Class 3 landfill capping is inadequate resulting in landform failure.	Rehabilitation outcomes.	Major	Likely	High	Design criteria established; Research and development (5 year Improvement Plan).	Moderate	Moderate	Medium
Rehabilitation	Provision funding for rehabilitation works inadequate impacting outcomes.	Rehabilitation outcomes.	Major	Likely	High	Mine Closure Plan; Annual Rehabilitation Completion Report and Provision Review; Annual area open reconciliation.	Moderate	Unlikely	Medium
Rehabilitation	Provision funding for mine closure inadequate resulting in an inability to meet closure obligations.	Rehabilitation outcomes.	Major	Likely	High	Mine Closure Plan; Annual Rehabilitation Completion Report and Provision Review; Annual area open reconciliation.	Moderate	Unlikely	Medium
Rehabilitation	Provision funding of remedial works is inadequate impacting rehab and closure outcomes.	Rehabilitation outcomes.	Major	Likely	High	Revise plans for Dam 123; Develop intervention criteria for historical areas.	Moderate	Unlikely	Medium
Rehabilitation	Overburden placement in reconstructed profiles impedes lateral ground water flow resulting in interruption of hydrological regimes.	Impacts to Groundwater Dependant Ecosystems.	Major	Likely	High	Integrated mine and rehabilitation planning (5 year plan); Tracking progress against Plan.	Moderate	Moderate	Medium
Rehabilitation	Slimes not adequately dewatered and dried resulting in delays to landform completion.	Rehabilitation outcomes.	Moderate	Likely	High	Integrated mine and rehabilitation planning (5 year plan); Tracking progress against Plan.	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Rehabilitation	Overburden removal incorrectly characterised resulting in class 2/3 material in the upper soil profile.	Rehabilitation outcomes.	Major	Likely	High	Integrated mine and rehabilitation planning (5 year plan); Field supervision; Soil profile verification monitoring.	Moderate	Moderate	Medium
Rehabilitation	Overburden removal and placement not adequately planned resulting in loss of resource (i.e. Class 1).	Rehabilitation outcomes.	Moderate	Likely	High	Integrated mine and rehabilitation planning (5 year plan);	Minor	Moderate	Medium
Rehabilitation	Overburden removal incorrectly characterised resulting in incorrect placement of material (i.e. Class 1, 2, 3 material).	Rehabilitation outcomes.	Major	Likely	High	Integrated mine and rehabilitation planning (5 year plan); Field supervision; Soil profile verification monitoring.	Moderate	Moderate	Medium
Rehabilitation	Native seed resources inadequate to meet demand (delivery from suppliers or poor season) impacting outcomes.	Rehabilitation outcomes.	Moderate	Likely	High	Use of several contractors; Further gaps addressed in the Rehab Improvement Plan.	Moderate	Moderate	Medium
Rehabilitation	Mulch harvesting resources exhausted resulting in impacts to rehabilitation quality.	Rehabilitation outcomes.	Major	Likely	High	Mulch Harvesting Strategy developed; Mulch Harvesting Plan endorsed; Access to composted mulch form external sources.	Moderate	Moderate	Medium
Rehabilitation	Mulch placement not conducted to standard resulting in inadequate cover and poor topsoil stabilisation.	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Minor	Moderate	Medium
Rehabilitation	Cover crop establishment inadequate to stabilities topsoil.	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Minor	Moderate	Medium
Rehabilitation	Topsoil placement not conducted on contour resulting in the development of preferential flow paths.	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Rehabilitation	Stripping conducted without adequate characterisation of materials (veg type) resulting in impacts to rehab quality.	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Minor	Moderate	Medium
Rehabilitation	Stripping/placement of topsoil during wet conditions resulting in loss of soil structure (soil compaction/strength).	Rehabilitation outcomes.	Moderate	Likely	High	Supervision; Operator training; Regular inspection.	Minor	Moderate	Medium
Rehabilitation	Stripping without consideration to direct return or fresh cut placement resulting in loss of resource.	Rehabilitation outcomes.	Moderate	Likely	High	Integrated mine and rehabilitation planning (5 year plan); Field supervision; Soil profile verification monitoring.	Minor	Moderate	Medium
Rehabilitation	Native seed incorrectly identified resulting in inappropriate species within the seed mix.	Rehabilitation outcomes.	Moderate	Likely	High	Terms and conditions established in scope of works.	Minor	Moderate	Medium
Rehabilitation	Vegetation Harvesting off mine path impacting ecological values.	Rehabilitation outcomes.	Major	Moderate	High	Research and Investigation addressed in the 5 Year Improvement Plan and associated Mulch Harvesting Strategy.	Moderate	Unlikely	Medium
Rehabilitation	Tailing transfer (sand & slimes) inappropriately placed resulting in reconstructed landforms that do not adhere to design criteria.	Rehabilitation outcomes.	Major	Likely	High	Supervision; Operator training; Regular inspection.	Moderate	Moderate	Medium
Rehabilitation	Acid Sulphate Soils inadequately identified and characterised resulting in exposure of sulfidic material and impacts to rehab outcomes.	Rehabilitation outcomes.	Major	Moderate	High	Premining screening; Pit inspections; Conceptual model relating to ASS risks.	Moderate	Unlikely	Medium
Rehabilitation	Acid Sulphate Soils inadequately manage resulting in exposure of sulfidic material and impacts to rehab outcomes.	Rehabilitation outcomes.	Major	Moderate	High	Premining screening; Pit inspections; Conceptual model relating to ASS risks.	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Rehabilitation	First cut topsoil stockpiled resulting in a loss of propagule viability.	Rehabilitation outcomes.	Major	Likely	High	Supervision; Operator training; Regular inspection.	Moderate	Moderate	Medium
Stakeholder	Community engagement inadequate resulting in failure to maintain favourable community relations.	Community relations.	Moderate	Moderate	Medium	Support Regional collaborative biodiversity projects: – Western Shield fox baiting (DEC) – CPSM Pc research (Murdoch Uni) – Nightstalk Programs (Perth Zoo) – MERIWA Pc research (MERIWA) – Investigate support for Kings Park	Minor	Unlikely	Low
Waste	Clinical waste inappropriately disposed of resulting in impacts to the environment.	Soil and water contamination.	Minor	Unlikely	Low	Training; Supervision.	Minor	Unlikely	Low
Waste	Municipal litter from light vehicles and building impacting land and water.	Soil and water contamination.	Minor	Unlikely	Low	Periodic disposal; Training; SEIMS inspections; Environmental Inspections.	Minor	Unlikely	Low
Waste	Mechanical waste inappropriately disposed of resulting in impacts to land/water.	Soil and water contamination.	Minor	Likely	Medium	Periodic disposal, Training; SEIMS inspections, Environmental Inspections; Ruggies Recycling, Waste Management Strategy, Consolidation of Ruggies yard	Minor	Unlikely	Low
Waste	Radiation waste inappropriately disposed of resulting in impacts to land/water.	Soil and water contamination.	Minor	Unlikely	Low	Radiation monitoring prior to removing any production based scrap off site	Minor	Unlikely	Low

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
Waste	Municipal waste disposed of inappropriately resulting in little accumulation.	Soil and water contamination.	Minor	Likely	Medium	Periodic disposal; Training; SEIMS inspections; Environmental Inspections.	Minor	Unlikely	Low
Waste	Used heavy vehicle batteries stored incorrectly.	Soil and water contamination.	Minor	Likely	Medium	Periodic disposal; Training; SEIMS inspections; Environmental Inspections.	Minor	Unlikely	Low
Waste	Effluent waste inappropriately managed resulting in pollution to land/water.	Soil and water contamination.	Major	Unlikely	Medium	Waste treatment facilities; Maintenance servicing; Monitoring.	Minor	Unlikely	Low
Water	Bore water transfer resulting in loss of water from process due to seal or pipe failure.	Loss of water resource.	Moderate	Moderate	Medium	Regular inspection; Maintenance schedules (MSTs).	Insignificant	Likely	Low
Water	Abstraction from bores resulting in exposure of sulfidic material and release of contaminants.	Soil and water contamination.	Major	Unlikely	Medium	Premining screening; Conceptual model relating to ASS risks; Water monitoring; In-pit inspection.	Moderate	Unlikely	Medium
Water	Water demand/supply inadequately forecast resulting in breech of licence or under supply of resource.	Loss of water resource.	Major	Likely	High	Water balance to forecast water demand and supply; Monitoring abstraction and use.	Moderate	Moderate	Medium
Water	Dewatering of mine voids or process water dams resulting in exposure of sufidic material and release of contaminants to groundwater.	Soil and water contamination.	Major	Unlikely	Medium	Premining screening; Conceptual model relating to ASS risks; Water monitoring; In-pit inspection.	Moderate	Unlikely	Medium
Water	Dewatering of mine voids or process water dams resulting in groundwater drawdown and impacts to vegetation.	Impacts to biodiversity.	Major	Likely	High	Drawdown modelling and associated risk assessments; Regulator endorsement of plans; Hydraulic placement	Moderate	Moderate	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
						of tails and infiltration Dams; Backfill as soon as possible; Monitoring water level and veg health.			
Water	General plant/pumps leaking resulting in loss of water resources.	Loss of water resource.	Moderate	Moderate	Medium	Regular inspection; Maintenance schedules (MSTs).	Insignificant	Likely	Low
Water	Process Water Dams inadequately managed resulting in overtopping and impacts vegetation.	Impacts to biodiversity.	Major	Likely	High	Design criteria for TSF's and dams; TSF's built to design; Regular inspection.	Moderate	Unlikely	Medium
Water	Process Water Dams inadequately planned/constructed resulting in seepage through wall/based impacting vegetation.	Impacts to biodiversity.	Major	Likely	High	Design criteria for TSF's and dams; TSF's built to design; Regular inspection.	Minor	Moderate	Medium
Water	Process Water Dams inadequately planned/constructed resulting in wall failure and impacts to vegetation.	Impacts to biodiversity.	Major	Likely	High	Design criteria for TSF's and dams; TSF's built to design; Regular inspection.	Moderate	Unlikely	Medium
Water	Pumping from Process Water Dams below water table resulting in drawdown and impacts to vegetation.	Impacts to biodiversity.	Major	Likely	High	Drawdown modelling and associated risk assessments; Hydraulic placement of tails and infiltration Dams; Backfill as soon as possible. Monitoring water level and veg health.	Moderate	Moderate	Medium
Water	Tailing transfer (slimes) resulting in discharge to environment due to seal failure.	Impacts to biodiversity.	Major	Likely	High	Cleared pipeline corridors established.	Minor	Moderate	Medium
Water	Mullering brook design inadequate resulting in bank failure or excessive mobilisation of sediment.	Impacts to biodiversity.	Major	Likely	High	Design criteria; Monitoring of stream flow and sedimentation; Erosion control matting.	Moderate	Unlikely	Medium
Water	Mullering brook design inadequate resulting in disruption to baseline flow	Impacts to biodiversity.	Major	Likely	High	Design criteria; Monitoring of stream flow and	Moderate	Unlikely	Medium

Standard	Aspect	Impact	Consequence	Likelihood	Risk	Controls	Consequence	Likelihood	Risk
	regime.					sedimentation; Erosion control matting.			

APPENDIX D: SITE SPECIFIC LEGAL OBLIGATIONS

MINISTERIAL CONDITIONS 37 - COOLJARLOO

CONDITION NUMBER	MINISTERIAL CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
1	Adhere to the project description	All Managers
2	Undertake detailed dieback survey prior to mining	-[cleared]
3	Restrict mining until dieback treatment programmes developed	-[cleared]
4	Fund dieback research	SHE Manager
5	Restrict mining activity	-[no longer relevant]
6	Undertake groundwater and surface water monitoring and reporting	SHE Manager
7	Develop Environmental Management Programme	-[cleared]
8	Annual / Triennial Reporting	SHE Manager
9	Refer extensions of mining	Ops Manager SHE Manager
COMMITMENT NUMBER	**PROPONENT COMMITMENT**	**SUPPORTING RESPONSIBILITY**
1	Achieve a high standard of rehabilitation	SHE Manager
2	Develop fire management plan (ii) Maintain fire fighting vehicle	SHE Manager Site Manager
3	Maintain groundwater levels within natural range Maintain surface hydrological features	Ops Manager SHE Manager
4	Install groundwater monitoring network	SHE Manager
5	Assess vegetation changes	SHE Manager
6	Radiation monitoring performance	Ops Manager
7	Achieve high level of environmental and corporate social responsibility	-(direction setting only non – specific)
8	Liaise with CALM re dieback	SHE Manager
9	Undertake dieback surveys	SHE Manager
10	Undertake dieback education of employees	SHE Manager
11	Undertake studies of dieback treatment	SHE Manager
12	Check material sources for dieback prior to import to site	All Managers
13	Undertake dieback monitoring Develop contingency plans to return waters to dieback free	SHE Manager
14	Restrict access for dieback control	Ops Manager
15	Establish disease free nursery if required	SHE Manager

16	Research native species propagation	SHE Manager
COMMITMENT NUMBER	**PROPONENT COMMITMENT**	**SUPPORTING RESPONSIBILITY**
17	Adhere to Radiation Safety Act	All Managers
18	Adhere to Commonwealth Code of Practice for Radiation Protection	All Managers
19	Dispose of radioactive waste to appropriate standard	SHE Manager PMD Manager
20	Wash concentrate free of dust	Not relevant

MINISTERIAL CONDITIONS 790 – FALCON EXTENSION

CONDITION NUMBER	CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
1 - 1	Implement the approved proposal subject to the conditions and procedures in MS790.	All Managers
2 - 1	Proponent is responsible for implementation of the approved proposal.	Operations Manager
2 - 2	Notify the CEO of the DEC of any changes to the name or address of the proponent within 30 days.	Operations Manager
3 -1	The approval to implement the proposal will lapse and be void if commencement mining does not begin with in 5 years.	-[cleared]
3 - 2	Report commencement of the proposal to the DEC within 5 years after approval.	-[cleared]
4 - 1	Submit an annual compliance report to the DEC.	SHE Manager
4 - 2	The annual report shall address items in an audit table approved by the DEC.	SHE Manager
4 - 3	Annual reports will include verifiable evidence of compliance and be signed off by the DEC.	SHE Manager
4 - 4	Annual compliance reports will be made available to the public.	SHE Manager
5 - 1	Performance review reports to be submitted in the 2nd and 4th year after productive mining.	SHE Manager
5 - 2	Performance review reports shall be made available to the public.	SHE Manager
6 - 1	Translocate DRF growing in areas required to be cleared to suitable temporary alternative locations.	SHE Manager/Ops Manager
6 - 2	Avoid disturbance of DRF and priority flora outside of the approved clearing boundary.	SHE Manager/Ops Manager
6 - 3	Monitor the health and abundance of native vegetation including DRF and priority species.	SHE Manager
6 – 4	Annually submit the results of monitoring required by condition 6-3 to the DEC.	SHE Manager
6 - 5	Notify the DEC within 21 days of any identified decline in vegetation health	SHE Manager
6 – 6	Vegetation health and abundance monitoring results are to be made publicly available.	SHE Manager
7 – 1	Ground water drawdown must not exceed absolute minimum magnitude and absolute maximum rate trigger levels.	SHE Manager/Ops Manager
7 - 2	Ground water drawdown must not approach the potentially acid forming substrate to the extent acid waters are generated and released.	SHE Manager

CONDITION NUMBER	CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
7 – 3	The hydrology of the Mount Jetty Creek system must not be impacted by drawdown.	SHE Manager
7 – 4	Monitor ground water to determine compliance with conditions 7–1, 7-2, and 7-3.	SHE Manager
7 – 5	Submit results of ground water monitoring to DEC annually	SHE Manager
7 - 6	Propose management actions to be taken in the event conditions 7-1, 7-2 or 7-3 are not/ or not likely to be met.	SHE Manager/Operations Manager
7 - 7	The proponent must not generate or expose acid sulphate soils or discharge acid waters to the environment.	SHE Manager/Ops Manager
8 - 1	Prior to productive mining, baseline surveys are to be conducted.	[Cleared]
8 – 2	DRF are to be translocated back to original areas within 12 months of the cessation of productive mining.	SHE Manager/Ops manager
8 – 3 (1)	Within 3 years of the cessation of productive mining the proponent will re-establish vegetation to the criteria listed in MS790.	SHE Manager/Ops Manager
8 -3 (2)	Scheduled rate of rehabilitation acceptable to the DEC.	SHE Manager/Ops Manager
8 – 4	Progressively monitor the performance of the rehabilitation against the criteria.	SHE Manager
8 – 5	Submit an annual rehabilitation performance report to the DEC.	SHE Manager
8 – 6	Report the findings of the Nicholls and Woodman review of rehabilitation practices and standards to the DEC. If the criteria are an improvement on those in 8-3 then they shall be used.	SHE Manager

MINISTERIAL CONDITIONS 557 – OREBODIES 27200 and 28300

CONDITION NUMBER	CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
1 - 1	Adhere to the approved proposal.	Ops Manager
1 - 2	Refer any changes to the proposal to the EPA if the Minister determines they are substantial.	SHE Manager
1 - 3	Changes to the proposal may be effected where the Minister determines that the changes are not substantial.	SHE Manager
2 - 1	Proponent commitments are to be adhered to.	All Managers
2 - 2	Subsequent proponent commitments made to fulfil conditions in the Ministerial Statement must be adhered to.	All Managers
3 - 1	The Proponent is responsible for implementing the proposal until such time the Minister revokes that authority and nominates another.	All Managers
3 – 2	The conditions must be adhered to if another proponent is nominated by the Minister.	NA
3 – 3	Notify the DEC of any change to the name or address of the proponent within 30 days.	Ops Manager
4 - 1	Provide evidence of substantial commencement of the proposal within 5 years after approval.	[Cleared]
4 - 2	The approval to implement the proposal will lapse and be void if commencement mining does not begin with in 5 years.	NA
4 – 3	An extension to the 5 year window period for the substantial commencement of the proposal may be applied for via the Minister.	NA
4 - 4	Where the proposal has not changed significantly the Minister may approve an extension to the 5 year window period of substantial commencement.	NA
5 – 1	Submit periodic compliance reports to the DEP	SHE Manager
5 – 2	DEP is responsible for assessing compliance to the conditions, procedures and commitments in MS557.	SHE Manager
5 - 3	Compliance disputes will be resolved by the Minister.	NA
6 - 1	Demonstrate to the EPA that an EMS is in place.	SHE Manager
6 – 2	Implement the EMS refer to in 6-1.	SHE Manager/Ops Manager
7 - 1	Develop a Surface Water and Ground Water Management Plan.	[cleared]
7 - 2	Implement the Ground Water and Surface Water Management Plans.	SHE Manager/Ops Manager

CONDITION NUMBER	CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
7 -3	The Ground and Surface Water Management plans must be made publically available.	[cleared]
8 – 1	Prepare a Rare Flora Management Plan	SHE Manager
8 - 2	Implement the Rare Flora Management Plan.	SHE Manager/Ops Manager
8 - 3	Make the Rare Flora Management Plan publically available	SHE Manager
9 - 1	Develop an Integrated Mine and Rehab Plan	SHE Manager
9 - 2	Implement the Integrated Mine and Rehab Plan to achieved rehabilitation criteria included as part of 9 -1.	SHE Manager/Ops Manager
9 - 3	Make the Implemented Mine and Rehab Plan publically available.	SHE Manager
10 – 1	Submit a performance review report every 6 years to the DMP.	SHE Manager
Commitment Number	**PROPONENT COMMITMENT**	
1	Manage environmental impacts arising from the proposal	SHE Manager/Ops Manager
2	Improve environmental performance	SHE Manager/Ops Manager
3	Minimise disturbance to the native vegetation.	SHE Manager/Ops Manager
4	Improve the knowledge of the abundance of priority species on the mining lease and nearby reserves	SHE Manager
5	Limit the impact on the abundance of priority species	SHE Manager
6	Improve the knowledge of ecological function and conservation status of the Emu Lakes wetland system.	SHE Manager
7	Minimise impacts to wetlands and drainage systems.	SHE Manager/Ops Manager
8	Minimise impact on vegetation due to groundwater drawdown	SHE Manager/Ops Manager
9	Ensure a high standard of rehabilitation	SHE Manager/Ops Manager

DEC LICENCE CONDITIONS (Licence No. 5319)

CONDITION NUMBER	CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
	BOUNDARY	
G1	Demarcate lease boundary.	Operations Manager
	ANNUAL REPORTING REQUIREMENTS	
G2(a)	Prepare Annual Environmental Report (AER) by 1st April.	All Managers
G2(b)	Include certain information in the AER.	SHE Manager
G2(c)	Submit an annual compliance audit with the AER.	SHE Manager
	REPORTING OF EXCEEDED LICENCE LIMITS	
G3(a)	Advise Director within 24 hrs of any exceedances or breach.	SHE Manager
G4(b)	A full report to be provided to the Director within 7 days of the licensee becoming aware of an exceedance.	SHE Manager
	AIR POLLUTION CONTROL CONDITIONS	
	DUST – GENERAL REQUIREMENT	
A1(a)	Adhere to the agreed Dust Management Plan.	All Managers
A1(b)	Monitor dust in accordance with the Dust Management Plan and relevant Australian Standards.	SHE Manager
	WATER POLLUTION CONTROL CONDITIONS	
	SLIMES DAMS/SOLAR DRYING CELLS	
W1	Retain any decant water from the slimes (fines) dams and/or solar drying cells on the premises.	Operations Manager
W2(a)	Dewatering and storm water discharged in Mullering Brook must meet certain criteria.	Operations Manager SHE Manager
W2(b)	Ensure waste water discharged in W2(a) does not cause erosion.	Operations Manager SHE Manager
	WATER MONITORING AND REPORTING	
W3(a)	Monitor quality and quantity discharge water and Mullering Brook	SHE Manager
W3(b)	Monitor quantity and quality of Mullering Brook exiting and entering the premises.	SHE Manager
W3(c)	Monitor groundwater levels and quality.	SHE Manager
W3(d)	Water samples collect to Aust. Standards	SHE Manager
W3(e)	Water samples analysed by NATA registered lab	SHE Manager
W3(f)	Water monitoring data included in Annual Environmental report	SHE Manager

CONDITION NUMBER	CONDITION (paraphrased)	SUPPORTING RESPONSIBILITY
	LIQUID CHEMICAL STORAGE	
W4(a)	Chemicals & hydrocarbons to be bunded where the total volume on the premises exceeds 250L.	All Managers
W4(b)	Bunded compound built to design	All Managers
W4(c)	Immediately recover spills inside or outside the bunded compound.	All Managers
	VEHICLE WASHDOWN AREAS AND ANCILLARY OPERATIONS	
W5(a)-(c)	Fuel oil traps at vehicle wash-down areas. Maintain inspection schedules to ensure effective operation.	Operations Manager
	STORMWATER DIVERSION FROM WASTE MANAGEMENT AREAS	
W6	Divert stormwater away from Black Waste Pit	Operations Manager
	PROTECTING WATER BODIES FROM WASTE MANAGEMENT AREA	
W7(a)	Waste Management area 3 metres above highest seasonal ground water	Operations Manager
W7(b)	Minimum distance of 100 metres between waste management area and natural water body	Operations Manager
	SOLID WASTE DISPOSAL CONDITONS	
S1(a)-(d)	Solid Waste Disposal in accordance with prescribed conditions and reported in annual report	Operations Manager
	ANALYSIS OF WASTE	
S2	Analyse waste	SHE Manager
	ARRANGEMENT OF TYRE STOCKPILES	
S3	Correct storage of tyres	Operations Manager
	BURIAL OF TYRES	
S4(a)	Correct criteria followed when burying tyres	Operations Manager
S4(b)	Tyre inventory	Operations Manager

ENVIRONMENTAL RESPONSIBILITIES
ALL MANAGERS, COOLJARLOO

RESPONSIBILITY	ACTION	SUPPORTING POSITIONS
Establish environmental objectives and implementation plans	Develop annual environmental action plans.	SHE Manager
Environmental monitoring and reporting the effectiveness of environmental programmes and taking corrective action as required. Monitoring Effectiveness Corrective action	Implement monitoring provisions of Environmental Management Programme Regular environmental inspections Prepare quarterly environment reports Managed on a case by case basis	SHE Manager
Reporting of environmental hazards and taking prompt action to remedy identified hazards	Proper, timely implementation of environment incident reporting provisions of Environmental Management Programme/ EPM	All Managers
Identification, collection and distribution of documents and records relevant to environmental issues	Maintain environmental database Maintain environmental report library and filing system Monitor government/administrative / industry developments and reports	SHE Manager
Development of skills of personnel in interpreting and understanding environment matters	Environmental awareness sessions - Communication meetings Inductions/ re- inductions Development / dissemination of Environmental Handbook and literature	All Managers
Compliance with environmental law statutes, regulations and orders	Maintain and implement Operational procedures consistent with statutory law Monitor statutory law	All Managers
Development of, and compliance with site specific environmental procedures	Maintain Environmental Procedures Institute reporting mechanisms, to confirm compliance	All Managers

Note:
When faithfully implemented the above constitute the majority of what is required to demonstrate due diligence.
In addition the General Manager should personally:

- Substantiate that environmental concerns that arise are promptly addressed.
- Act immediately when it is apparent the system (ie. Adherence to procedures) has failed.
- Demonstrably give effect to, and insist upon, adherence to policy and procedures.

Responsibilities have been drawn from the Cooljarloo Environmental Management Programme.