ILUKA RESOURCES

GINGIN MINERAL SANDS PROJECT

Environmental Protection Statement

August 2004

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

APPENDICES

EXECUTIVE SUMMARY

Iluka Resources proposes to establish a mineral sands mine in the Shire of Gingin. Gingin is located approximately 80 km north of Perth, Western Australia. The Gingin Project is located to the east of the Brand Highway north of the Dewar Road intersection. The area is on Minerals to Owner (MTO) title and therefore no mining or exploration leases are required. Additional approvals are required from the Shire of Gingin rather than the Department of Industry and Resources. Iluka Resources has successfully mined and rehabilitated MTO properties in the Southwest. Overall the project management will not change from standard Iluka practices.

The Gingin Project Area occurs at the footslopes of the Gingin Scarp, between the Swan Coastal Plain to the west and the Dandaragan Plateau at the foothills of the Darling Escarpment to the east.

The current landuse is agriculture and the Project Area has been extensively cleared. Two watercourses transect the orebody at the northern and southern ends of the pit. In the central area of the Project there is a wetland depression. The wetland depression and the North Stream are classified Resource Enhancement Category Wetlands.

No Threatened Ecological Communities, Declared Rare or Priority Flora species were located and none of the plant communities identified during the survey are classified as either regionally or locally significant. A fauna survey identified a total of 20 bird species, no fish species, no amphibian species, five mammal species (in addition to livestock) and three reptile species. No aquatic fauna was found in the watercourses surveyed. No rare or priority fauna species were observed during the survey.

No Aboriginal archaeological or ethnographic sites were found in the Project Area. One European heritage site, an old building ruin, has been relocated to the Gingin township for use in a community project.

Ore will be mined progressively from a single pit with 9.4 million tonnes of ore removed to produce 1.4 million tonnes of heavy mineral concentrate. Pre-production will commence in January 2005 and mining in May 2005. The mine will be operation for four years. Facilities will be moved from a current mining operation in the Southwest. This includes the concentrator, screen plant, conveyor, offices, mining unit and mining equipment. Additional equipment will be sourced as required.

Pre-production earthworks will include site clearing, drainage establishment, stripping topsoils and subsoils, removing the overburden, preparing the mining surface and establishing the site access, offices and concentrator area.

The ore will be mined using dry mining techniques. Ore will be conveyed from the in pit hopper to a centrally located screen plant. Solar drying dams will be used to dry the clay fines prior to returning to the pit along with the sand fines. Overburden will be returned to the mining void and landscaping and rehabilitation commenced as mining progresses.

Consultation has been undertaken by Iluka with a range of stakeholders. These include local landowners, local community, Shire of Gingin, state government departments and community interest groups.

Management of the Project development, operation and closure will be conducted in a manner that will ensure the environmental impacts of the Project are minimised and acceptable. The Iluka Environmental Health and Safety Management System will be used to manage environmental aspects of the Gingin Project.

Groundwater drawdown is required for dry mining operations. Modelling has shown that based on worst case scenarios the cone of groundwater depression resulting from drawdown has the potential to extend under nearby groundwater bore users. A water resources management plan has been developed and will be implemented to proactively manage any adverse impacts.

The diversion of two watercourses is required to enable mining. The watercourses will be diverted around the edge of the mining pit. Following the cessation of mining the original watercourse alignment will be re-instated. Improvements will be made to the post-mining landscape by fencing, planting trees and creating understorey vegetation along the watercourses. In addition to the rehabilitation, restoration of 1 km upstream on the North Stream will be conducted to enhance the values of this area. The rehabilitation program will include more native vegetation that what will be cleared. A further offset for the clearing of the resource enhancement category wetlands will be the establishment of a restoration scheme to support catchment landcare and watercourse improvement programs.

Naturally occurring acidic soils have been located in one drillhole on the Gingin orebody. Further investigations are underway to determine the extent of the acidic soils. These soils require specific management strategies to ensure the material is returned to the mining void as soon as possible and drainage is controlled and contained.

There are five nearby landowners to the Project. Noise modelling based on worst case scenarios has shown that noise modifications and proactive management will be required to ensure compliance with the noise regulations. A noise management plan has been developed and will be implemented during pre-production activities and throughout the Project life.

Other Environmental factors considered in the development of this Project include:

- Flora
- Fauna
- Radiation
- Air Emissions
- Heritage
- Light
- Visual amenity
- Rehabilitation and Closure

A number of environmental commitments have been made by Iluka for the Gingin Mineral Sands Project. These are outlined in the following table.

Table A: Management Actions

Number	Environmental Factor	Action	Objectives	Timing	Advice
1	Flora and Fauna	Prepare Vegetation and Fauna Management Plan that includes: • Minimisation of impacts on native vegetation • Delineation of areas of vegetation to be retained or cleared • Retention of topsoil for use in rehabilitation. • Dieback and weed control for equipment leaving site. • Progressive rehabilitation of mined areas. • Photo monitoring of vegetation downstream on North Stream. • Inspection of tailings dams for trapped animals.	To maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement of knowledge.	Prior to Commencement	CALM Ag Dept Gingin Shire
2	Flora and Fauna	Implement Vegetation and Fauna Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 1.	Throughout Project	CALM Ag Dept Gingin Shire
3	Surface water / Groundwater	Implement the Water Resources Management Plan. Report in Annual Compliance Report.	To maintain the quantity of water so that existing social water users are protected.	Throughout Project	Gingin Shire
4	Surface water	Prepare Drainage Management Plan that includes: • Site water control. • Bunding and drainage plans. • Water storage and segregation. • Stormwater management. • Release of excess water. • Contaminated water management.	To ensure onsite water management does not impact receiving surface water and groundwater environments.	Prior to Commencement	Gingin Shire
5	Surface water	Implement the Drainage Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 4.	Throughout Project	Gingin Shire

Number	Environmental Factor	Action	Objectives	Timing	Advice
6	Groundwater	Provide alternative water arrangements for landowners if bores are adversely affected by the Project.	To maintain the quantity of water so that existing social water users are protected.	Throughout Project	Gingin Shire
7	Acidic Soil	Develop a Soils Management Plan that includes: • Delineation of the area of highly acidic soils. • Operational handling of the soils during mining and rehabilitation. • Treatment of acidic soils. • Minimising water ingress into acidic soils. • Water collection and treatment system.	No impacts from acidic soils on surrounding environment or rehabilitated landscape.	Prior to Commencement	
8	Acidic Soil	Implement the Soils Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 7.	Throughout Project	
9	Radiation	Undertake a background radiation survey prior to commencement of mining.	To ensure that radiological impacts to the public and the environment are kept as low as reasonable achievable and comply with acceptable standards.	Prior to Commencement	DoIR
10	Radiation	Ensure that post-mining radiation levels are at or below the pre mining levels.	Achieve the objectives of commitment 9.	Rehabilitation	DoIR
11	Waste	Prepare Waste Management Plan that includes: • Storage, segregation and disposal of waste streams.	To minimise waste produced, to recycle & dispose of wastes in an acceptable manner.	Prior to Commencement	Gingin Shire
12	Waste	Implement the Waste Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 11.	Throughout Project	Gingin Shire
13	Air Emissions	Prepare Dust Management Plan that includes: • Minimising dust generation. • Minimising off-site emissions. • Monitoring dust levels. • Dust suppression measures.	To ensure that emissions do not adversely affect environmental values or the heath, welfare and amenity of people and land use s by meeting statutory requirements and acceptable standards.	Prior to Commencement	Gingin Shire

Number	Environmental Factor	Action	Objectives	Timing	Advice
14	Air Emissions	Implement the Dust Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 13.	Throughout Project	Gingin Shire
15	Light	Prepare Light Management Plan that includes: • Placement of site lighting to minimise light spill.	To avoid or manage potential impacts from light overspill and to comply with acceptable standards.	Prior to Commencement	Gingin Shire
16	Light	Implement the Light Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 15.	Throughout Project	Gingin Shire
17	Noise	Implement the noise management plan. Report in Annual Compliance Report.	To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.	Throughout Project	Gingin Shire
18	Heritage	Prepare Heritage Management Plan that includes: • Discovery of archaeological material. • Cultural awareness and site identification training.	To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	Prior to Commencement	DIA
19	Heritage	Implement the Heritage Management Plan. Report in Annual Compliance Report.	Achieve the objectives of commitment 18.	Throughout Project	DIA
20	Rehabilitation and Closure	Implement the Closure Plan. Report in Annual Compliance Report.	To ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values.	Rehabilitation	CALM Gingin Shire

1. INTRODUCTION

1.1 The Proposal

Iluka Resources Limited (Iluka) is currently undertaking a Detailed Feasibility Study (DFS) to mine mineral sands at the Gingin Deposit in Western Australia. The Project is located approximately 2.5 kilometres (km) west of the township of Gingin and 80 km north of Perth (Figure 1). An aerial photograph of the site is provided as Figure 2.

If results of the DFS are favourable, then Iluka plans to have an operational plant on site and to begin mining by May 2005. Based on a processing rate of 250 tonnes per hour (tph), mining of the Gingin Deposit is expected to be completed over three and a half years.

The proposed Gingin Project will comprise:

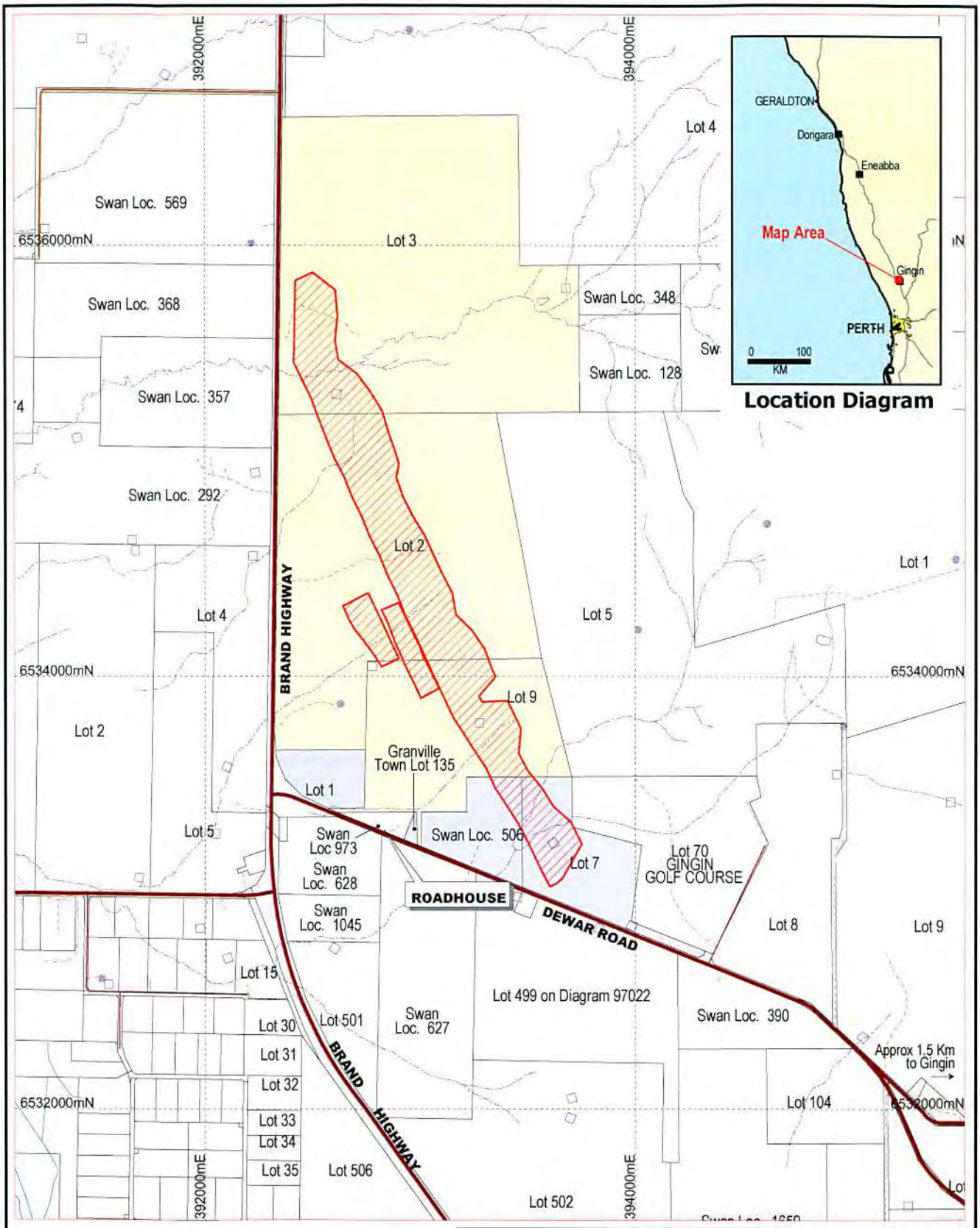
- open cut mining to a depth of 28 m;
- an in-pit feed hopper;
- feed conveyors;
- a centrally located screen plant;
- a 250 tph concentrator;
- Heavy Mineral Concentrate (HMC) Stockpiles;
- a clean water dam;
- a process water dam;
- solar drying dams;
- site offices, crib room and ablution block;
- potable water storage;
- weighbridge;
- monazite unloading facility;
- workshop and tool shed;
- parking area;
- mine access roads; and
- earthmoving contractors' area (parking and workshop).

The proposed site layout is presented in Figure 3. The key characteristics of the Project are outlined in Table 1.

Table 1: Key Characteristics Table

Element	Quantities / Description
Life of Mine (mine production)	Less than 4 years (continual operation)
Size of Orebody	80 hectares
Area of disturbance	280 hectares
Major Components Pit Hopper Screen plant 250 tonne per hour Concentrator Solar drying dams Processing plant, including ore stockpiles Infrastructure (site office, water supply bore, pipeline, conveyor, power supply, roads etc.)	See figure 3 for details.
Ore mining rate (maximum)	2,800,000 tonnes per year
Overburden mining rate (maximum)	3,650,000 tonnes per year
Hours of Operation	24 hours per day, 7 days per week
Water Supply Source Maximum Annual Requirement Source Maximum Annual Requirement	 Yarragadee Aquifer 1,500,000 kilolitres per year Superficial Aquifer 1,000,000 kilolitres per year
Fuel storage capacity Annual fuel usage	50,000 litres 3,300,000 litres per year
Heavy mineral concentrate transport (maximum)	12 return trucks per week.

This Environmental Protection Statement has been developed in consultation with the Environmental Protection Authority (EPA). It describes the proposal, the existing environment, and the potential environmental and social impacts of the proposal and proposes strategies to mitigate and manage the potential impacts.



LEGEND

- Pit Limits
- ILUKA Properties - MTO
- Kitson Properties - MTO

N

0 0.5 1 Kilometers

MGA Coordinates, GDA94

ILUKA

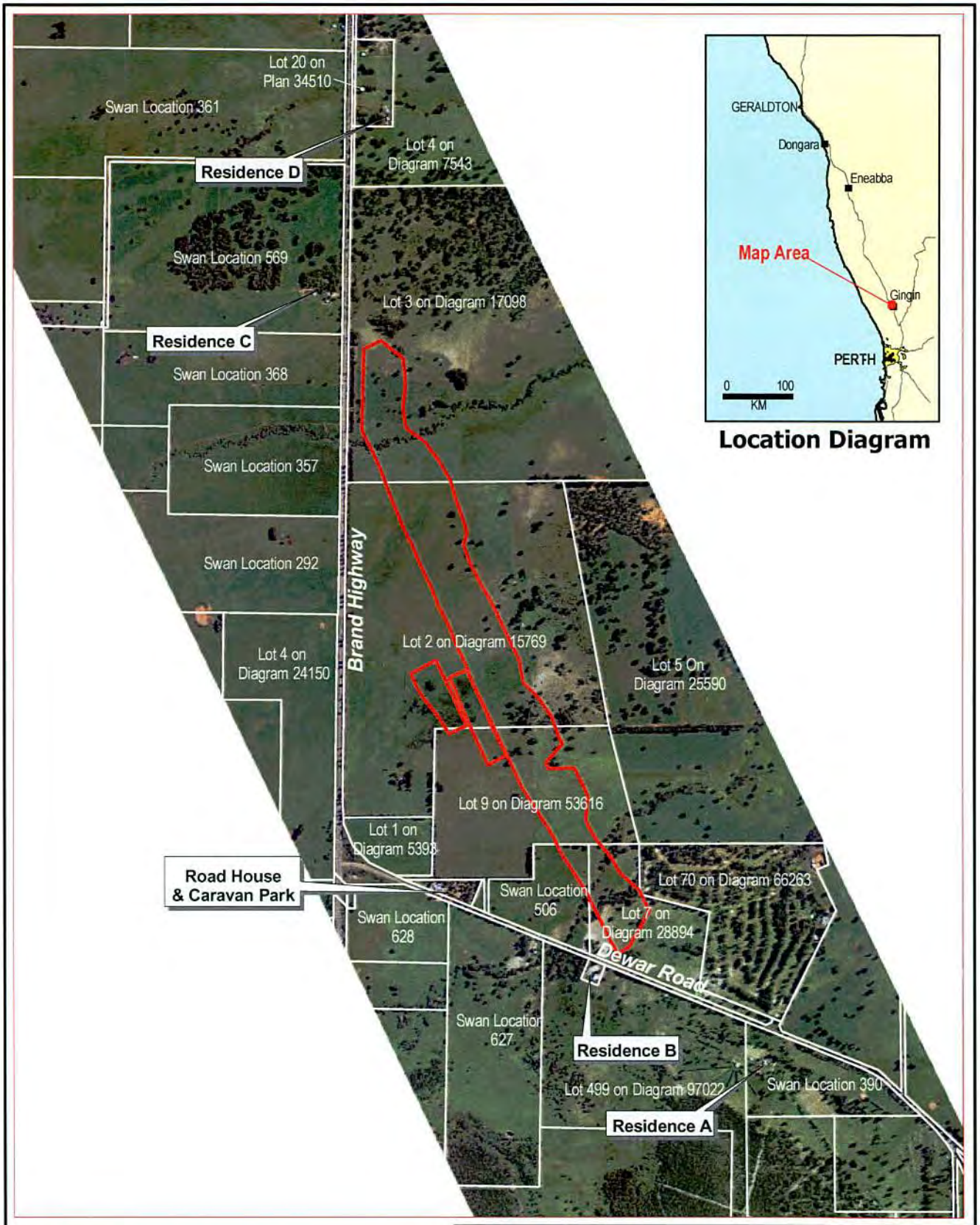
ORIG :	URS
DRAWN :	S.P.
SCALE :	1:25 000
DATE :	27 April 2004

GINGIN DEPOSIT

LOCATION PLAN

DWG No : 36211 ver.03

FIGURE : 1



LEGEND

Pit Limits

N

0 500 1000 Meters

Date of Photography - 22 Sep 2000

ILUKA

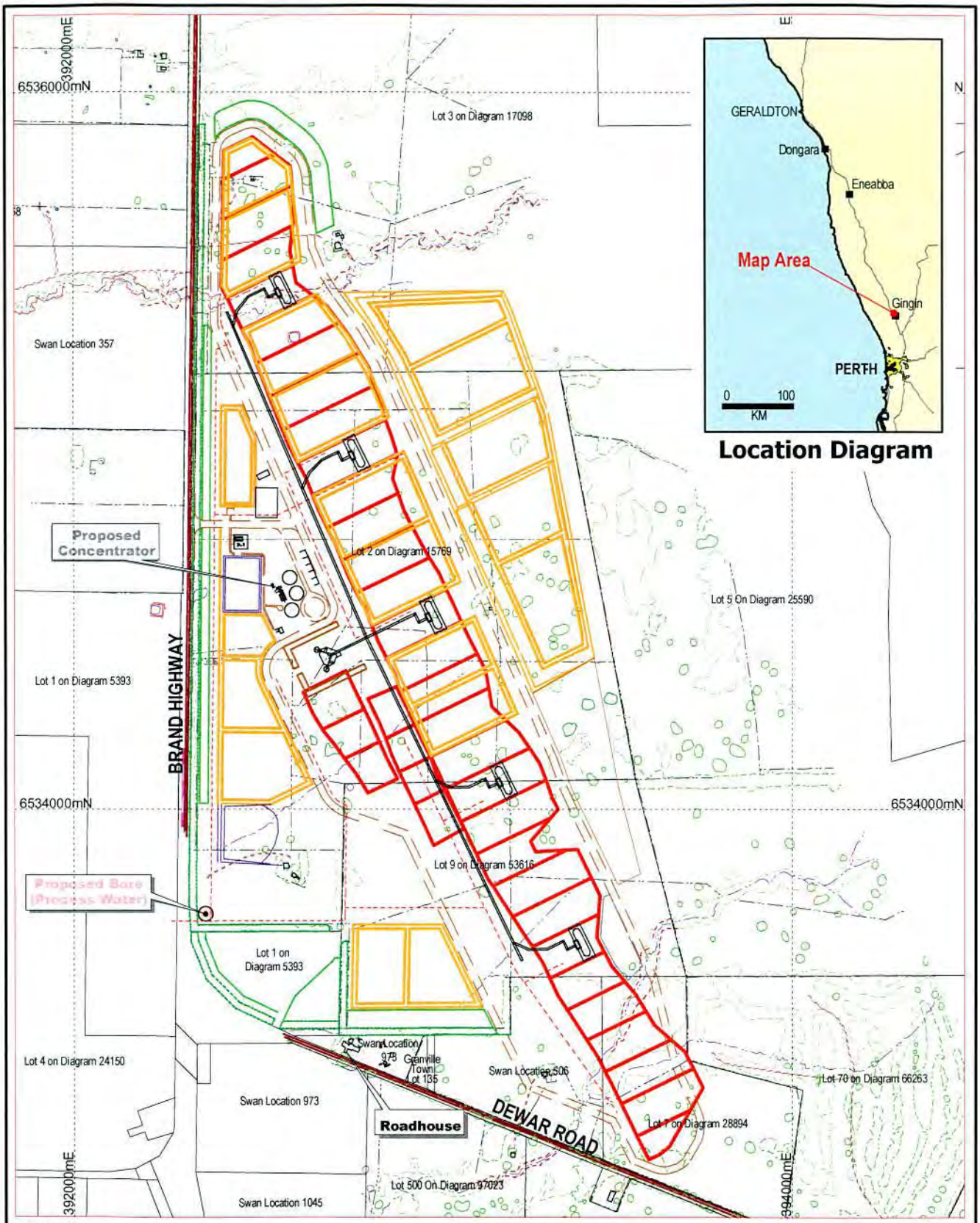
ORIG :	L.SADLER
DRAWN :	S.P.
SCALE :	1:25 000
DATE :	9 DEC 2003

GINGIN DEPOSIT

AERIAL LOCATION PLAN

DWG No : 125185 ver.00

FIGURE : 2



Legend

- Water Dam
- Infrastructure
- Mine Road
- Mining Area
- Noise Bund
- Ore Stockpile
- Power
- Solar Drying Dam
- Stockpile
- Topsoil Stockpile
- Tree Belt
- Proposed process water bore

0 400 800 Meters

MGA Coordinates, GDA94

N

ILUKA

GINGIN DEPOSIT

SITE LAYOUT

ORIG :	L.Sadler		
DRAWN :	S.P.		
SCALE :	1:15,000		
DATE :	12 DEC 2003	DWG No : 122175 ver.02	FIGURE : 3

1.2 The Proponent

The Proponent for this Project is Iluka Resources Limited (Iluka). Iluka is an international mining and processing company, which has mineral production and processing operations in Australia and the United States. Iluka's major business activities are mining and processing titanium minerals, mining and processing zircon, coal mining (joint venture) and mineral exploration. Currently, Iluka's mining and mineral processing operations in Western Australia are located in the Capel and Eneabba-Geraldton regions. These are referred to as the South-west and Mid-west operations respectively. The Great Eastern Highway divides the two regions. The Gingin Project will be a continuation of Iluka's mining operations with the concentrator moving from an existing southwest minesite.

Iluka is a signatory to the Australian Minerals Industry Code for Environmental Management. The adoption of the Code signifies a corporate commitment to responsible environmental management.

The proponent can be contacted at:

Iluka Resources Limited

Level 23, 140 St Georges Terrace

PERTH WA 6000

ABN 34008675018

For further information contact:

Lisa Sadler, Senior Environmental Advisor

Tel: (08) 9360 4700

Fax: (08) 9360 7744

Email: lisa.sadler@iluka.com

1.3 Location

Gingin is located approximately 80 km north of Perth, Western Australia. The Gingin Deposit is located approximately 2.5 km northwest of the Gingin townsite, to the east of the Brand Highway and north of Dewar Road. The deposit lies within the Shire of Gingin and the South West Mineral Field, and comprises five ore reserves of varying sizes that follow a southeast-northwest direction (Figure 3).

1.4 Land Tenure

All properties within which the Gingin Deposit occurs are Minerals-to-Owner (MTO) land alienated from the Crown prior to 1899. The land title of this land includes the rights to all minerals excluding gold, silver and other precious metals. Iluka does not hold any mining leases over the Gingin Deposit as this is not required on MTO land. While exploration and mining on MTO land are not covered by the provisions of the *Mining Act 1978*, Iluka recognises that the requirements of the *Environmental Protection Act 1986*, *Soil and Land Conservation Act 1945*, *Rights in Water and Irrigation Act 1914*, *Wildlife Conservation Act 1950* and *Aboriginal Heritage Act 1972* do apply. The *Mines Safety and Inspection Regulations 1995* will apply to the radiation management for the site.

Iluka owns the majority of the properties that make up the Project Area, and a landowner agreement is in place for the remaining property.

A summary of the relevant landholders is shown in Table 2. The land owned by the Kitson Estate covers the southern end of the orebody.

Table 2: Gingin Landholders

Landholder	Crown Grant No. (C.G.)	Total area (ha)
Iluka Resources Limited	Part Swan Locations 128, 354 & 508, Lot 2 Part Swan Locations 128 & 340, Lot 3 Part Swan Locations 128, 354, 355, 506, Lot 9	375
Kitson Estate	Swan Location 506 Portion of each of Swan Locations 354 and 508, Lot 1 Part Swan Locations 511 & 536, Lot 7	51

1.5 History

Iluka has conducted exploration in the Gingin area since 1971. Initial results were encouraging and more extensive drilling programs occurred throughout the early 1970s, including bulk sample collection and metallurgical test work. Additional smaller deposits were identified within the Gingin area, namely the Gingin South and Muchea deposits.

During the 1970s and 1980s, as drill data increased, several economic assessments were conducted on the Gingin Deposit. These investigations identified the deposit as economically viable, recommended follow up drilling and a requirement to secure future mining access as the properties were Minerals-To-Owner. As a result, Iluka now holds the majority of the overlying properties, with the exception being the property held by the Kitson Estate.

The Gingin Project is currently scheduled to commence production in May 2005. Pre-production work is scheduled to commence in January 2005, subject to receipt of relevant statutory and other approvals.

2. EXISTING ENVIRONMENT

2.1 Regional Setting

The Gingin Project Area (the Project Area) lies approximately 80 km north of Perth within the Shire of Gingin. The Shire of Gingin is comprised mainly of Swan Coastal Plain but also encompasses western foothills of the Darling Escarpment. The Shires of Chittering, Victoria Plains, Dandaragan, the City of Joondalup and the Indian Ocean surround the Shire (Shire of Gingin, 2002). There are five towns within the Shire of Gingin: the administrative centre of Gingin, plus the coastal towns of Lancelin, Guilderton, Ledge Point and Seabird.

A range of broadacre and intensive agricultural and horticultural production forms the main income base for the region. The coastal area is enjoying increasing popularity as a tourist destination (Shire of Gingin, 2002).

Mineral sands mining and processing currently occur in the region to the north and south of the Gingin Deposit at Eneabba and Muchea respectively.

2.2 Climate

Gingin has a Mediterranean-type climate with hot dry summers and cool wet winters. Records dating from 1889 indicate that the average annual rainfall in the area is 735.4 mm. June and July are the wettest months with a mean rainfall of 146.4 mm and 150.5 mm, respectively. December and January are the driest months, with a mean rainfall of 10.1 mm and 9.6 mm respectively (Table 3). Evaporation generally exceeds rainfall during the period from September to April. Temperatures at Gingin range from a mean minimum of 6.3°C in August, to a mean maximum of 32.9°C in February.

Iluka installed a meteorological station on site in 2002.

Table 3: Average Temperature, Evaporation and Rainfall at Gingin

Month	Temperature[1] (°C)		Mean Pan Evaporation[2] (mm)	Mean Rainfall[3] (mm)
	Mean Daily Maximum	Mean Daily Minimum		
Jan	32.7	15.9	325.5	9.6
Feb	32.9	16.5	254.8	12.8
Mar	30.3	15.0	226.3	17.3
Apr	26.9	12.6	150.0	34.4
May	23.0	9.6	96.1	101.7
Jun	19.9	7.9	75.0	146.4
Jul	18.4	6.9	71.3	150.5
Aug	18.7	6.3	80.6	115.1
Sep	20.5	7.5	99.0	69.1
Oct	24.1	9.1	148.8	48.4
Nov	27.9	11.7	201.0	19.0
Dec	30.8	14.6	263.5	10.1
Mean	**25.3**	**10.9**	**5.5**	**Total 735.4**

Source: Climate and Consultancy Section of the Western Australian Regional Office of the Bureau of Meteorology, Perth.

Notes: 1 Data collected for Gingin Aero from 1996 to 2003.
2 Data collected for the Upper Swan Research Station from 1957 to 1992.
3 Data collected for Gingin from 1889 to 2003.

2.3 Landform and Geology

The Project Area occurs at the footslopes of the Gingin Scarp, which lies between the Swan Coastal Plain to the west and the Dandaragan Plateau at the foothills of the Darling Escarpment to the east (Smolinski and Scholz, 1997). Within the Project Area the topography is generally flat with an east west gradient of 1:60, rising more sharply in the east of the orebody.

The Project Area is within the eastern margins of the Perth Basin, a deep linear trough of sedimentary rocks that extends 1,000 km in a north-south direction (Dames & Moore, 2000). Deposition within the basin has occurred in three distinct phases, the ages of which are listed below:

- Tertiary – Quaternary - Yoganup Formation, Guildford Formation.
- Cretaceous - Leederville Formation.
- Jurassic - Yarragadee Formation, Parmelia Formation.

The expected stratigraphy beneath the Project Area is summarised in Table 4.

Table 4: Expected Stratigraphy Beneath the Project Area

Stratigraphic Unit	Age	Possible Thickness (m)
Surficial alluvium	Quaternary	0 – 5
Guildford Formation	Quaternary	2 – 15
Yoganup Formation	Tertiary-Quaternary	5 – 15
Leederville Formation	Cretaceous	0 – 30
Parmelia Formation	Jurassic	150 – 400
(Parmelia Formation – Otorowiri Member)	Jurassic	(50 – 80)
Yarragadee Formation	Jurassic	>1,000

Source: Dames & Moore (2000).

The mineralisation is contained within the sediments of the Yoganup Formation, a littoral unit deposited during marine transgressive phases in the Pleistocene. The accumulations of heavy minerals (HM) are thought to have occurred primarily where rivers and creeks draining from the Archaean Shield entered the sea.

Longshore drift and winnowing action by waves and northwesterly storm swells resulted in the removal of lighter sands, leaving accumulations of HM.

Locally the stratigraphy of the Yoganup Formation consists of red-orange-white clayey sand to sand with inter-bedded clay layers. A conglomerate containing well-rounded pebbles/boulders of quartzite/granite and gneiss is often present at the base of the Formation.

Yellow well-sorted dunal sands commonly overlay the littoral units. These units are partially lateritised and some pisolitic gravels have developed at the surface.

The basement is generally grey clay to poorly sorted sandstone of the Leederville Formation or weathered granite/gneiss where the Yoganup Formation laps rocks of the Yilgarn Craton.

The deposit itself consists of five main strandlines. The main strand abuts the basement formation with the other two strands lying to the west. The two remaining smaller strands lie to the northeast and southeast of the main strand. The overlying lateritic cover formation

is mineralised to varying degrees. The hardness of this cover formation varies along the deposit.

2.4 Soils

A soil survey conducted by Oracle Soil and Land Pty Ltd (2002) for the Project found that the soils in the Project Area originated from the adjacent Gingin Scarp and Dandaragan Plateau, being deposited by alluvial, fluvial and colluvial processes. The characteristics of these soils are strongly influenced by the present redoximorphic conditions.

The soil types present in the Project Area are composed of eight distinctly different soil materials. The properties of these materials are diverse and some exhibit a number of adverse properties that will require careful management during mining and rehabilitation. Based on their properties, the soil materials have been classified into three Soil Material Management Units (SMMU) of Topsoil, Subsoil and Overburden. The SMMU's are utilised in the planning, operation and rehabilitation management of soils.

The Topsoil (SMMU 1) within the mining area exhibits optimal physical and chemical properties, and subsequently can be handled easily during mining and rehabilitation. However, in some areas the topsoil approaches the strongly acidic end of the pH scale and subsequently liming may prove beneficial for optimal growth of some agricultural and native plant species.

The Subsoil (SMMU 2) within the mining area is comprised of yellow-brown to red to pale grey sand and yellowish-brown to pale grey, gravely clay soil materials. Similar to the topsoil, these subsoil materials exhibit optimal physical and chemical properties and can be handled easily during mining and rehabilitation; they are unlikely to develop adverse soil properties. The low silt and clay content of the sandy soil material limits its water holding capacity and subsequently the incorporation of 10-20% fines material during rehabilitation would be beneficial and is recommended by Oracle (2002).

The Overburden (SMMU 3) within the mining area consists of the grey clay and grey siltstone/mottled sandstone soil materials. Both soil materials exhibit macro and microstructural instability, slaking rapidly when air-dried aggregates are re-wet. Consequently, these materials should be handled conservatively (i.e. low disturbance) and should be replaced in the mining void at depth, reducing the contact between these materials and heavy machinery near the surface.

2.4.1 Acidic Soils

A preliminary assessment for Acid Sulfate Soils (ASS) was conducted on the lithologies intersected by the groundwater bores, previous site visits and baseline groundwater and surface water quality data collected to date (URS, 2003a).

Soil profiles within the proposed mining areas typically comprise sand or loamy sand. The shallow lithologies to several metres depth usually comprise unsaturated sands, clays and ferruginised zones.

Previous site visits indicate the central project area, near piezometer GS13, the only area where the water table is less than 1 to 2m below ground, is devoid of any obvious surface signs of acidity.

Chloride-sulphate ratios have been reviewed from available groundwater quality data (piezometers GS3, GS8, GS9, GS17 and GSP1) to assess potential for acid generation from mining. This dataset indicates a low acid potential at all sites, except GS8, based on typical $Cl:SO_4$ ratios of 9 to 23. At site GS8S, $Cl:SO_4$ ratios of 1.2 to 1.6 have been recorded since

January 2002. A dark grey carbonaceous mudstone occurs at depths of about 6 to 8 m, above the water-table, which fluctuates between about 8.5 to 9.0 m. It is possible that oxidation of sulphide material from the mudstone is occurring, however pH values (5.6 to 6.6) are not anomalously low.

A field investigation into the occurrence of ASS was undertaken in November 2003. Analysis was conducted by the Chemistry Centre and a review of results undertaken by Oracle Soil and Land Pty Ltd.

Three drillholes were sampled within the orebody and were located in areas considered to have the highest ASS potential. Samples were collected every metre and tested for Suspension Peroxide Oxidation Combined Acidity and Sulfate (SPOCAS) and Chromium Reducible Sulfur (CRS).

The results of the SPOCAS and CRS testwork indicate that these soils do not contain acidifying sulfidic minerals (i.e. pyrite), indicating that these soils are not potential acid sulfate soils. The majority of samples have Existing and Potential Acidity less than the action criteria specified by the DoE. All of the analysed holes have low oxidisable sulfidic acidity.

One drillhole in the northern area of the deposit had several samples with the Total Peroxide/Potential Acidity (TPA) greater than the guideline value of 18 mole H+/t. This was attributable to the high inherent or existing Total Actual Acidity (TAA) in these soils. Analysis of pH_{KCl} and pH_{ox} show that these samples do not contain significant amounts of oxidisable sulfidic minerals. This is also supported by the very low S_{KCl}, S_P and S_{Cr} values.

A metals analysis was also conducted on the soils. This found naturally high levels of Arsenic and Chromium in several of the samplies. These levels are higher than the environmental investigation levels specified by the DoE in the contaminated sites guidelines. These levels are for contaminated sites rather than naturally occurring materials and the guideline does acknowledge that some soils have naturally high background concentrations of heavy metals. The elevated As and Cr levels, in the samples are also to be expected given the nature and origin of these samples, and the geochemical behaviour of these metals. Both As and Cr are geochemically considered residual hydrolysates, meaning that they are preferential retained in the soil, as opposed to being highly mobile and removed by leaching. It is likely that the elevated As and Cr levels in these samples have been inherited from the mineral structure of the glauconitic parent minerals.

2.5 Radiation

Iluka Resources' current mid west operations have a Radiation Management Plan which applies to the mining and concentrating operations at Eneabba, processing operations at Narngulu and the Wharf Ship Loading Operations within the Port of Geraldton, operated by the Geraldton Port Authority. The plan was prepared in accordance with the requirements of the regulation 16.7 of the *Mines Safety and Inspection Regulations 1995* and the Department of Minerals and Energy Publication RSG02 Preparation of a Radiation Management Plan (May 1996) was followed to the maximum extent possible. The Plan will be updated to incorporate mining operations at Gingin, and will be reviewed within two years of its submission or at intervals designated by the State Mining Engineer.

A background radiation survey of the Gingin Project Area will be conducted prior to the commencement of mining.

2.6 Surface Hydrology

Characterisation of the surface water environment of the Project Area was undertaken by URS during preparation of a surface water diversion report (URS, 2003a).

The Project Area is drained by a number of small streams which discharge into Gingin Brook to the west. A small wetland depression exists in the central portion of the Project Area. Surface water is evident from the onset of winter rains through to early summer. Streams and the location of existing and planned monitoring sites are shown on Figure 4.

The streams generally flow from the east to the west or southwest, passing through culverts on Brand Highway or Dewar Road. The largest streams, the North and South streams have channel lines (NS2 and SS3) extending back toward the hinterland of the catchment. Three smaller streams (CS3, CS2 and an unnamed stream) drain a permanent wetland in the central Project Area. The North Stream and wetland in the central Project Area are classified as resource enhancement category wetlands (Figure 5). These areas were re-evaluated by the DOE from conservation category wetlands on 15 June 2004 following an application by Iluka.

The NS2 and SS3 streams have broadly parabolic, well grassed cross sections, 30 to 40 m wide at the top and two to three metres deep. A well defined, sandy low-flow channel, typically one to three metres wide and half to one metre deep, meanders through the broader streamline. The smaller streams are typically shallow channels primarily in grassed depressions.

Most of the streams and the central wetland areas have a baseflow component in winter as a result of groundwater seepage.

The existing streamlines in the Project Area are generally erosionally stable. There is some evidence of erosion occurring near the road crossings on Dewar Road (South Stream) and the Brand Highway (North Stream). The streambed below the crossing on Dewar Road, near the monitoring point SS3, is exhibiting erosion. The profile of the South Stream below the road is considerably narrower and deeper than upstream. The North Stream immediately below the crossing on the Brand Highway also forms an active erosion area.

There is one conservation category wetlands and one high conservation category wetland within a 500 m radius of the mining area. These domains are degraded, being accessible to livestock and subject to weed invasion (Figure 5).

The Project Area is within a surface water management area proclaimed under the *Rights in Water and Irrigation Act 1914*. In areas proclaimed under this Act, the Department of Environment (DoE) ensures that water use is contained within sustainable diversion limits through a system of licences and permits. The Project Area does not occur within a Public Drinking Water Source Area.

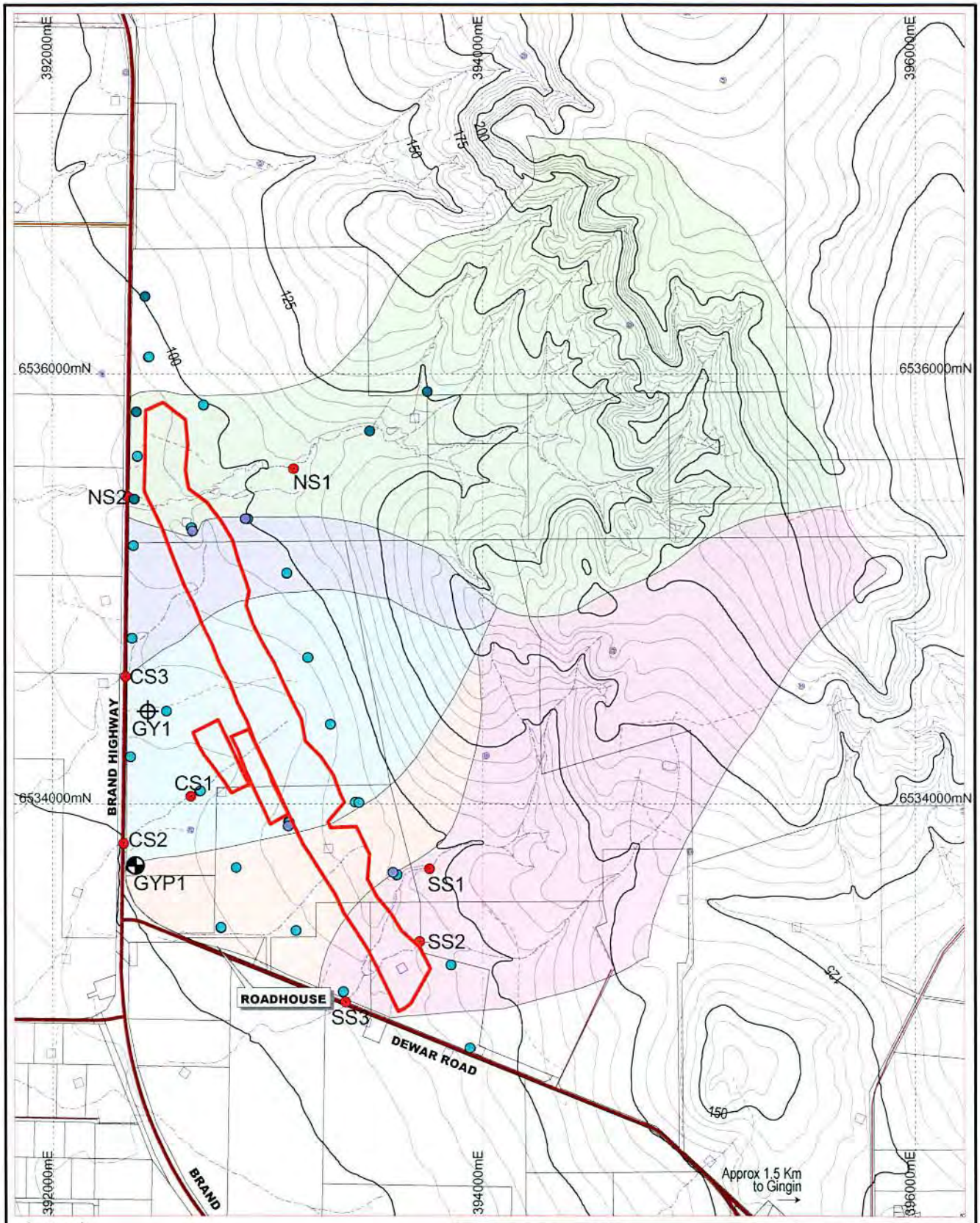
2.7 Groundwater

The Gingin Deposit occurs within the Gingin Groundwater Area (GGA), which is managed by the Swan-Goldfields-Agricultural regional office of DoE in accordance with an interim Sub-Regional Allocation Strategy released in 2001.

Several studies have been completed by Dames & Moore (2000) and URS (2002a, 2002b, 2003b) to investigate the hydrogeology of the Project Area and assess the impacts of abstraction from the superficial formations, for mine dewatering, and the Yarragadee Formation, for process water supplies. Key findings of these studies regarding the local hydrogeological environment and existing use of groundwater resources include:

- Shallow groundwater resources occur within the Yoganup and Guildford formations.
- Groundwater levels in the superficial formations typically range from 10 to 20 m in northern areas, 4 to 14 m in central areas and 2 to 12 m in southern areas.
- Groundwater flow within the local superficial formations is predominantly in a westerly direction, with subtle variations that reflect the surface topography, particularly in areas of higher relief on the eastern side of the Project Area.
- Groundwater quality within the superficial formations is predominantly brackish (1,200 to 5,000 mg/L Total Dissolved Solids [TDS]), slightly acidic and of a sodium-chloride type.
- Deeper groundwater resources beneath the Project Area occur within sandy beds of the Yarragadee Formation, below about 450 m. These resources are isolated from the superficial formations by thick clay and siltstone sequences of the Parmelia Formation.
- Groundwater within the Yarragadee Formation is brackish (1,300 mg/L TDS), slightly alkaline and of a sodium-chloride type.
- Existing use of the shallow groundwater resources for domestic and stock supplies typically occurs from low-yielding windmill bores on the western side of the Brand Highway. These bores are usually less than 30 m deep and abstract 10 to 30 kL/day.
- The most significant local users of the Yarragadee Formation and other confined aquifer groundwater resources are:
    - Koorian Estate, an olive plantation located two kilometres north of the Project Area, with an allocation of 3,000,000 kL/annum from the Yarragadee Formation and 250,000 kL/annum from the Leederville Formation within Sub-area 5 of the GGA; and
    - Cheriton Estate Winery, located two kilometres east of the Gingin Deposit, with an allocation of 1,096,000 kL/annum from the Leederville Formation within Sub-area 6 of the GGA.

The locations of the piezometers and production bores at the Gingin Deposit are shown on Figure 4.



Legend

- Superficial Aquifer Production Bore
- Superficial Aquifer Monitoring Bore
- Site Regional Monitoring Piezometer
- Yarragadee Monitor Bore
- Yarragadee Production Bore
- Surface water monitoring sites
- Cadastre
- Pit Limits
- SS2 Catchment
- No Named Stream Catchment
- NS2 Catchment
- CS2 Catchment
- CS3 Catchment

N

0 500 1000 1500 Meters

MGA Coordinates, GDA94

ILUKA

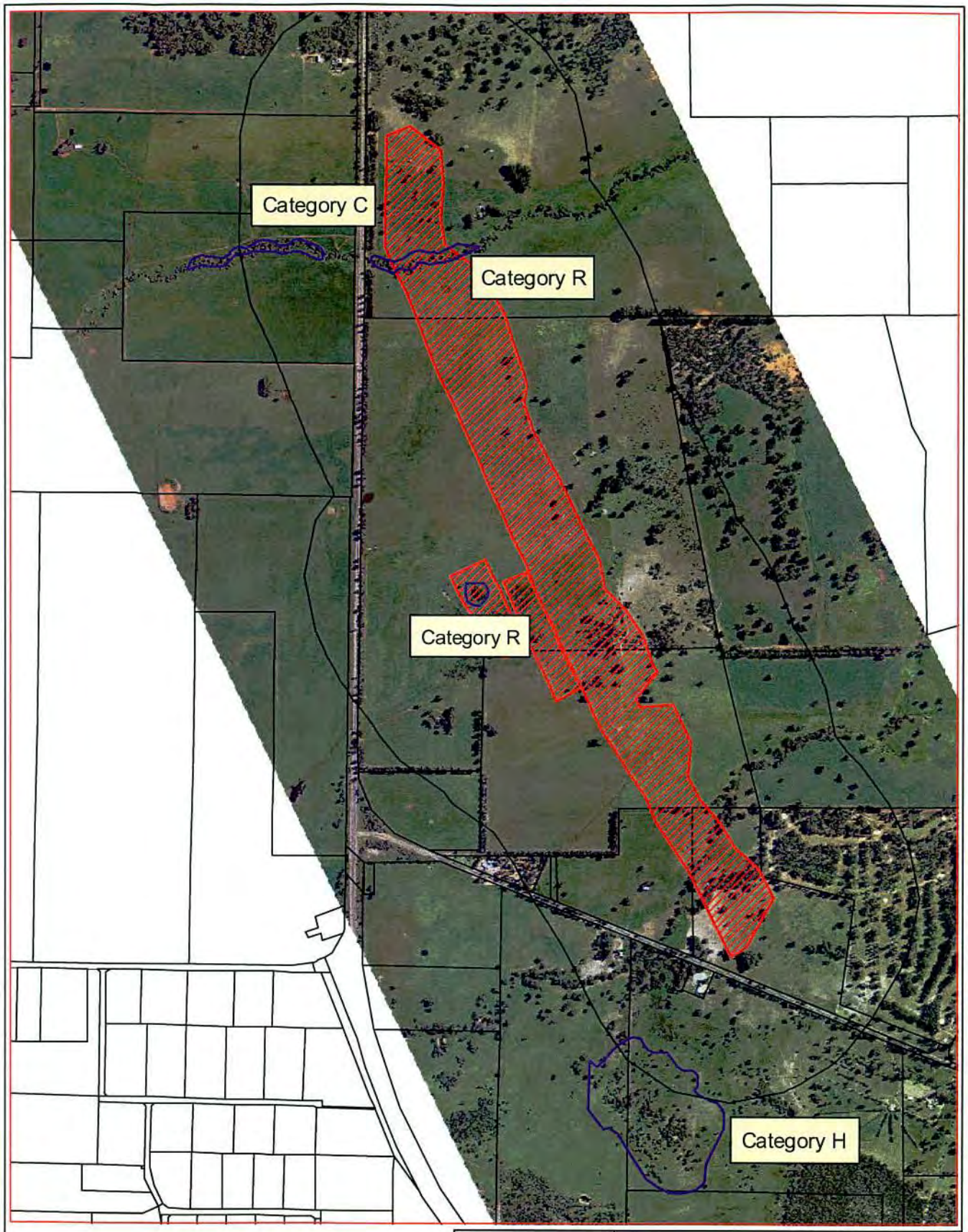
ORIG :	URS
DRAWN :	S.P.
SCALE :	1:25,000
DATE :	27 April 2004

GINGIN DEPOSIT

STREAM CATCHMENTS, SURFACE WATER MONITORING AND BORE LOCATIONS

DWG No : 122176 ver.01

FIGURE : 4



N

180 0 180 360 540 Meters

1:18000

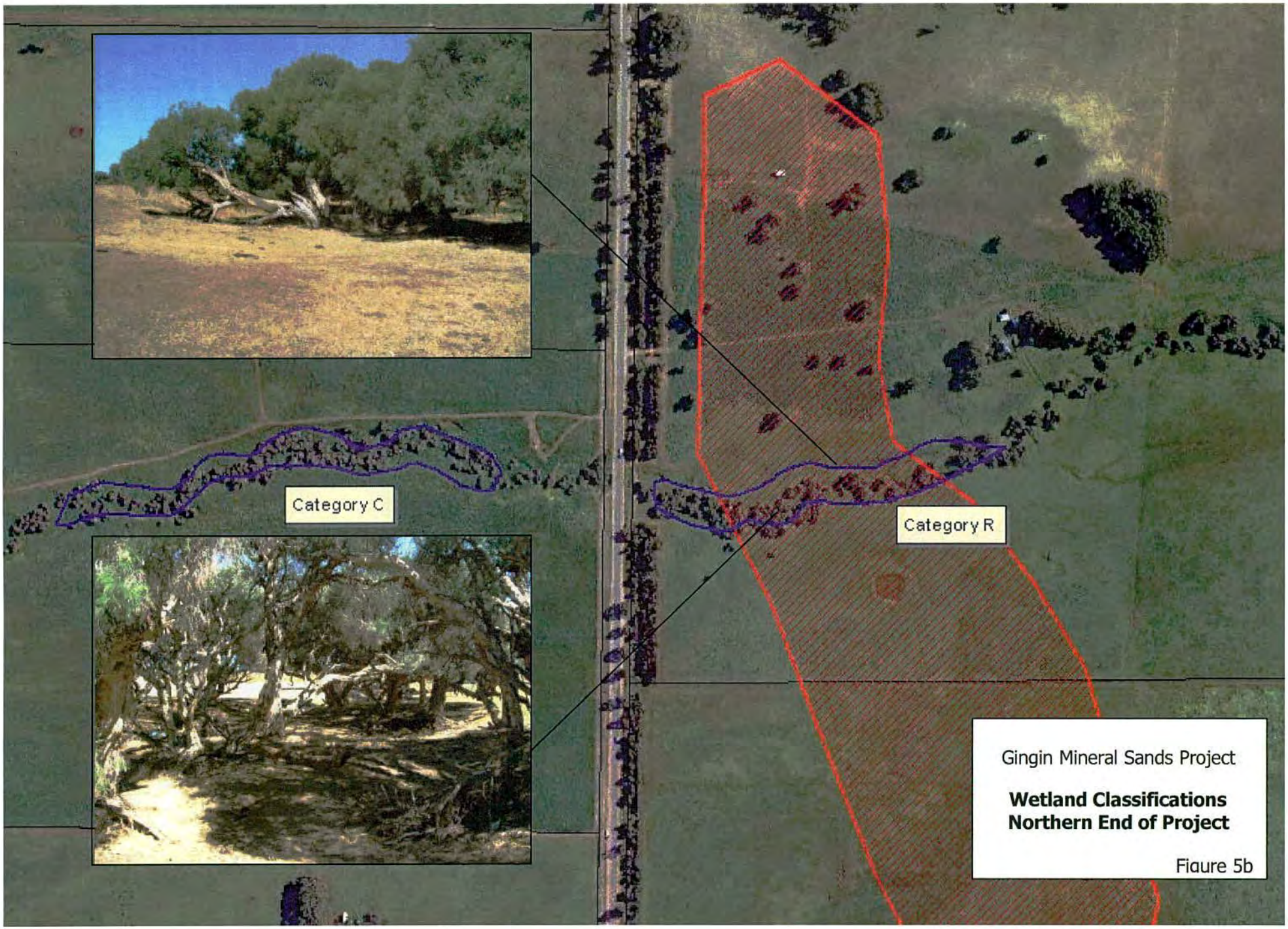
ILUKA

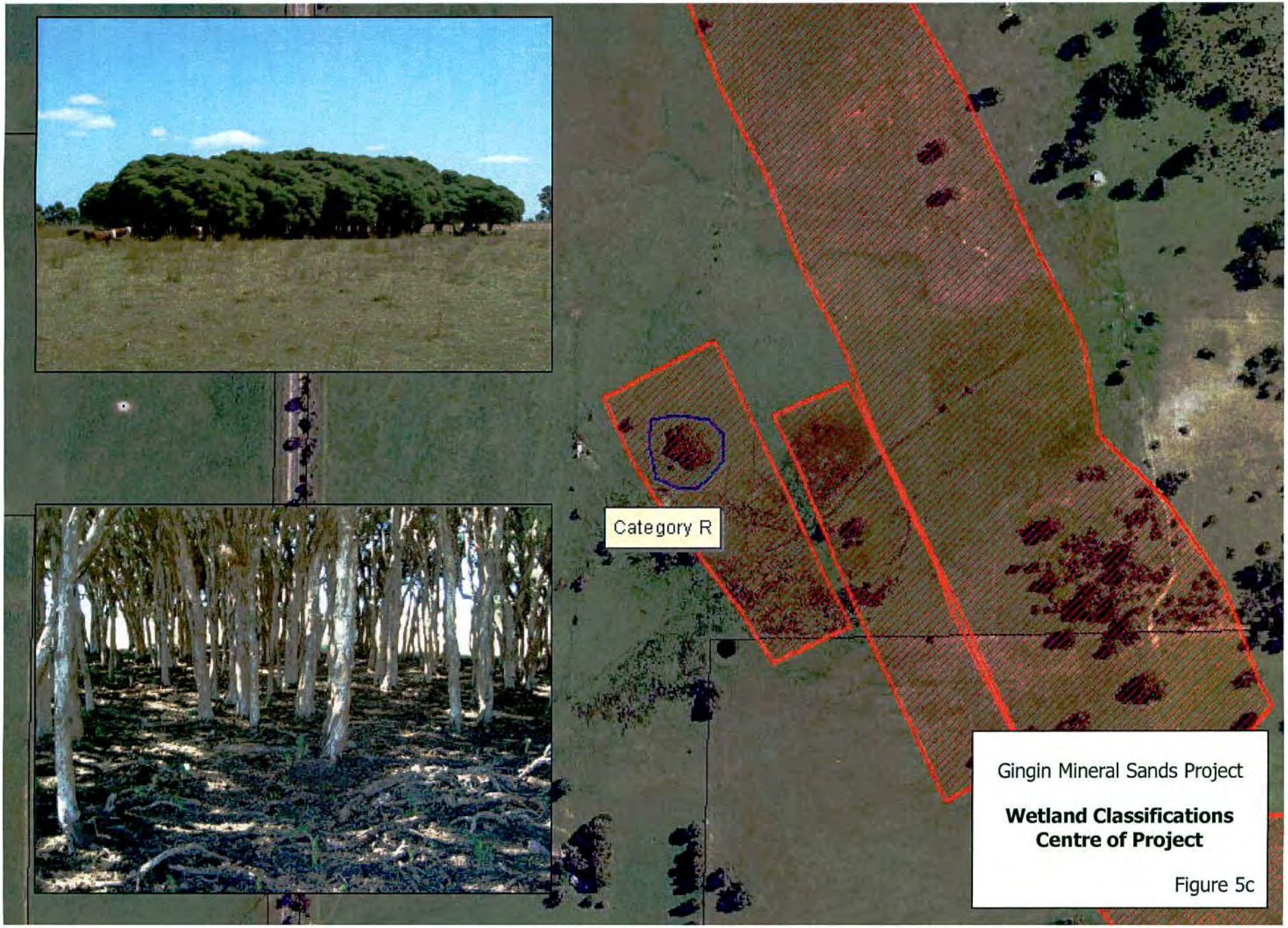
GINGIN DEPOSIT

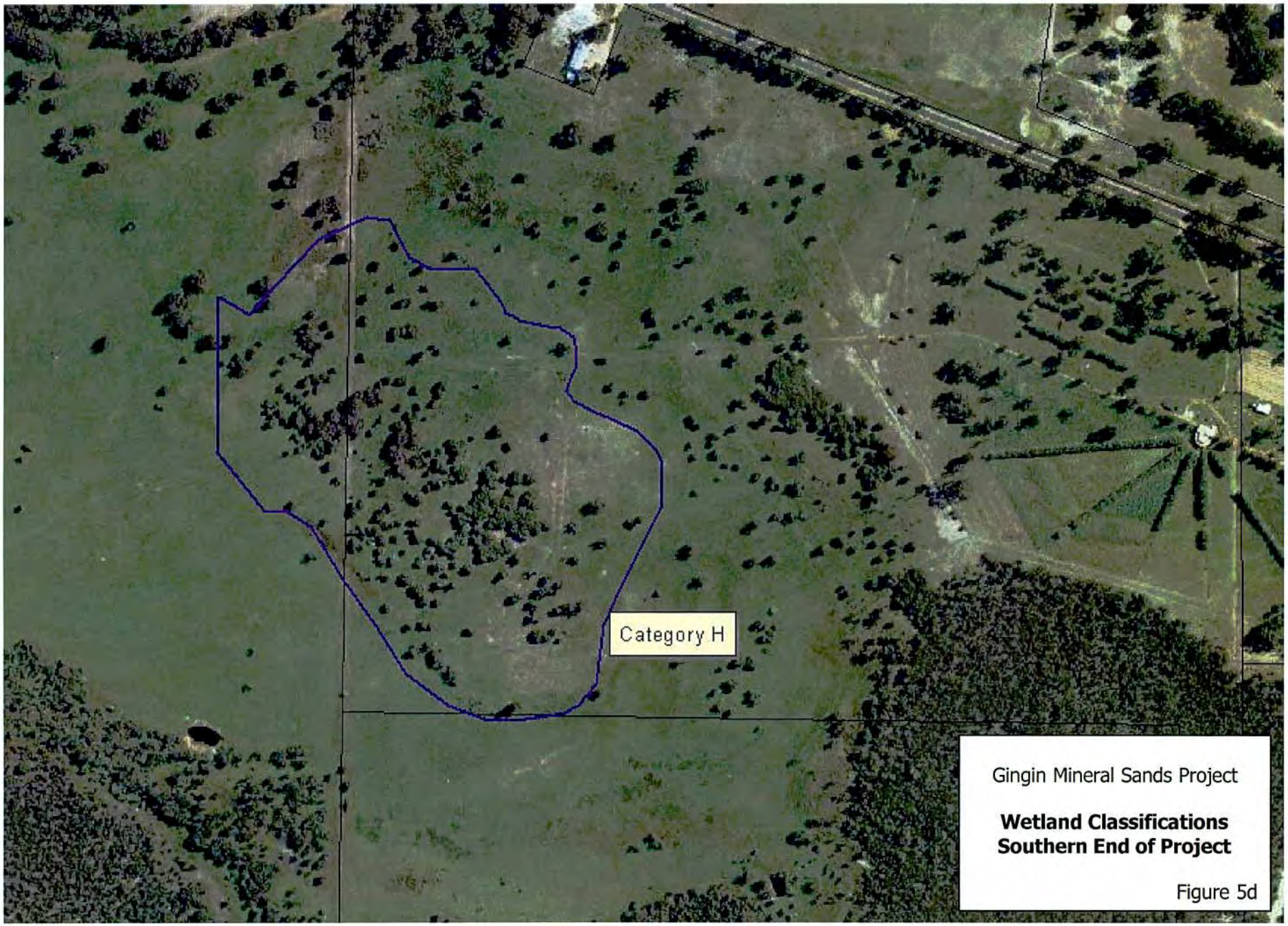
Wetland Classification

DRAWN:	L Sadler
DATE :	20 Jun 2004
SCALE:	1: 18000
REF :	s:\..\gingin.apr

Figure: **5a**


Category C
Category R
Gingin Mineral Sands Project
Wetland Classifications
Northern End of Project
Figure 5b


Category R
Gingin Mineral Sands Project
Wetland Classifications
Centre of Project
Figure 5c



Gingin Mineral Sands Project

Wetland Classifications
Southern End of Project

Figure 5d

2.8 Flora and Vegetation

Mattiske Consulting Pty Ltd undertook a flora and vegetation survey of the Project Area in September 2001. A report of this survey (Mattiske Consulting Pty Ltd, 2001) is summarised below.

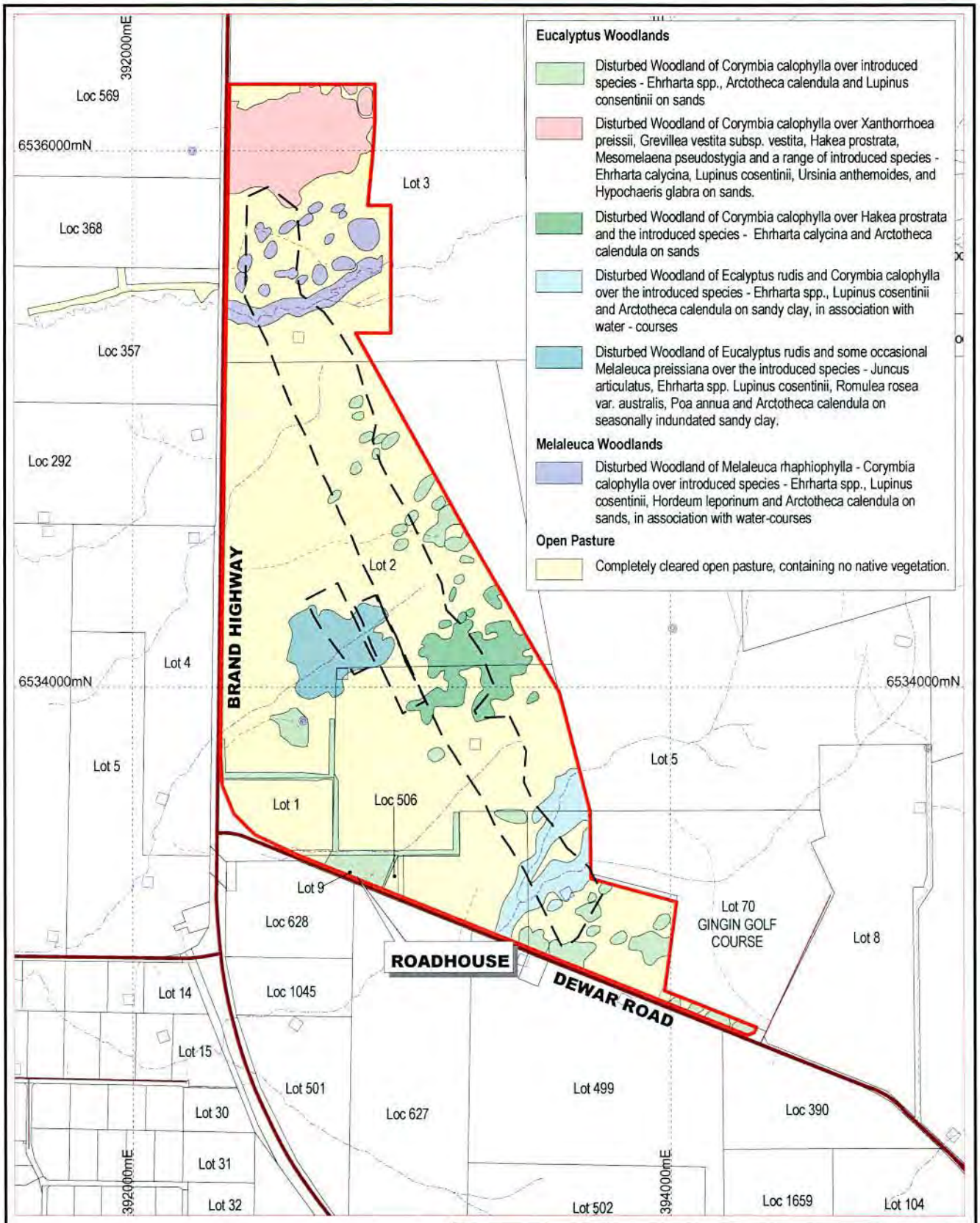
No Declared Rare or Priority Flora species, pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act* 1950 and listed by the Department of Conservation and Land Management (CALM) (2000), were located during the survey. No endangered or vulnerable species pursuant to s178 of the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) were located during the survey.

Five eucalypt woodland remnant communities and one melaleuca woodland remnant community were identified during the survey (Figure 6). The area has been largely cleared and grazed with only the occasional native tree and understorey species persisting within each community.

No Threatened Ecological Communities pursuant to Schedule 2 of the EPBC Act were located and none of the plant communities identified during the survey are classified as either regionally or locally significant.

None of the weed species identified during the survey are Declared Plants in the Gingin area. Two of the weed species found within the Project Area, *Solanum linneanum* (Apple of Sodom) and *Zantadeschia aethiopica* (Arum Lily), are classified as Declared Plants in southern areas of the State, but not in the vicinity of Gingin.

It is considered likely that *Phytophthora cinnamomi* (Jarrah dieback disease) is present in the Project Area, but the low number of native plants and the high density of weed species within the survey area limited any assessment of extent and severity. In view of the degree of disturbance of the vegetation, a more specific survey is unwarranted.



LEGEND

Pit Limits

Survey Boundary

This figure is to be read in conjunction with Mattiske Consulting Pty Ltd Report No. URS0106/88/01

N

0 500 1000 Meters

MGA Coordinates, GDA94

ILUKA

GINGIN DEPOSIT

VEGETATION

ORIG : URS	
DRAWN : S.P.	
SCALE : 1:20,000	
DATE : 27 April 2004	DWG No : 122177 ver.01

FIGURE : 6

2.9 Fauna

GHD Pty Ltd conducted a fauna survey of the Project Area in March 2004. A total of 20 bird species, no fish species, no amphibian species, five mammal species (in addition to livestock) and three reptile species were observed. No aquatic fauna was found in the creeklines surveyed.

No rare or priority fauna species were observed during the survey. The EPBC Act Protected Matters and CALM Databases listed the following rare and priority species for the general Gingin area, *Calyptorhynchus baudinii* (Baundin's Cockatoo), *Calyptorhynchus latirostris* (Carnaby's Cockatoo), both schedule 1 species and *Haliaeetus leucogaster* (White-bellied Sea-eagle), listed as vulnerable.

Although not observed, the Cockatoos may feed on Marri nuts in the Project Area on occasion, however given the degraded nature of the bush areas in the Project Area, they are more likely to be seen flying overhead, in search of more suitable feeding habitat. The White-bellied sea-eagle is not considered likely to be observed in the Project Area, as it is 40 km from the coast, the Sea-eagle's preferred habitat. None of the bird species identified in the Project Area are rare or priority species.

Four of the five mammal species observed were introduced species, the *Vulpes vulpes* (Red Fox), *Oryctolagus cunuculus* (European Rabbit), *Mus musculus* (House Mouse) and *Rattus norvegicus* (Brown Rat). The native mammal was the *Macropus fuliginous* (Western Grey Kangaroo).

The extensive clearing of the Project Area and its use for grazing has led to disjunct and degraded habitats. The lack of understorey leads to a reduced fauna presence. Rabbits, foxes, mice, rats, a gwardar (Western Brown snake) and skinks were all observed in the vicinity of derelict dwellings which provided shelter, although rabbits were also observed in the area of *Xanthorrhoea* vegetation in the east of the Project Area. The remaining vegetation was limited in habitat value. Potential bird and marsupial nesting sites were occupied by feral bees and while there were nectar resources present in the form of flowering Marri trees, there was a lack of understorey to provide shelter between Marri stands, limiting use of the resource to birds and feral bees.

There are no vegetation corridors on the site to provide a link between the plateau and the coastal plain. Better linkages are found along more heavily vegetated Brooks to the north and south of the Project Area.

The only fauna found in the north stream was two backswimmers and one diving beetle. One Brown Rat was observed in overhanging Melaleuca branches crossing the creek, however no birds were seen. Several decomposed livestock carcasses were observed along the creekline. Filamentous algae, Azolla and grass were found in the creek. No deep pools, which may have provided habitat for fish and amphibians, were found. A winter-wet dampland on the site may be utilised by winter feeder birds such as Ibis and some duck species, however the dampland is not considered a drought refuge to migratory birds during summer (GHD, 2004).

2.10 Social Environment

The Shire of Gingin is located approximately 84 km north of Perth and covers an area of 3,325 km^2. The townsites of Gingin, Guilderton, Seabird, Ledge Point and Lancelin occur within the Shire (Shire of Gingin, 2002).

The town of Gingin was constructed around a loop of the Gingin Brook in the 1830s. Today, Gingin is a busy agricultural town with a population of 473. The main industries in the district are viticulture, wheat, sheep, cattle and horticulture.

The nearest dwellings to the Project Area are shown on Figure 2 and comprise:

- a residence, roadhouse and caravan park located within Swan Location 973;
- a residence located within Location 569;
- a residence located within Lot 20;
- a residence located within Location 390
- a golf course located on Lot 70; and
- a panel beater's business and residence located approximately 200 m from the southern end of the deposit on Granville Town Lot 30, Dewar Road.

2.10.1 Land Use

The area of the proposed Gingin Project was cleared for grazing many years ago. Beef cattle production is the primary agricultural activity and shire zoning is compatible with the proposed mining activity.

Iluka currently leases its Gingin properties for grazing. Cattle and sheep grazing are also the primary land use on the Kitson property. Following the completion of mining Iluka propose to rehabilitate the land to its pre-mining composition and productivity. To determine this, Iluka commissioned John Wise Consultancy to independently assess and establish the pre-mining productivity levels of the rehabilitated pastures. The results of this study will be used as the baseline for the post rehabilitation assessment during closure planning.

2.10.2 Vehicular Traffic

The Project Area is located adjacent to the Brand Highway, which is a major road servicing northern Western Australia. A snapshot of data collected by Main Roads Western Australia (MRWA) during the period of 16 October to 22 October 2000 provides an indication of current vehicular movements on the Brand Highway adjacent to the Project Area. These data were collected at a location on the Brand Highway 16.3 km from the junction with the Great Northern Highway. The Monday to Sunday average daily volume of traffic during this period was 2,396 vehicles. A breakdown of vehicle usage of the Brand Highway during this period is shown in Table 5.

Table 5: Vehicle Usage of Brand Highway (16 – 22 October 2000)

Vehicle Class	Vehicle Description	Average Daily Usage
1	Short (sedan, wagon, 4WD, utility, light van, bicycle, motorbike etc)	1,696
2	2.Short – Towing (trailer, caravan, boat etc)	179
3	Two Axle Truck or Bus	112
4	Three Axle Truck or Bus	33
5	Four Axle Truck	6
6	Three Axle Articulated	13
7	Four Axle Articulated	27
8	Five Axle Articulated	35
9	Six Axle Articulated	85
10	B Double	41
11	Double Road Train	150
12	Triple Road Train	14

Source: MRWA, Perth.
Note: 1. Within Gingin Shire 16.3 km from the junction of Brand and Great Northern Highways.

2.10.3 Aboriginal Heritage

A desktop study was undertaken by McDonald, Hales and Associates in November 2001 to identify potential archaeological and ethnographic issues that may exist in the vicinity of the Project Area. This was followed by archaeological and ethnographic surveys. A report of the desktop study and surveys is summarised below.

Ethno historical evidence from the Gingin-Bindoon area and previous archaeological investigation in proximity to the present Project Area indicates that there is a high potential for further archaeological sites to be discovered, particularly in the vicinity of creeks in the north and south of the Project Area.

Archaeological Survey

The archaeological survey was undertaken in August 2002 by conducting a series of closely-spaced parallel pedestrian transects. Overall, an area of approximately 26.4 ha was inspected. Unfortunately, effective survey coverage was constrained by poor ground surface visibility and access difficulties (particularly across damper areas). However, the sampling is considered to be adequate for the size of the Project Area. No Aboriginal archaeological material was identified by survey within the Project Area.

Ethnographic Survey

The ethnographic survey was undertaken in September 2002 with seven members of the Yued native title claim working party and two Aboriginal consultants from the Bibbulmun Tribal Group who have associations with the survey area.

No ethnographic sites were identified by any of the Aboriginal consultants that would be impacted upon by Iluka's activities. The Yued native title claimants indicated that the Gingin area was of general spiritual significance but were unable to pinpoint any specific ethnographic sites. The consultants from the Bibbulmun Tribal Group expressed concern that mining activities may adversely impact upon the drainage system that traverses the mining area and requested that the native vegetation be retained or salvaged where possible.

2.10.4 European Heritage

European explorers and pioneers arrived in the area of Gingin in 1831, making it one of the earliest European-settled areas in Western Australia. The town retains some important remnants of its pioneering days dating back to the 1850s (Shire of Gingin, 2002).

One group of historical buildings was known to exist within the Project Area, namely the ruins of the Beauly's Farmhouse. This site was recorded on the Shire of Gingin's register of historic sites. Through a consultative process with the Shire of Gingin, Iluka has removed the remains of the farmhouse to the town of Gingin. The Shire of Gingin plans to incorporate the stones into a picnic area, which will include a plaque stating their historical significance and will form part of the town's historical walking trail.

3. PROJECT DESCRIPTION

3.1 Overview

The Gingin Project comprises:

- open-cut mining to a depth of 28 m;
- an in-pit feed hopper;
- feed conveyors;
- a centrally located screen plant;
- a 250 tph concentrator;
- HMC stockpiles;
- a process water dam;
- a return water dam;
- solar drying dams;
- site office, crib room and ablution block;
- potable water storage;
- weighbridge;
- monazite unloading facility;
- workshop and tool shed;
- parking area;
- mine access roads; and
- earthmoving contractors' area (parking and workshop).

Based on the use of an existing 250 tph concentrator, the Gingin Project is scheduled to operate for a total of 48 months, of which 7 months are allocated to site establishment and a further 41 months for mining. Rehabilitation will be undertaken progressively over the course of the Project, however it is expected that an additional three years of ongoing rehabilitation work will be required, post mining.

Mineralisation is known to continue to the north and south of the Gingin Deposit. These areas are a part of Iluka's exploration program, but are not developed sufficiently to be a part of this proposal.

The Project is scheduled to commence pre-production in January 2005 following receipt of relevant approvals. Commencement of the production phase is dependent on completion of mining at Iluka's North Capel West minesite. The proposed activity schedule for the Gingin Project is outlined in Table 6.

Concentrate from the Project will be transported by road transport to the Narngulu Processing Plant. Some material may be transported to Capel depending on plant throughput requirements. No changes to the mill operations or environmental management will be required to accommodate HMC from the Gingin Project.

Table 6: Proposed Activity Schedule for the Gingin Project

Activity	Timing
Pre-production	January 2005 – April 2005
Production	May 2005 – July 2008
Phased Rehabilitation of site	August 2008 – December 2013

3.2 Mining Operations

3.2.1 Mine Plan

Mining of the Gingin Deposit is planned to commence at the southern end of the deposit within Iluka property moving southwards onto Kitson's property before advancing in a northerly direction. This south to north development is advantageous as it will allow:

- progressive rehabilitation;
- creation of solar drying dam space (backfilling to follow mining);
- the return of the Kitson Property to pre-mining contours;
- orderly development of the deposit;
- temporary diversion and subsequent mining through of the two watercourses, including the North Stream, to occur during the summer months.

There will be no internal concentrator or screen plant relocation required during the mine life. The in-pit feed hopper will be relocated several times as mining progresses.

3.2.2 Site Preparation

Site clearing will be minimal, but the clearing of any saleable timber will precede general clearing activities. Subsequent clearing will be carried out using a dozer and a front-end loader. The vegetation will be mulched where appropriate, or stockpiled for use in rehabilitation.

Topsoil characteristics and depth have been surveyed and the results of the survey are presented in the Pre-mining Soil Survey, Characterisation and Management Report prepared by Oracle Soil and Land Pty Ltd (2002).

The overburden ranges from 2 m to a maximum of 20 m in depth with an average thickness of approximately 8 m. It is planned to remove the overburden by truck and excavator, and to place it directly over the sand tailings in the mining void where possible. Overburden that cannot be directly placed in the void will be stockpiled for replacement during progressive rehabilitation.

Overburden will be replaced in accordance with the recommendations of the Pre-mining Soil Survey, Characterisation and Management Report.

Overburden removed during pre-production will be used to create pads for plant infrastructure, dams, roads and visual barriers. The main access road from the site to Brand Highway will be bituminised.

3.2.3 Mining Method

Dry mining techniques will be utilised at the Gingin Project. The likely ore mining method will be scrapers feeding a drive-over feed hopper located on the floor of the mining pit. In areas containing rock, a truck and shovel fleet may be utilised.

Exploration drilling has indicated areas of induration in the ore zone that may require ripping prior to removal. Mining investigations conducted as part of the PFS have shown that this material can be removed without blasting.

Ore from the feed hopper will be transferred via conveyor out of the pit to a screening plant located on the surface at the mid-point of the orebody. The screen plant will separate ore particles of less than 2 mm in size from oversize material, and the fine material will be pumped to the wet concentrator. Any oversize product from the screening plant will be used for construction of internal roads or placed directly back into the mined-out pits.

The mining area will transect two watercourses, the North and South streams that traverse the northern and southern limits of the proposed pit. Both the North and South streams will be temporarily diverted to facilitate mining. Mining will also cross the wetland areas and small streams in the central Project Area. The central wetland is interpreted to be predominantly sustained by baseflow from the local shallow aquifer systems. This local wetland system will be disturbed by mining activities.

The mining area will be dewatered via a sump located on the pit floor. A mobile electrical installation will be installed at the sump, and pit water will be pumped back to the process water dam for use in the production process.

3.2.4 Pit Design

A geotechnical investigation into the proposed mining void design has been conducted. This investigation included a desktop study and confirmation of predictions from a test pit excavated to the top of the ore zone at Gingin.

The proposed pit limits resulting from that study are shown on Figure 3 and are based on the criteria outlined in Table 7.

Table 7: Criteria for Proposed Pit Limits

Item	Criterion
Maximum Mining Depth	28 m
Batter Angle	34 degrees
Surface Area of Pits	80 ha
Volume of Ore	4.5 M bcm
Volume of Overburden	5.7 M bcm

3.2.5 Ore Processing

Ore mined at Gingin will be processed through a standard Iluka design wet concentrator consisting of a five-stage spiral circuit.

Processing of ore from the Gingin Project will utilise equipment relocated from an existing Iluka southwest mining operation. The processing operation will not change from that currently practised.

Following the mining and feed preparation stages described in Section 3.2.3, ore is separated using standard gravity separation techniques utilising a five-stage spiral circuit concentrator. The concentrator produces HMC, a sand tail and a clay fraction tail. The concentration process does not involve the use of any chemicals, however a non-toxic flocculent is added to the clay fines after separation to aid in densification. Tailings disposal is discussed in Sections 3.2.6 and 3.2.7.

HMC will be stockpiled, dewatered and air-dried adjacent to the wet concentrator before being transported to the Narngulu Processing Plant in Geraldton. Depending upon the quality of the HMC and requirements of the processing plants, some material may be transported to the Capel Processing Plant.

A schematic diagram of the mining and processing operations is shown as Figure 7.

3.2.6 Sand Tailings Disposal

The sand tailings produced from the concentrating process consist of reject sand and water. Tailings will be pumped via polyethylene pipes to the in-pit disposal area and dewatered using dewatering cyclones. The underflow from the dewatering cyclones consists of sand at approximately 70% solids and will be pumped directly into the mined-out pits. The overflow is returned to the process water dam for re-use in the concentration process.

3.2.7 Clay Disposal

Clay fines from the concentrator will be pumped to a thickener for flocculation and then pumped to solar drying dams. When dried, clay fines will be removed by scrapers and used as a soil conditioner in the rehabilitation process. Decanted water from the solar drying dams will be drained back to the process water dam for re-use. Solar drying dams are considered the most appropriate method of clay fines disposal due to the clay content of the orebody, size of the orebody and size of the lease area.

A total of 170 ha of solar drying dams will be required to contain the estimated 1.53 million tonnes of clay fines likely to be produced by the 250 tph concentrator over the life of the Project. A total of 103 ha of space specifically cleared for solar drying dams will be required. The remainder of the drying dams will be located on the mining area. Where possible, dams will be used more than once to minimise the amount of clearing required.

3.2.8 Transport Corridors

Several possible site access roads were considered in consultation with the landowners, Main Roads WA and the Gingin Shire. The most suitable access was considered to be off Brand Highway. This is based on safety, visual, noise, environmental and economic analysis.

The new intersection requires widening of the Brand Highway for the inclusion of safety slip lanes and lighting. Main Roads WA has been consulted regarding the road upgrades.

The haulage route for HMC road trains is proposed to occur off the site access road, onto the Brand Highway to Narngulu industrial site in Geraldton (Figure 8). There is the potential for some HMC to be transported to Capel, dependant upon quality requirements in each processing plant.

At estimated production rates, it is anticipated that there will be up to 12 return journeys per day leaving the site over the life of the Project. The trucks proposed to be used for transporting HMC will be rigid trucks with two six axle trailers or similar.

3.2.9 Support Infrastructure

Support infrastructure that will be developed specifically for the Gingin Project includes:

- mine access roads;
- pads and footings for the concentrator, feed preparation plant, thickener, workshop and weighbridge;
- in-pit hopper;
- overland conveyor;
- screen plant;
- electrical substations and pumps;
- site office;
- cribroom;
- ablution block and change room;
- workshop;
- process water dams including licensed discharge point (if required);
- intra-site electrical reticulation;
- visual and noise screens;
- employee parking area; and
- earthmoving contractor's area (for parking and maintenance).

Some of the required infrastructure will be relocated from the previous minesite. The equipment to be relocated will include the concentrator and HMC and tails stackers. The development of access roads and power supply will be progressive with mining. To meet the clay handling requirements of the Project, a new transportable thickener will be constructed on site.

Process water for the operation will be sourced from the test production bore developed into the Yarragadee Formation. The bore is located in the southwest corner of Lot 2 (Figure 4).

No on-site accommodation is required.

3.2.10 Resource Requirements

Water

Water demands will vary during different phases of the Project. An indicative project schedule and forecast water demands are presented in Table 8.

Table 8: Indicative Annual Water Demands

Project Phase	Forecast Water Demand (kL)						
	2005	2006	2007	2008	2009	2010	2011
Establishment	250,000						
Mining and Processing	1,850,000	2,100,000	2,100,000	525,000			
Rehabilitation				47,000	62,000	62,000	62,000

The majority of the process water supply will be sourced from production bore GYP1, which is located near the southwestern limit of the project area (Figure 4). This bore is designed to yield 1.5 GL/yr from the Yarragadee Formation and was installed in March 2002 under the terms and conditions of the DoE-issued exploratory Groundwater Well Licence Number 110547, which expired on 30 April 2002.

Subsequent to revision of project water demands by Iluka throughout the PFS stage, completion of the project hydrogeological investigations (URS 2002a,b) and the requirements of the DoE as outlined in exploratory GWL No. 110547, URS re-submitted GWL applications (11 September 2002). These revised applications are for 1.0 GL/yr from the Superficial Aquifer and 1.5 GL/yr from the Yarragadee Formation and effectively supersede the pre-existing applications. The DoE advised that the Department and the Gingin Water Resources Advisory Committee have considered the applications and that they required Iluka to conduct a regional bore census prior to granting of the licences. A further bore census was undertaken between September and October 2003 (URS, 2003b). Additional information was supplied to the DoE as requested.

Dewatering abstractions from shallow production bores and mine sumps will be used as a preferential process water supply throughout the mining phase. Based on shallow groundwater investigations and groundwater flow modelling (URS, 2002b), annual dewatering abstractions from the superficial formations are expected to range from about 0.3 to 0.9 GL. Dewatering abstractions includes sands tails water, rainfall and surface water run-off from disturbed areas collected in the mining void.

It is proposed that water suitable for drinking will be transported to site and stored in a potable water supply tank. Alternatively bottled water may be utilised.

Power

Electrical power requirements for the entire site are expected to be approximately 4 Mega Watt (MW) at 22 kilo volts (kV). Electricity will be supplied from the Western Power electricity grid.

Fuel

Diesel fuel for machinery, vehicles and plant will be trucked to the site. As is current practice at other Iluka minesites, it will be stored in approved containment vessels and surrounded with an appropriate bund wall built to required standards.

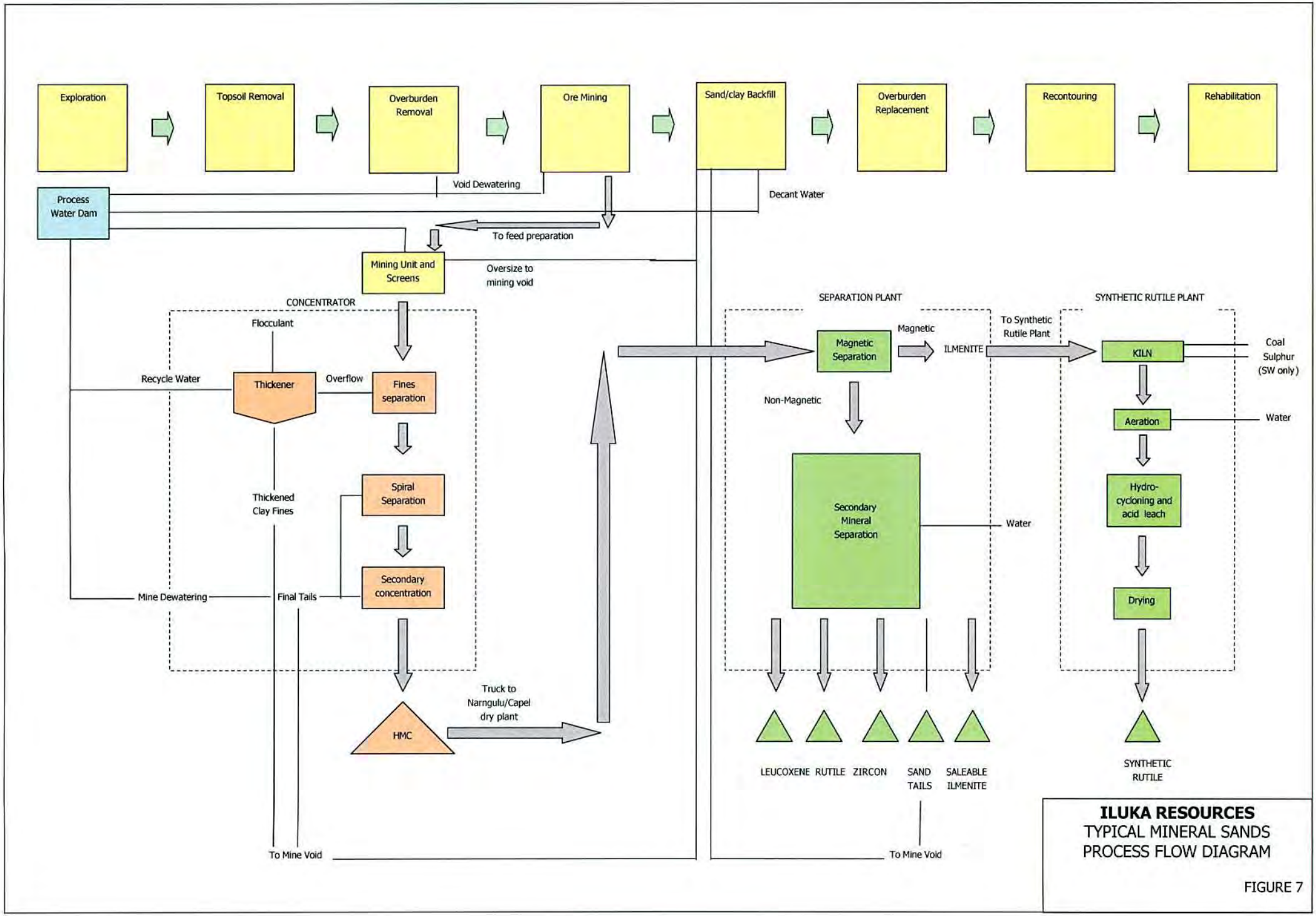
3.2.11 Workforce

A total of approximately 60 employees, including Iluka personnel and contractors, will operate the Gingin minesite. Personnel will be sourced from existing Iluka operations where possible. In the event that recruitment of additional personnel is required. Iluka will advertise in local papers and The West Australian to encourage local people to apply.

Employees will be encouraged to source their own accommodation on the region. No accommodation will be supplied by Iluka.

3.2.12 Hours of Operation

The proposed Project will operate twenty-four hours per day, seven days per week. Where possible ore mining will be undertaken on a continuous 24 hours per day, seven days a week basis. Noise modelling has shown that in certain weather conditions and operational setups mining will need to be restricted to comply with the noise regulations. This will be achieved through noise reduction measures as outlined in Section 5.10.



ILUKA RESOURCES
TYPICAL MINERAL SANDS
PROCESS FLOW DIAGRAM

FIGURE 7


Geraldton
Narngulu
DONGARA
ENEABBA
LEEMAN
Brand
JURIEN
Indian
Ocean
DANDARAGAN
CATABY
Highway
LANCELIN
Gingin mine site
GINGIN
MUCHEA
PERTH
Map
Area
Perth
Location Diagram
The transport route between Gingin and Narngulu follows:
From Gingin along:
Brand Highway
Rudds Gully Road
Goulds Road
to Narngulu
approx ~ 320km
Legend
Transport routes
Roads - Primary
Roads - Secondary
N
0
50
100km
ILUKA
ORIG : L.Sadler
DRAWN : D.G.S.
SCALE : 1:2,000,000
DATE : 6 Nov. 2003
GINGIN - NARNGULU
TRANSPORT ROUTE
DWG No : 124569 ver.00
FIGURE : 8

4. COMMUNITY CONSULTATION

4.1 Objective

In Western Australia the environmental approvals process is a public process, whereby the Proponent is expected to consult with the public and government agencies to ensure that the most current information about local issues and concerns is used in the environmental and social impact assessment of the proposed project.

As a signatory to the Code for Environmental Management, Iluka has committed to:

- Integration of environmental, social and economic considerations into decision-making and management, consistent with the objectives of sustainable development.
- Openness, transparency and improved accountability through public environmental reporting and engagement with the community.

The objective of the consultation program conducted during the preparation of this document was to allow all individuals, groups and agencies that will potentially be affected by the proposal to have their interests considered during the environmental impact assessment process. This will ensure that issues raised are addressed adequately both in this environmental review and following the implementation of the proposal.

4.2 Consultation Program

The Gingin Strategic Community Relations Plan was developed and implemented by Iluka to ensure that an open dialogue between the company and residents was developed and maintained, and to engage the local Gingin community in all aspects of the mine approval process and ongoing management of the operation.

The objectives of the Plan are to:

- identify key stakeholders within the Gingin community;
- consult with the Gingin community and external stakeholders to ensure that all issues and concerns are managed throughout the life of mine;
- continually develop a targeted communication strategy that ensures Iluka's access to mining the Gingin deposit; and
- add value to the Gingin community throughout the life of mine.

The consultation program conducted during the preparation of the Environmental Referral comprised the following phases:

- identify stakeholders;
- disseminate information and identification of stakeholder issues;
- collect feedback from stakeholders; and
- respond to the stakeholder issues.

Stakeholders for the Project have been identified as community members in the immediate surrounds of the Project, people within the Gingin Shire, special interest groups and decision-making authorities. Table 9 lists the stakeholders consulted during the preparation of this document.

Table 9: List of Stakeholders

Stakeholder Group	Specific Stakeholders
Community Members	Landowner in Project Area (Kitson Estate)
	Landowners, Residents and Business Owners adjacent to Project Area
	Gingin Shire Residents and Business Owners
Community and Industry Organisations and Groups	Yued Native Title Claimants
	Gingin District High School
	Tiwest Joint Venture
	Frogmore Progress Association
	Gingin Land Conservation District Committee (LCDC)
	Conservation Council of WA
	Wildflower Society
	Marine and Coastal Community Network
Government Agencies	Environmental Protection Authority (EPA)
	Department of Environment (DoE)
	Department of Industry and Resources (DoIR)
	Gingin Shire
	Department of Agriculture (DoA)
	Main Roads Western Australia (MRWA)

Methods used by Iluka to disseminate information to the community and identify key issues regarding the Gingin Project involved the following consultation mechanisms.

All Stakeholders

Two Community Updates have been distributed to all residents within the Gingin Shire and to other non-local stakeholders. These provide an update of the mine planning, approvals process and Iluka's operations.

Landowners adjacent to the Project Area

Several meetings and ongoing discussions on key issues such as dust, noise and groundwater have been held with individual landowners. Landowners were invited on a site tour of the Capel operations.

Gingin Community

In addition to the community update, Iluka provides input to community news and publications. This has included a stall at the Gingin Expo in 2003. Through its community sponsorship program Iluka has provided sponsorship for community events and developments.

Yued Native Title Claimants

The native title claimants were involved in the archaeological and ethnographic studies conducted in 2002. Ongoing discussions are being held with these claimants informing them of the project development.

Gingin District High School

Discussions have been held with representatives of the Gingin District High School.

Tiwest Joint Venture

As Tiwest is a mineral sands company operating in close proximity to the Gingin Project, Iluka has regular discussions with Tiwest to keep them informed of the status of the Gingin Project.

Frogmore Progress Association

A meeting was held with Frogmore Progress Association in March 2004 to update the group on the Gingin Project. Many of the landowners had been visited previously during the bore census.

Gingin Land Conservation District Committee

Iluka has had several discussions with members of the Gingin LCDC. Iluka has been invited to present at the next LCDC meeting in June 2004.

Conservation Council of WA

A meeting was held in April 2004 with the Conservation Council of WA and a summary of the Gingin operations presented.

Wildflower Society and Marine and Coastal Community Network

The Wildflower Society and Marine and Coastal Community Network groups responded to the advertisement in The West Australian advertising the EPS level of assessment. A letter was sent to both groups with copies of the community updates and a question and answer sheet on the Gingin Project. Both groups have been added to the distribution list for future updates.

EPA, DoE, CALM, DoIR, DoA, Gingin Shire, MRWA

Discussions, meetings, correspondence and site visits have been conducted with the key decision making authorities for the Gingin Project.

Table 10 summarises the issues raised by and discussed with the stakeholders consulted by Iluka.

Table 10: Summary of Stakeholder Issues

Issues Raised	Response
Community Members	
Enquiries regarding the need for accommodation for workers	At the time of this issue being raised, Iluka has not made any decisions on accommodation requirements for the proposed Gingin mine site. Since then, it has been decided that no accommodation will be supplied by Iluka and that employees will be encouraged to source their own accommodation.
Queried if the EPA would be setting limits for Iluka in regards to dust, noise etc. as they do at other mine sites	Iluka would be subject to certain limits as set out in licences issued by the EPA. The company is required to apply for licences before mining commences and will be required to report against these licences.
Will there be employment opportunities for local residents.	Iluka advertises all vacant positions and locals will be encouraged to apply. All applicants will be required to meet the selection criteria before being considered for any position.
Concerns in regards to advertisment for water licence.	Iluka is required to advertise their intention of applying for a water licence and will be required to undertake studies to show the company can manage any water issues that may arise.
Concern about noise impacts on cattle.	It was explained that Iluka has been mining in the SW for over 40 years and close to dairy farms; the company has not experienced any concerns regarding noise effects on cattle. Noise limits will need to be adhered to by Iluka and these are set out by the EPA.
Concerns about impacts on water supply when mining commences	Iluka has undertaken studies in regards to water impacts and conducted a bore census of nearby landholders. The information provides an indication of the worst case potential impact on nearby landholders. Discussions have been held with these landholders and an operating strategy and water resources management plan put in place to manage the issues.
Concerns about the effect on the natural spring.	It is believed that there would be no impact on the natural spring due to its position.
Queried if Iluka would be continuing the tree belt along the boundary of Kitson property & the Golf course, due to the state of the current fencing and to stop stock entering the Golf Course.	Advised that it was not Iluka's intention to continue the tree belt. There will be a bund wall erected along this boundary and fencing and shade cloth placed on top of the bund wall.
Concern regarding trees in tree belt on Brand Highway growing into powerlines	Contact made with Western Power to have trees lopped.
Concerns regarding noise.	Iluka undertakes noise modelling to determine the proposed noise levels for the site. This allows Iluka to minimise noise impacts and address issues. The company must adhere to noise regulations set by DoE. Bund walls will be erected, concentrator will be insulated, earth-moving machinery will be modified to reduce noise significantly. A noise management plan has been prepared to address these issues. Advised that community members talk to Shire councillors who visited the Stratham West site in Capel to discuss their experience of the noise from that minesite. Results from noise modelling were discussed with relevant landholders.

Issues Raised	Response
Concerns regarding dust from the mining operation.	Explained Iluka's dust management plan and work that has been undertaken at other sites to manage dust. This includes: water trucks running through out the day, roads being sprayed down with a bonding agent, earth moving machinery to cease work in extreme conditions, bund walls being covered in grass or environmentally friendly glue type substance to form a crust, this technique is also used in other open areas that the company does not need to drive onto. Iluka must also adhere to licence conditions set out by the DoE. A dust-monitoring program will be set up on site and results reported to the DoE.
Concerned about the value of property once mining commences.	Explained that the mining would only be for a short period of 3 years.
Queried if Iluka would be interested in running programs at the local school.	Advised that Iluka has supported schools in other towns where we operate and like to get the schools involved in projects such as tree planting etc. and also undertaking tours for the schools.
Concern about 24 hours 7 day per week operation.	Explained that 24 hours 7 days per week is our standard operating hours but can be subject to modification depending on noise modelling. It was explained that due to noise constraints, Iluka might not operate some heavy earth moving machinery during night time hours and in certain weather conditions. This issue has also been addressed in community updates.
Concern about Iluka having a stack from their operation.	It was explained that Iluka would not have a stack coming from Gingin Project. The process utilised is wet concentration, which uses water to separate the heavy mineral from the sand. The sand is then returned to the pit and the water is recycled. Further information on Iluka's activites and operations was provided to the community member.
Concern regarding the donation to the Gingin Aquatic Club was to convince the community to accept the proposed project.	Advised that it was not Iluka's intention. Iluka supports many projects in the communities in which it operates and was approached by the committee for funding.
Contact made with Iluka about using offices at the Gingin Business Centre.	Advised that Iluka would normally have offices on site.
Concern regarding salinity and effects of mining on these levels for users in the Frogmore LIA	Advised that it would be unlikely that the salinity levels would be affected by mining. It was explained that Iluka has many piezometers and monitoring bores around the site that are monitored regularly and any affects would be noticed from this monitoring.
Concern about truck movements and why the company was not using rail.	Advised that Iluka was not using rail due to the cost and also the fact that there is nowhere for Iluka to load trains. The rail line also does not go up the Brand Highway. It would be a significant cost for Iluka to set up a station and truck the mineral to that point, as the company would then probably have to put in bins etc. to store the mineral. The cost of something that substantial may make the project unviable.
Queried why Iluka would not be processing mineral at the Muchea processing plant.	Advised that the processing plant at Muchea is owned by Tiwest, a different mineral sand company.
Concerned about the cumulative effects of extra trucks on the Brand Highway and there being nowhere to overtake, especially during winter.	Advised that our truck movements would be minimal, approximately 12 trucks per day.

Issues Raised	Response
Expressed concerns about mining of the blocks and that they were beautiful and that the company would never get them back to what they were.	Explained that over the years the company has had a very good success rate of rehabilitating the land. Iluka has had excellent results and agricultural land that has been rehabilitated at other mine sites has often returned better productivity post mining.
Community and Industry Groups	
Concern that mining activities may detrimentally impact upon the drainage system that runs through the mining area.	Iluka will schedule mining of the deposit to minimise its impact on the site drainage system and will also provide the concerned party with the relevant environmental information to alleviate their concerns.
Request that the native vegetation be retained or salvaged where possible	Iluka will minimise its impact on native vegetation on the site and, where viable, will salvage timber. Iluka will also provide the concerned party with the relevant environmental information to alleviate their concerns.
Increase in student numbers at Gingin District High School.	Iluka has advised that mining is not expected to commence until December 2004; this would not affect school numbers until the 2005 school year. Iluka will advise the school of any changes to this schedule.
Concern regarding groundwater drawdown on the users in Frogmore LIA	Advised that groundwater drawdown impacts are not anticipated to reach the Frogmore LIA. Explained that bore would be monitored within Frogmore LIA and results presented to the residents bi-annually.
Suggested liaison with LCDC group during rehabilitation of the watercourses.	Iluka proposes to keep the Gingin LCDC informed of the Gingin Project and involve the group during rehabilitation of the watercourses.
Suggested requesting formally naming the streams through the project area.	Iluka will approach the Gingin Shire and the Geographe Names Committee regarding the identification and naming of the watercourses.
Expressed concern regarding mining under the watercourses and suggested not mining areas under these areas.	Iluka believes these areas can be mined without compromising the long-term environmental values of the watercourses. Following mining improvements will be made to the recreated watercourses that increases the biodiversity, flora and condition of the watercourse.

4.3 Ongoing Consultation

Iluka will continue to liaise closely with local and state authorities and the local community during the construction and operation of the Project and will continue to implement a consultation program that includes regular meetings with landowners in proximity to the mine, and community consultations as issues arise.

The consultation program following the submission of this Environmental Referral will involve:

- ongoing liaison with the DoE;
- ongoing liaison with surrounding residents;
- conducting open days for the local public;
- meetings with the Gingin community if required;
- meetings with councillors and staff of the Gingin Shire;
- provision of information on the Project to the Iluka workforce; and
- dissemination of information through community newspapers in the region.

5. ENVIRONMENTAL IMPACTS AND MANAGEMENT

5.1 Area of Disturbance

The total area of disturbance will be approximately 280 ha. A breakdown of the clearing is shown in Table 11. Of the 280 ha, 8.1 ha were classified as native vegetation by the Department of Agriculture. Where possible, solar drying dams are located on backfilled mine voids to minimise the amount of disturbance required.

Table 11: Disturbance Requirements

Description	Area (hectares)
PITS Includes pits, roads, noise bunds, stream diversions, stockpiles.	140 ha
SOLAR DRYING DAMS Includes 64 ha located on mine pits.	170 ha minus 64 ha cleared for pits = 103 ha
INFRASTRUCTURE Includes concentrator area, pipelines, process water dam, return water dam, screenplant, conveyor, miscellaneous infrastructure.	30 ha
TOTAL DISTURBANCE	**280 ha**

As an area of greater than one hectare of native vegetation will be cleared as a result of the development of the Gingin deposit and the proposed clearing will result in a change in land use, a Notice of Intent to Clear Land was submitted to the Commissioner of Soil and Land Conservation at the Department of Agriculture. The application was reviewed by the Department and a land degradation report prepared and submitted to the Commissioner of Soil and Land Conservation. A letter of approval was received from the Commissioner on 29 April 2004. The letter included advice from the DoE and CALM. This is addressed in Table 12.

Table 12: Advice on Clearing Approval

Advice	Iluka Response
The area has <30% vegetation types. Clearing may have irreversible consequences for conservation of biodiversity and is therefore not supported.	The vegetation and flora survey identified that the site vegetation was in poor condition and contained a low number of native plants and high density of weeds. None of the vegetation is fenced from livestock and generally only overstorey species remain. 8.1 ha of vegetation will be cleared for mining. Rehabilitation will include 12 ha of native vegetation. This vegetation will be fenced from livestock and include understorey species. The rehabilitation programs will enhance the biodiversity of the Project Area in the long-term.
The proposal is within the Gingin Groundwater Area and therefore a license may be required to extract groundwater.	An application has been made for groundwater licences for dewatering of the superficial aquifer and water abstraction from the Yarragadee Aquifer. Refer to Section 5.5.

Advice	Iluka Response
All riparian vegetation should be maintained.	Riparian vegetation along the North and South Streams will be diverted and the current watercourse cleared to allow mining. This vegetation is highly degraded and is grazed by cattle and sheep. Following mining the streams will be aligned along the original watercourse and revegetated. The recreated streams will include high and low flow channels, meanders and riparian vegetation. The streams will be fenced to exclude stock. Stock crossings and watering points will be established. Advice will be sought from the Gingin LCDC and the DoE in the recreation of the watercourses. The rehabilitated watercourses will improve the riparian vegetation along the streams in the Project Area in the long-term.
The Project will impact on two conservation category wetlands.	These wetlands have been reclassified to resource enhancement category wetlands. Iluka has committed to restoring the wetlands and rehabilitating native vegetation. Iluka has also committed to restoring 1 km of North stream upstream of the mining operation on Iluka land. In addition, Iluka has committed to developing a revegetation scheme to support catchment landcare and watercourse improvement programs. These measures will improve on biodiversity of the area and improve the condition of vegetation in the catchment.
The risk of acid sulfate soils.	The risk of acid sulfate soils has been addressed. There were no acid sulfate soils identified. An area of natural high acidity was identified. A management plan will be put in place to manage this material during mining. Refer to Section 5.6.
Impact of groundwater drawdown on nearby users and wetlands.	Impacts on groundwater users and wetlands have been identified. Make-up water options have been developed in consultation with stakeholders. Vegetation will be monitored using photo points. Refer to Section 5.5.
Suggest that offsets are established for areas equal to or greater than the area proposed to be cleared using local provenance plant species.	8.1 ha of native vegetation will be cleared. 12 ha of native vegetation will be re-established in rehabilitation. Local provenance plant species will be utilised. A further offset will include the revegetation scheme to support catchment landcare and watercourse improvement programs.

CALM concluded that "the current landuse (grazing by sheep and cattle) if continued, will further contribute to the degradation of the watercourses and remaining vegetation within the property. The proposed revegetation, fencing and river restoration after mining is a positive outcome for the property".

Millable and firewood timber will be removed from site for use. A proportion of the vegetation cleared during the Project development will be stockpiled for use in rehabilitation. Grasstrees will be salvaged where possible. Prior to site establishment a vegetation management plan will be developed to ensure that the clearing of native vegetation is minimised by the placement of infrastructure and disturbance in areas of least native vegetation disturbance.

Commitments

1. Prepare Vegetation and Fauna Management Plan that includes:
   - Minimisation of impacts on native vegetation.
   - Delineation of areas of vegetation to be retained or cleared.
   - Retention of topsoil for future use in rehabilitation.
   - Dieback and weed control for equipment leaving site.
   - Photo monitoring of vegetation downstream on North Stream.
   - Inspection of tailings dams for trapped animals.
2. Implement Vegetation and Fauna Management Plan.

5.2 Flora and Vegetation

As a low number of native species and a high density of introduced species occur within the Project Area, impacts on native vegetation due to the implementation of the Project will be minimal and localised. The Corymbia woodland that occurs in the north of the Project Area will not be disturbed by mining activities.

Phytophthora cinnamomi (Jarrah dieback disease) is more than likely present in the soil and there is a high density of weed species in the Project Area. There is a very limited opportunity for dieback or weeds to have any more of an adverse effect (Mattiske Consulting Pty Ltd, 2001). Therefore vehicle hygiene procedures to limit the spread of dieback and introduced species within the Project Area are not warranted. However, machinery at the site will be thoroughly washed down prior to being transported to any areas in Western Australia susceptible to dieback, but where the fungus is not already known to be present. Likewise, machinery will be thoroughly washed down prior to transportation to any areas in Western Australia where the weed species present in the Project Area are declared elsewhere in the State. *Solanum linneanum* is a Declared Plant in the District of Jerramungup and in the Albany, Busselton, Manjimup and Harvey regions; *Zantadeschia aethiopica* is a Declared Plant in the Albany, Busselton, Manjimup and Harvey Regions.

Most of the vegetation disturbed by the Project will be introduced pasture species established for grazing. Iluka will undertake rehabilitation of disturbed areas to achieve a similar or greater productivity than currently exists in these areas.

The Project will be designed, constructed and operated to minimise the impacts on remnant vegetation by:

- avoiding clearing of native vegetation where possible, particularly of large trees;
- defining the area to be cleared on maps and supervising clearing activities;
- confining temporary work areas to previously disturbed areas, where practicable;
- parking vehicles and machinery in designated areas;
- liaising with the Department of Agriculture regarding the management of *Solanum linneanum* (Apple of Sodom) and *Zantadeschia aethiopica* (Arum Lily);
- ensuring that dust control measures are implemented;

- retaining topsoil, root stock and cleared vegetation in designated areas for use in rehabilitation;
- progressively rehabilitating and monitoring disturbed areas with native vegetation where appropriate; and
- raising the awareness of the workforce about conservation issues through environmental awareness training.

Areas of pasture will be returned to a similar or greater productivity level than exists at the site at present by:

- re-creating the soil profile through the return of topsoil and subsoil to disturbed areas;
- adding clay fines to the subsoil to improve soil fertility and moisture retention;
- implementing seeding, fertilising and weed control farming practices as appropriate; and
- conducting productivity monitoring to assess the success of rehabilitation.

Commitments

See previous commitments under Section 5.1.

5.3 Fauna

Due to the lack of fauna habitat and the existing high degree of disturbance in the Project Area, minimal impacts on fauna are expected due to the Project.

To manage the presence of any fauna accessing the site, the following management strategies will be employed:

- no firearms will be kept on site;
- no domestic pets will be allowed on site; and
- tailings dams will be routinely checked for the presence of any animals trapped within the sediment.

Commitments

See previous commitments under Section 5.1.

5.4 Surface Hydrology

5.4.1 Stream Diversions

The orebody extends over two watercourses. Iluka believes mining of these areas can be achieved without compromising the long-term beneficial values of the watercourses. URS has prepared a report (URS, 2003a), detailing the proposed temporary diversion of the North and South watercourses. It is proposed to sequence mining through the northern and southern watercourse features during the summer period, thereby allowing these features to be re-established prior to the onset of the subsequent winter period and enabling the conservation of baseline streamflows. Surface water quality is unlikely to be affected significantly by the proposed diversions.

The North and South stream diversions will be constructed and vegetated to minimise erosion and preserve streamflow resources. The area and hydrologic characteristics of the resulting diversion catchments is similar to the existing stream catchment and should not increase flows or change the hydrologic characteristics of the streams downstream. The diversion channels are trapezoidal in shape and have been designed to contain a 1 in 50 year rainfall event. The diversions will be constructed sequentially with the mining operations. The first stage will be to develop a drainage channel along the eastern side of the pit. This will divert overland flow into the South and North stream diversions. The south stream diversion will be created first and direct waterflow around the edge of the mining area and return to the original watercourse at the Dewar Road crossing (Figure 9). The north stream diversion will be created as mining advances to the north. Flow will be diverted around the edge of the mining area and return to the original watercourse at the Brand Highway crossing (Figure 10). The diversion channels will be stabilised with existing pastoral species and/or geotextile fabrics where needed to minimise the potential for erosion.

The North and South streams immediately downstream of the mine area support degraded riparian vegetation. This vegetation is likely to rely on streamflow and groundwater baseflow to sustain current ecological functions. The catchment areas for the North and South streams will remain about the same, and hence flow regimes will not be significantly changed during the diversion. Modelling shows that predicted monthly flows for the North and South streams are similar before and during mining, while predicted runoff hydrographs for a 50-year, 90-minute recurrence storm before and during mining are also similar.

Erosion currently present in the North Stream (below the Brand Highway crossing) and in the South Stream (below the Dewar Road crossing) outside the Iluka properties and downstream of the Project Area is not expected to be exacerbated by the diversion works as the flow regimes will not be significantly changed. Water quality and quantity will continue to be monitored upstream and downstream of the Project Area as outlined in Table 13. This monitoring includes regular analysis of Total Suspended Solids and Turbidity upstream and downstream of the diversion points.

Vegetation along the North and South streams will be cleared to allow mining. Both streams have been modified to the point where they have little or no riparian vegetation and are of minimal ecological value. Minimal native fauna utilise the area. However, the North Stream and central wetland area are classified Resource Enhancement Category Wetlands. Offsets for mining these wetlands are required. Offsets provided by Iluka for the mining of these areas include:

- rehabilitation of the central wetland, North Stream and South Stream following mining;
- incorporation of more native vegetation than existing pre-mining into rehabilitation;
- restoration of 1 km upstream on North Stream; and
- revegetation scheme supporting landcare and watercourse improvement programs.

Following mining the streams will be recreated along their original alignment. The recreated stream zone with have low and high flow zones and incorporate gentle meanders consistent with the surrounds. The beds and banks will be vegetated to protect from erosion.

Both streams will be fenced from grazing stock and include stock watering points and crossings. Revegetation will consist of species existing pre-mining activity plus other native understorey species. Assistance will be sought from the Gingin LCDC and the DoE in

recreating the streams. Further detail on rehabilitation, restoration and revegetation is provided in Section 7.

The main impact of the proposed mining and associated diversion drains will be to reduce or eliminate natural flows in the central streams, CS3, CS2 and unnamed watercourses that flow from a wetland depression in the middle of the Project Area. The results of mining and local diversion will be disturbance by mining of the wetland and a net reduction in yields in downstream reaches of the CS3, CS2 and unnamed streams by an estimated 340,000 kL/annum. The forecast reduction in streamflow yields is due to the intersection by mining of groundwater baseflow that recharges the wetland and drawdown impacts of mine dewatering.

The CS3 and CS2 streamlines west of the Brand Highway have been cleared, are grazed and no longer support riparian vegetation. As these streams are mostly vegetated by pasture species (with isolated upper storey species), and moisture will be available from groundwater seepage and direct rainfall, downstream impacts on riparian vegetation due to reduced surface water flows from upstream are not likely to be significant.

Gingin Brook runs through the town of Gingin, southeast of the mine area, then braids into a series of channels, lakes, wetlands and swamps to the southwest and west. Some of this area is classified as "Conservation" and "Lakes Policy Area – DoE 6/95" by the DoE. All the streams in the proposed mine area discharge toward these wetland areas and ultimately into Gingin Brook. The reduced flows in the CS3, CS2 and unnamed streams are not expected to have any impact on the downstream riparian vegetation and wetland areas associated with the Gingin Brook because the volume of flow is insignificant compared to the volume received via Gingin Brook. The catchment for these wetland areas is in the order of 342 km2, more than 100 times larger than the mine area.

The findings of technical studies and the results of a local water census have indicated that one dam on the Dewar property may require additional makeup water. Discussions have been undertaken with the landowner and provision made for the release of clean water into the water drainage channel to ensure dam water levels were maintained. Only small volumes of water are anticipated to be required. Monitoring of the water levels will be conducted weekly over summer.

The surface water monitoring program and reporting strategy is outlined in Table 13 and Table 14.

The Project Area is within a surface water management area proclaimed under the *Rights in Water and Irrigation Act 1914*. In such areas, the DoE is responsible for ensuring that surface water use is managed in accordance with a system of licences and permits. Any use of water or construction of infrastructure, (e.g. dams) that would result in diminished flows to the downstream environment require a '5C Licence to Take Surface Water'. As flows downstream of NS2 and SS3 would not be diminished by the diversion bund (as no water is being removed from the system for use), a '5C Licence to Take Surface Water' is not be required for the proposed diversions. However, advice from the DoE (M. Viskovich, pers. comm.) has indicated that an '11/17/21A Permit to Interfere with Bed and Banks' is required for this proposed works. Clarification has also been provided by the DoE (M. Viskovich, pers. comm.) that a '5C Licence to Take Surface Water' for any surface run-off diverted from disturbed areas for process water supply use is not required. These applications have been submitted to the DoE for assessment.

Commitments

3. Implement the Water Resources Management Plan.

Table 13: Surface Water Monitoring Program

Source	Locations	Monitoring Parameters	Monitoring Frequency	Comments
BASELINE ENVIRONMENTS				
Streamflow	NS2, CS3, SS3	Streamflow	Continuous	Gauging stations
	NS1, NS2, CS1, CS2, CS3, SS1, SS2, SS3	EC, TDS, TSS, turbidity, pH, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, HCO_3, Total Alkalinity, Ammonia, NO_3, NO_2, Total P, Total Kjeldahl, Nitrogen and Filterable Reactive Phosphorous	Quarterly	Sampling during streamflow events only and opportunistically during significant runoff events. NATA-registered laboratory.
	NS2, CS3, SS3	Erosion stability – visual assessment	Bi-annually and after large runoff events	
	Project area	Rainfall	Minimum daily	
OPERATING ENVIRONMENTS				
Streamflow	NS2, CS3, SS3	Streamflow	Continuous	Gauging stations
	NS1, NS2, CS1, CS2, CS3, SS1, SS2, SS3	pH, EC, TDS, TSS, turbidity	Monthly	Sampling during streamflow events only and opportunistically during significant runoff events.
	NS1, NS2, CS1, CS2, CS3, SS1, SS2, SS3	EC, TDS, TSS, turbidity, pH, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, HCO_3, Total Alkalinity, Ammonia, NO_3, NO_2, Total P, Total Kjeldahl, Nitrogen and Filterable Reactive Phosphorous	Quarterly	NATA-registered laboratory. Sampling during streamflow events only and opportunistically during significant runoff events.
	NS2, CS3, SS3	Erosion stability – visual assessment	Bi-annually	
	Project area	Rainfall	Minimum daily	
	Dewar Dam	Dam water content	Weekly in summer	Make-up supply

Table 14: Surface Water Resources Reporting

Source	Reporting Parameters
Project Area Water Resources	Water Year The Water Year for reporting purposes shall be based on a calendar year. Annual reports will be submitted to the relevant regulatory authorities within three months of the end of each Water Year.
Project Area Water Resources	Annual Water Resources Review All monitoring and management records of the local surface water and groundwater resources will be collated and assessed on an annual basis. The Water Resources Review contents will be compatible with the guidelines issued by the DoE for Aquifer Reviews.
Water Resources Review Streamflow	Important aspects of the Water Resources Review include: • Records of streamflow volumes and quality. • Baseline environments. • Quantitative and qualitative assessments of the off-site impacts of diversion drains. • Assessments of erosion. • The definition of issues linked to the diverted watercourses. • Management initiatives to mitigate the known issues, including necessary revisions of the Operating Strategy. • Procedures for and volumes of make-up supplies diverted to the Dewar Dam. • Review of monitoring requirements.

5.4.2 Stormwater Management

Potential sources of stormwater include runoff from the mining area, screenplant, mining workshops and the concentrator area. Stormwater from the mining area will be collected in the mining void and pumped with groundwater dewatering to the clean water pond. Water collected around the cleared perimeter of the mining area will be directed to settling sumps and allowed to overflow through a controlled outlet. This will allow for any sediment in the water to settle prior to release. Stormwater collected from the mining workshop and the concentrator area will be directed to the process water pond.

The Project will be designed to minimise stormwater flows. This includes a bund along the eastern side of the project area directing overland flow into the North and South streams. The amount of area open at any stage is minimised and topsoil and perimeter bund stockpiles are revegetated to minimise runoff.

Potential contamination sources include the concentrator area, mine workshop, vehicle washdown bay, fuel bays and refuelling areas. Runoff from the concentrator and mine workshop will be directed to the process water pond and utilised in the process. Oil water separators will be installed in areas of hydrocarbon storage and use.

Water release in a storm event will be from the clean water pond. Pumping of water from the clean water pond to the process pond in a storm event will be kept at a minimum level.

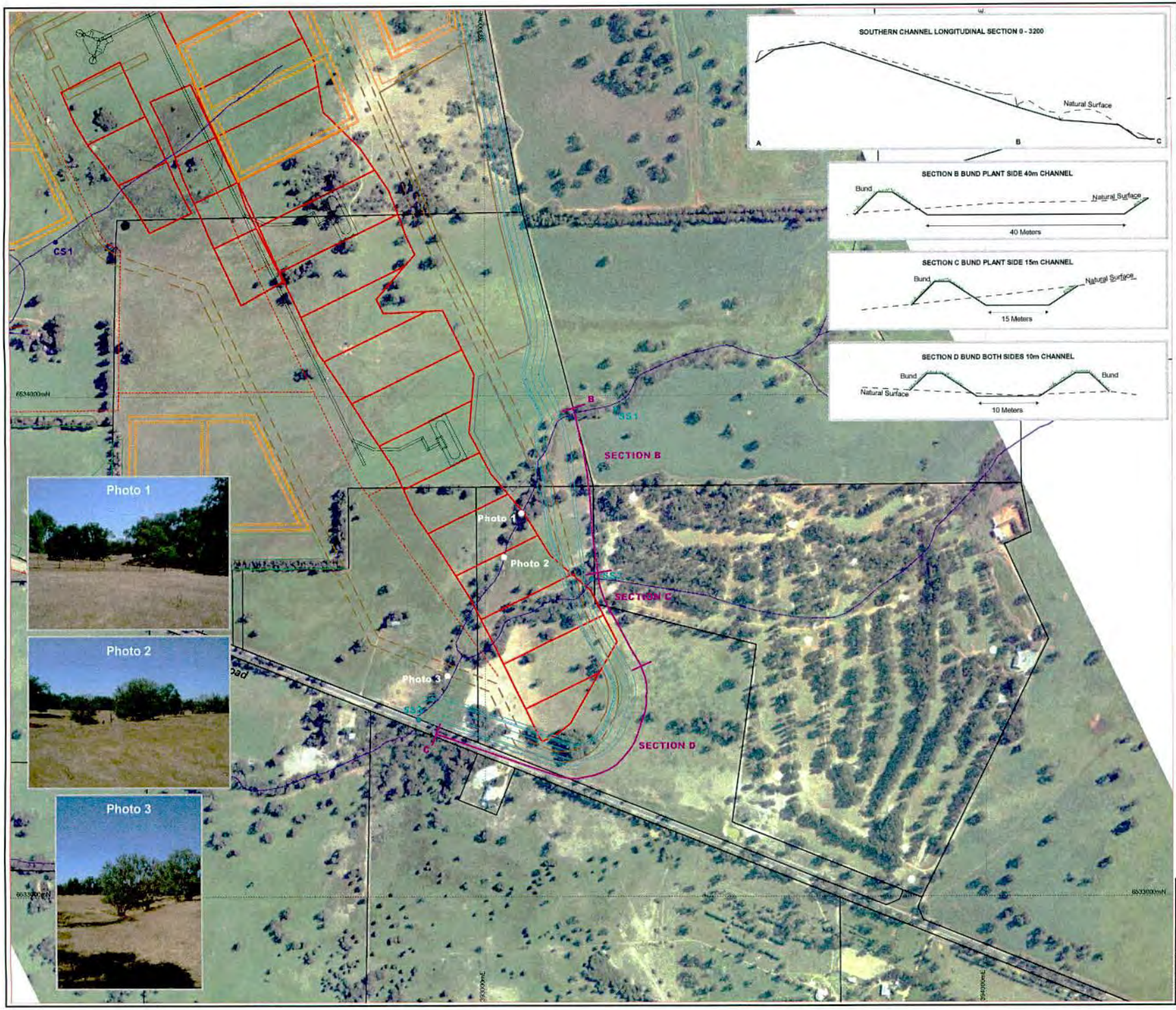
Water release will be monitored for water quality and quantity on a regular basis in accordance with the site pollution prevention licence. Streamflow and quality will also be monitored upstream and downstream of the Project Area as outlined in Table 13.

Hydrocarbon areas will be bunded in accordance with the site licence conditions. The refuelling area, washdown bay and workshop areas will be designed to minimise stormwater runoff into the facilities and water from these areas will be directed to the process water pond.

A Drainage Management Plan, incorporating stormwater management, will be developed and implemented to minimise impacts on surface drainage and the risk of pollution in surface water runoff.

Commitment

4. Prepare Drainage Management Plan that includes
    - Site water control.
    - Bunding and drainage plans.
    - Water storage and segregation.
    - Stormwater management.
    - Release of excess water.
    - Contaminated water management.
5. Implement the Drainage Management Plan.



REVISIONS

No	ORIG	DESIGN	DATE	COMMENTS

Legend

- Existing Channels
- Stream Diversions
- Powerlines

Surface water monitoring sites
- NS
- SS
- CS

Preliminary Site Layout
- Clean Water Dam
- Infrastructure
- Mine Roads
- Mining Area
- Noise Bund
- Ore Stockpile
- Power
- Return Water Dam
- Solar Drying Dam
- Stockpile
- Topsoil Stockpile
- Tree Belt
- Plant Roads

Note: Date of photography 22.09.2000

Location Diagram

N

0 200 400 600 800 Meters

MGA Coordinates, GDA94

ILUKA

ORIG :	S.JONES
DRAWN :	S.P.
SCALE :	1:5,000
DATE :	28 JAN 2004

GINGIN

CONSTRUCT SOUTHERN PART OF SOUTH STREAM DIVERSION

DWG No 131463 ver 00

FIGURE : 9

REVISIONS

No	ORIG	DESIGN	DATE	COMMENTS

Legend

- Streamflow
- Stream Diversions
- Powerlines

Surface water monitoring sites
- NS
- SS
- CS

Preliminary Site Layout
- Clean Water Dam
- Infrastructure
- Mine Roads
- Mining Area
- Noise Bund
- Ore Stockpile
- Power
- Return Water Dam
- Solar Drying Dam
- Stockpile
- Topsoil Stockpile
- Tree Belt
- Plant Roads

Note: Date of photography 22.09.2000

Location Diagram

N

0 200 400 600 800 Meters

MGA Coordinates, GDA94

ILUKA

ORIG:	S.JONES
DRAWN:	S.P.
SCALE	1:5,000
DATE	28 JAN 2004
DWG No	131465 ver 00

GINGIN

CONSTRUCT NORTH STREAM DIVERSION

FIGURE : 10

5.5 Groundwater

5.5.1 Dewatering - Superficial Aquifer

The proposed mining of the Gingin Deposit will abstract groundwater from the superficial formations, drawing down the water table in the immediate vicinity of the project area.

Based on the results of a detailed field investigation program, completed in early 2001, a groundwater flow model was developed to simulate dewatering abstraction and assess the impacts of mining upon the shallow groundwater resources. Modelling indicates that the extent of 0.5 m of drawdown caused by dewatering would be limited to within about 1,000 m to the west of the Brand Highway and about 500 m south of Dewar Road. The modelling simulations also indicate that the mining of the Gingin Deposit will only have a short-term effect on the superficial formations, with groundwater levels recovering to baseline elevations (assuming average rainfall) within about four years.

Water use census studies completed in February 2001 and September to October 2003 indicate that several groundwater bores located in close proximity to the project boundaries may incur a drawdown interference of 2 to 5 m. Drawdowns of this magnitude may adversely affect the capacity of the bores. Iluka has consulted with these particular groundwater users to outline the potential impacts, the nature of the proposed groundwater monitoring program and tabled a commitment to supply make-up water should groundwater monitoring indicate any adverse impacts. A water resources management plan has been prepared outlining the potential impacts and make-up water options.

5.5.2 Supply Bore – Yarragadee Aquifer

An assessment of the potential impacts of proposed abstraction from the production bore GYP1, installed by Iluka in the early stages of 2002, has been undertaken by URS using groundwater flow modelling (URS, 2002a). GYP1 is screened within the Yarragadee Formation at depths of about 454 to 590 m.

The predictive simulations performed during the modelling indicate that impacts from the proposed abstraction are negligible or insignificant. Drawdown effects are limited to the Yarragadee and Parmelia formations. Drawdown impacts within the production bore of the nearest user of the Yarragadee Formation (Koorian Estate) are predicted to be limited to about 0.4 to 0.5 m.

Drawdown within the Leederville Formation is considered to be restricted to a maximum of about 0.2 m after four years. The predicted drawdowns do not propagate to the overlying superficial formations, which support some wetland systems to the west of the Project Area.

The predicted drawdowns are considered conservatively high, as the modelling has applied an abstraction rate of 2,000,000 kL/annum for a four-year period, whereas actual abstraction is likely to be significantly less over a slightly reduced period. Drawdown effects are considered short-term and the aquifer system should effectively recover within about four years from the cessation of abstraction.

5.5.3 Groundwater Resources Monitoring and Management

Programs for the monitoring and management of the local groundwater resources have been formulated based on the findings of technical studies and the results of a local water census.

The completed census has indicated that the local landholders predominantly use the shallow groundwater and surface water resources.

The census has also confirmed that the primary areas of drawdown risk occur to the west and south of the project area. The risks are linked to drawdowns potentially compromising, in-part, existing superficial formations groundwater supplies on properties owned by Morley, Greville, Dewar, Schaeffer and Green. Consultation focussed on the provision of make-up supplies has involved these landowners. These consultations outlined commitments by Iluka to provide make-up supplies, with preference that such supplies be abstracted from the Yarragadee Formation. These commitments have been outlined in a letter to each stakeholder. Agreed resolutions for make-up supply to adversely affected existing amenities include:

- Monthly monitoring of piezometers adjacent to properties. Drawdown of more than 1 m increases monitoring to weekly and triggers discussions with landowner.
- Provision of alternative water sources in consultation with the landowner. Options discussed with the landowners include supplying water from Iluka's Yarragadee Bore, supply of tank and carting potable water, release of water to streamlines and installation of new bore.

Groundwater drawdown has the potential to impact ecological values in the area of drawdown. This potential is expected to be minimal due to the depth to watertable of over 10 metres indicating the vegetation is more reliant on surface water than groundwater. A portion of the north stream downstream of the Project Area is classified as conservation category wetland and is within the area of drawdown. Surface water in North stream is being redirected around the mining area and there will be minimal impact on surface water flows. Baseline surface water flows in the north stream are being monitored upstream and downstream of the proposed mining area. This will be continued during operations. Maintaining natural stream flows along the North stream will provide this vegetation with a water source and there are not anticipated to be any decline in vegetation health due to groundwater drawdown. As an added precaution this vegetation will be monitored using photo points. An area 500 m south of Dewar Road classified as high conservation category wetland is also within the area of drawdown. The Dewar Road site is on the edge of the predicted drawdown levels and is not expected to be adversely affected. A further two conservation category wetlands are located 1 km to the south-east of the Project Area and are outside the predicted drawdown area.

The impacts on local groundwater resources and existing amenities will be proactively monitored and managed to protect the environment and the rights of existing water resources users. A Water Resources Management Plan has been developed that outlines the potential impacts and proposed water make-up (Appendix A). This includes a Water Resources Operating Strategy is applicable to the groundwater resources of the superficial formations and Yarragadee Formation. Operating rules of the strategy are outlined below.

Monitoring and management commitments are outlined in Table 15 and Table 16. The programs will be reviewed and updated in the Annual Water Resources Review.

Operating Rules

- Adherence to regulatory licences and the Operating Strategy.
- Preservation of the rights of existing water resources users, culminating in the make-up of supplies where existing amenity is lost or partially reduced. Predominant areas

of focus will be the Morley, Greville, Dewar, Schaeffer and Green properties, as is appropriate based on the findings of technical studies and the completed census.

- Benchmarking of existing water resources use and quality based on recorded census findings and available monitoring data.
- Use of the monitoring and management programs to enable transient comparison between predicted and actual drawdowns in pit-perimeter and regional piezometers. A six monthly review will be sent to the landowners.
- Drawdown impacts of more than 1 m on the peizometers adjacent to the properties of Morley, Greville, Dewar, Schaeffer and Green will trigger further monitoring and discussions. Initial measures will be to consult with these stakeholders to explain the drawdown circumstances and to evaluate any known adverse impacts caused by the drawdown at that time. Proactive measures to mitigate any shortfall in supply will be instigated.
- Provision of required make-up supplies will continue until the local recovery of the water table mitigates the observed adverse drawdown impacts. If the water table does not recover as anticipated post mining, replacement water supplies will be sourced for the impacted landowners. This could include installation of new superficial bores elsewhere on the property or construction of surface water dams.
- The provision of make-up supplies will be specifically reported to the relevant regulatory authorities in Water Resources Review reports.
- There is some uncertainty in both the transient magnitude of mine dewatering abstractions and forecasts of process water supply demand. Both of these aspects will influence the site water balance and allocation requirements from the superficial formations and Yarragadee Formation. Annual reporting to the DoE will incorporate extraction rates from both formations. Reductions or increases in licence allocations will be sought from the DoE if required to ensure that they are compatible with actual groundwater use.

GWL applications to abstract 1.0 GL/annum from the superficial formations and 1.5 GL/annum from the Yarragadee Formation were lodged on 11 September 2002. These applications were advertised publicly, as required by the 2001 amendments to the Rights in Water and Irrigation Act 1914, on 9 January 2003. It is understood that there were no public responses to these advertisements.

The DoE has advised that the Department and the Gingin Water Resources Advisory Committee have considered the applications and that they require the findings of the regional bore census prior to granting of the licences.

Table 15: Groundwater Monitoring Programs

Source	Locations	Monitoring Parameters	Monitoring Frequency	Comments
BASELINE ENVIRONMENT				
Superficial Formations	GS1 to GS23, inclusive	Groundwater levels	Monthly	Pit-perimeter multipiezometers
	RG1, RG2, RG3, RG4, RG5	Groundwater levels	Monthly	Regional piezometers
	B1, Whisson, Golf Course	Groundwater levels	Monthly	Private bores
	GS3, GS8, GS9, GS13, GS17	pH, TDS, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, Total Alkalinity, HCO_3	Quarterly	NATA-registered laboratory
Yarragadee Formation	GYP1, GY1	Groundwater levels	Monthly	Pit-perimeter facilities
	GB1, AM6A	Groundwater levels	Monthly	Regional Leederville Formation
	GB5, AM4, AM4A, AM6	Groundwater levels	Monthly	Regional Yarragadee Formation
OPERATING ENVIRONMENT				
Superficial Formations	Sump-pumps	Abstraction volumes, operating hours	Weekly	Mine-dewatering
		Cumulative abstraction	Monthly	Mine-dewatering
	GS1 to GS23, inclusive	Groundwater levels	Monthly	Pit-perimeter multipiezometers
	RG1, RG2, RG3, RG4, RG5	Groundwater levels	Monthly	Regional piezometers
	B1, Whisson, Golf Course	Groundwater levels	Monthly	Private bores
	GS3, GS8, GS9, GS13, GS17	pH, TDS, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, Total Alkalinity, HCO_3	Quarterly	NATA-registered laboratory
Yarragadee Formation	GYP1	Abstraction rates and volumes	Weekly	Process supply
		Operating hours	Weekly	
		Groundwater levels	Weekly	Note if bore is on or off
	GY1	Groundwater levels	Weekly	
	GB1, AM6A, GB5, AM4, AM4A, AM6	Groundwater levels	Monthly	Regional piezometers
	GYP1	EC, pH, temperature, pH, TDS, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, Total Alkalinity, HCO_3	Quarterly	NATA-registered laboratory.

Table 16: Groundwater Resources Reporting

Source	Reporting Parameters
Project Area Water Resources	Water Year The Water Year for reporting purposes shall be based on a calendar year. Annual reports will be submitted to the relevant regulatory authorities within three months of the end of each Water Year.
Project Area Water Resources	Annual Water Resources Review All monitoring and management records of the local surface water and groundwater resources will be collated and assessed on an annual basis. The Water Resources Review contents will be compatible with the guidelines issued by the DoE for Aquifer Reviews.
Water Resources Review - Groundwater	Important aspects of the Water Resources Review include: • Definition of baseline environments. • Abstraction records for the superficial formations and Yarragadee Formation. • Groundwater level data from the designated multipiezometers, piezometers and private bores. • Groundwater level data from GYP1. • Groundwater quality records for the superficial formations and Yarragadee Formation. • Assessments of the local and regional drawdown impacts due to mine dewatering abstractions. • Assessments of the local and regional drawdown impacts due to process water supply abstractions from the Yarragadee Formation. • Six-monthly comparisons between observed and predicted impacts of abstractions from both the superficial formations and Yarragadee Formation. • Revision, if necessary, of the predicted impacts of future abstraction. • The definition of known issues linked to the mine dewatering and/or process water supply abstractions. • Management initiatives to mitigate known issues, including assessments of any adverse impacts on neighbouring landowners, principally Morley, Greville, Dewar and Green, outlining: • drawdown thresholds linked to reductions in the amenity of existing supplies; • make-up supply strategy and sources; • make-up supply volumes; • forecast duration of the drawdown mitigation measures; • current and outstanding known issues in relation to off-site adverse impacts. • Comparison of licensed and actual groundwater use. • Revision of the project water demands based on operating experience and revisions to licence allocations for compatibility with actual needs. • Review of monitoring requirements. • Revisions, if appropriate, to the Operating Strategy.

5.5.4 Contingency Plans

The successful development of the Gingin Deposit is dependent on an adequate and secure process water supply. The forecast supply demand is comparatively large-scale, being in the order of 2,500 ML/annum. Where practical, the supply demand will be reduced by measures to conserve groundwater resources. The absence of a secure process water supply would be highly detrimental to the project, limiting both its technical feasibility and its commercial viability.

The completed technical studies and local water resources census demonstrate a sound knowledge of the local groundwater environments, existing users, available groundwater resources and potential impacts of project development. Based on this knowledge, the risks posed by project development to the environment and existing water supplies are understood and considered to be manageable and adequately mitigated under the commitments formulated in the Operating Strategy. Also, in practical terms, the provisions of make-up water to any adversely affected existing users is forecast to account for <1% of the annual water demand for the project. Such potential make-up requirements will be

accommodated as the first water supply priority, involve comparatively small volumes and accordingly will be easily provided. As such, the contingency plans only relate to the provision of secure process water supplies.

If the mine dewatering and Yarragadee Formation abstractions do not meet supply demands for periods of short duration (presumably for several days at most) and are predominantly linked to operational faults or circumstances, then:

- the processing plant operations may need to be temporarily suspended; or
- the plant throughput temporarily reduced to match the available water supplies.

If the water supply demands cannot be met for extended periods, presumably because demand exceeds the licensed groundwater allocations and/or mine dewatering abstractions are significantly less than predicted, then other supply options would need to be investigated and developed. Alternatively, the project might be modified to enable compatibility with available process water supplies. Such modifications would be linked to changes in operating practises (perhaps involving co-disposal of sand and clayey fines by-product streams), reducing operational hours and/or reducing throughput.

In the event that the licence applications sought for this project are not sufficient or allocations are reduced, then investigations to abstract larger volumes of water from the superficial formations, streamflow and/or the Yarragadee Formation would need to be initiated.

Several potential options for provision of make-up supplies for processing include:

- Equipping of the existing four superficial formations test production bores, with expected short-term yield capability of 500 kL/day.
- Installation of additional superficial formations production bores in the near vicinity of the mining area. The preferred areas occur along the eastern pit limits, predominantly in the vicinity of multipiezometers GS2, GS4, GS5, GS6, GS7 and GS8 where local aquifer tests demonstrate the local superficial formations aquifer system is of comparatively high transmissivty. Any necessary investigations would preferentially commence in the vicinity of GS4 and GS8 where measured specific capacities are greatest.
- Enlarging the active pit area by advancing the mining face and/or retarding the backfilling of designated areas, particularly on the eastern pit perimeter, increasing groundwater throughflow intercepted by the pit.
- Seasonal diverting and storage of some streamflow volumes - with allowable limits dictated by environmental provisions to downstream areas.
- Seeking of increased Yarragadee Formation allocations; from reserve future drinking water supply allocations. It is our understanding that a draft policy on temporary allocation of such reserves is being prepared for this occurrence by the Department of Environment (DoE). This project, being of comparatively short duration, is unlikely to significantly influence the security of future drinking water supply developments.

These options have not been fully assessed and are not part of this environmental impact assessment. Prior to any of these options being implemented, Iluka understands that environmental impact studies need to be conducted and liaison established with the decision making authorities for the appropriate approvals. During this time, mining operations may be limited or suspended.

Commitments

See previous commitments under Section 5.2.

6. Provide alternative water arrangements for landowners if bores are adversely affected by the Project.

5.6 Soil Management

The acid sulfate soils testwork indicated that a specific acid sulfate soils management plan is not required given the low sulphide content of the Gingin soils. However, the strongly acidic nature of a proportion of the soils does require special management to ensure that erosion of the stockpiled material is kept to a minimum and runoff is contained within the mining area.

This material is largely contained within the overburden material in the Guildford Formation, with soil management unit 3a. The volume of this soil management unit is approximately 612,000 m^3. A geological drilling program is currently underway to further assess this material. Up to 250 soil samples are being collected for analysis. This will delineate the highly acidic soils within the orebody model. A management plan will be developed for handling this material during operations. This will include preferentially returning the material directly to the mining void, treatment with lime or other neutralising agent as required, implementing designated erosion and sediment control structures, minimising water ingress through bunds and diversion banks upslope and a leachate collection and treatment system.

In addition, further soil testing is being undertaken to determine the levels of Arsenic and Chromium that are released into the soil solution under acidifying conditions. These metals are not envisaged to pose any management issues when present in the solid soil particles and it is only when they are released into the soil solution and become mobilised that potential contamination may result. Based on the concentration in soils, the concentration of the metals in dust is anticipated to be well below guideline values.

Commitments

7. Develop a soils management plan that includes:
   - Delineation of the area of highly acidic soils.
   - Operational handling of the soils during mining and rehabilitation.
   - Treatment of acidic soils.
   - Minimising water ingress into acidic soils.
   - Water collection and treatment system.
8. Implement the Soil Management Plan.

5.7 Radiation

The heavy mineral concentrate from the Gingin Project contains the mineral monazite. Monazite contains the naturally occurring radioactive elements thorium and uranium, which are associated with all heavy minerals mined by Iluka. Ilmenite and zircon are also classified as "radioactive materials". The concentration of thorium and uranium in the heavy mineral concentrate produced is typically in the order of 800 ppm thorium and 100 ppm uranium, however varies, as it is significantly dependent on the percentage of the mineral

monazite. The mineral monazite typically contains around 60,000 ppm thorium and 2,500 ppm uranium.

This mineral is a main source of possible radiation exposure at Iluka Operations. Monazite is the rare earth phosphate [Ce, La, Nd, Th (PO_4)]. Monazite content in mineral sand deposits is typically 0.1% and increases to approximately 1-2% in the heavy mineral concentrate.

Iluka Resources Midwest Operations maintains and implements a Radiation Management Plan that is reviewed and approved by the DoIR. The Radiation Management Plan details standard radiation procedures for mining, stockpiling, transport and disposal for protection of the environment and health of employees and the general public. In addition, the Plan covers requirements for environmental and dosage monitoring, record-keeping and reporting, and employee training. The current Radiation Management Plan will be updated with site-specific considerations for Gingin prior to commencement of operations.

As part of the Plan pre and post mining radiation surveys are conducted. Post-mining values must be at or below the pre-mining value.

Commitments

9. Undertake a background radiation survey prior to commencement of mining.
10. Ensure that post-mining radiation levels are at or below the pre-mining levels.

5.8 Waste Disposal

Waste disposal covers the following potential sources of waste:

- green waste (trees/bushes/undergrowth);
- overburden;
- oversize;
- clay fines;
- sand tailings;
- waste water;
- hydrocarbon products;
- structural waste;
- domestic waste; and
- sewage.

The waste management methods for each waste group are summarised below.

5.8.1 Green Waste

Where viable, timber will be salvaged for use. Greenwaste that cannot be mulched, chipped or milled (due to excessive sand, rock or other impediment), will be stacked and burnt.

5.8.2 Overburden

If not managed properly, the potential impact associated with the storage of overburden is the increased risk of sedimentation. This will occur where water disperses the sediment from its stockpile.

Iluka will manage overburden (non-mineralised) waste by returning it to the mining void during mining and in the closure and rehabilitation phase of the project. Returning it to the mining void during mining will limit the area susceptible to erosion.

5.8.3 Oversize

If not managed properly, the potential impact associated with the storage of oversize is the increased risk of erosion and weed invasion. In addition, the erosion may cause sedimentation away from the stockpile where water interacts with the stockpile interface.

As the wet concentration process requires all particles greater than approximately 2 mm to be removed from the ore, Iluka will manage all material greater than 2 mm by removing it during the screening process, in a number of stages. The oversize will be treated as overburden and returned to the mining void during mining. This will limit the area available for erosion or weed colonisation.

5.8.4 Clay Fines

Clay fines will be removed from the ore prior to wet concentrator processing by hydro-cyclones. Clay fines will be pumped to thickeners, and underflow from the thickeners will be pumped to shallow solar drying dams. The solar drying dams are preferentially placed over the area to be mined and the backfilled pits to minimise the area of clearing. The dams are also used as many times as possible. Alternative methods of clay disposal are continually being evaluated by Iluka. Should a suitable alternative that has less environmental impact be identified this will be raised with the DMA's and implemented at Gingin.

The potential impacts associated with the clay fines are related to its storage within the solar drying dams. During the pumping and drying process, the dams may experience some form of surface or subsurface seepage that may affect topsoil or vegetation surrounding the dam and groundwater in the case of an event of subsurface seepage. There is also potential for the pipes transporting the fines to leak or burst as a result of wear and tear, again affecting the soils around the dam. All pipes transporting clay fines will be butt-welded where possible to reduce the likelihood of this occurring.

Fauna may also be impacted if they enter the dam and are unable to get out of the wet fines.

During operations, the pipelines, dam surface and dam walls will be visually inspected on a regular basis for fauna, erosion and pipeline leaks.

Once dry the clay fines will be excavated from the solar drying dams and replaced into the mining void. In addition, some of the clay fines may be incorporated into the subsoil as part of the rehabilitation process.

5.8.5 Sand Tailings

Sand tailings will be produced in the mine site wet-concentrator and pumped to the mine void as a slurry. The sand tailings will consist principally of silica sand and will be allowed to dry before rehabilitation.

The potential impacts of the sand tailings on the environment include leakages both at the source and along the pipeline during transport to the mined void. Leakages may cause disturbances to topsoil or vegetation surrounding the pipe. In addition, fauna may become trapped within the slurry if they are able to access the void.

Management of these potential impacts will be undertaken by visual inspection of the pipes, the pump and the void to ensure no leakages or trapping of fauna has occurred. In addition, all pipes transporting clay fines will be butt welded where possible.

5.8.6 Water

The potential impact from the discharge of water will be localised flooding of the area. This may cause vegetation death and sedimentation of any exposed soils.

In the event that discharge of site water is required, monitoring will be conducted at a licensed discharge point. The volume of water to be discharged depends on pit dewatering as well as frequency and intensity of rain events. Where possible all water will be retained on site and used as process water.

5.8.7 Hydrocarbon Products

The potential impacts of hydrocarbon spillage on site are soil, groundwater and surface water contamination.

Iluka's earthmoving contractor will be the primary user of oils and greases on site. Management of these products will include the collection of them in a sump by the contractor. The products will then be disposed through an oil recycling firm.

Oily rags and used filters will be collected and disposed of through recycling or burning in an enviro-burner.

Spill kits will be supplied in appropriate areas to manage any incidents requiring them on site.

5.8.8 Structural Waste

Some structural waste will be generated from maintenance activities. This waste will be recycled through a scrap metal merchant.

Any non-recyclable scrap will be disposed of at a registered landfill site.

5.8.9 Domestic Waste

The potential impact of domestic waste is the general pollution of the environment both on and off site. Waste not secured has the potential to be blown away by wind or transported by water during a rainfall event.

Rubbish generated on the site such as food scraps, food wrappings and waste paper will be collected and disposed at the local Shire disposal site or approved alternative. Other wastes generated during engineering maintenance work such as packaging will also be treated as domestic rubbish and be disposed of accordingly. Water-borne waste (including sewage) will be disposed of using a septic tank system and a leach drain. An appropriate location away from bores and watercourses will be selected in consultation with the Shire of Gingin. Domestic waste disposal options will be reviewed with Gingin Shire.

5.8.10 Sewage

An approved septic system will be installed on-site and will be maintained regularly.

Commitment

11. Prepare Waste Management Plan that includes:
    - Storage, segregation and disposal of waste streams.
12. Implement the Waste Management Plan.

5.9 Atmospheric Pollution

Potential atmospheric pollutants from the Project are limited to airborne dust. The wet concentration process does not result in the generation of any gases or fumes. Power for the site will be obtained through the Western Power grid network.

Management measures employed at other Iluka operations for dust control will be used at the Gingin site. These methods will include:

- not disturbing topsoil until absolutely required;
- the regular watering and grading of all mine site roads;
- use of biodegradable chemical tackifiers that "glue" the surface down;
- use of oversize on embankments;
- use of mulch and stubble on open areas;
- establishment of temporary crops to both bind the soil and protect the soil surface; and
- re-establishment of pasture as soon as possible after mining has been completed.

These measures will be incorporated into a dust management plan for the Gingin site.

Commitment

13. Prepare Dust Management Plan that includes:
    - Minimising dust generation.
    - Minimising off-site emissions.
    - Monitoring dust levels.
    - Dust suppression measures.
14. Implement the Dust Management Plan.

5.10 Light

Mining and processing operations at Gingin will be undertaken on a 24-hour basis. Night lighting is required to ensure that the safety and security of operations is not compromised. However, lighting of night operations can also have negative external effects on nearby residents and traffic.

Potential impacts arising from illumination at night can arise from obtrusive light spill, by general luminance diffusion, reflection from existing surfaces or through atmospheric

scattering. These effects may impact directly on neighbouring dwellings, can potentially create safety hazards on adjacent roads due to glare reducing the visibility of objects, interfere with night time navigation signalling and reduce the overall environmental night amenity. Australian Standard AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting has been utilised to develop a range of management measures to assist in reducing the amount of diffusion and spill lighting created from night time operations.

In order to minimise lighting impacts, Iluka shall endeavour to:

- provide uniform illuminance over the target area without compromising visual conditions for workers;
- direct light sources at targeted work areas, preferably in a downwards direction;
- adopt a low vertical aiming angle of the light;
- preferentially use narrower light beams over wider, diffuse beams;
- fit louvres, baffles or shields to floodlights if required without reducing the lighting performance;
- position floodlights so that the brightest view of the lights is not directed towards eye-height on neighbouring properties;
- preferentially select floodlights that produce asymmetric beams;
- utilise shielding provided by trees, earth embankments or physical features between the illuminated mine area and neighbouring dwellings;
- adopt the highest mounting height;
- locate lighting as close as possible to the target area of illumination;
- preferentially select bulbs with smaller flux output; and
- conduct regular maintenance to maintain optimum performance.

A Light Management Plan will be developed to take these measures into consideration in the detailed design, site development, operation and closure phases. This plan will include conducting regular inspections of light impacts on neighbouring properties.

Commitment

15. Prepare Light Management Plan that includes:
    - Placement of site lighting to minimise light spill.
16. Implement the Light Management Plan.

5.11 Noise

SVT was engaged to undertake an environmental noise assessment of Iluka's proposed Gingin mine in October 2002 and October 2003. The 2002 acoustic noise model (ENM noise modelling program) was used to predict noise levels at the six noise sensitive premises located in the vicinity of the proposed mining operations under worst-case meteorological conditions for noise propagation. The 2003 noise assessment comprised of updating the 2002 model, conducting ambient noise monitoring at two new locations and reviewing the annual weather conditions that may result in noise exceedances. The conditions assumed for the noise assessment were the default conditions defined in the *EPA Draft Guidance Note No. 8* for assessing noise impacts for new proposals.

The noise levels used in the acoustic model in 2002 for the fixed plant, conveyors and the mobile equipment assumed no specific noise control treatments, however noise control treatments were included in the 2003 assessment. The conveyor has been modelled with 5 m high bunds on either side. In addition, the modelling assumed the conveyor is designed and operated to run using a combination of low noise idlers and low belt speed to emit less than 70 dB(A). The screen house was modelled with 12 m high bunds on the southwest and southeast side. The ore scraper and/or loader operating at night have been modelled using equipment modified to a 105 dB(A) limits.

Taking into account land use surrounding the proposed mine and traffic volume on the Brand Highway, the noise limits that apply at all of the six noise sensitive premises adjacent to the mine have been summarised in Table 17. These noise limits must be met 90% of the time.

Table 17: Noise Limits at Surrounding Noise Sensitive Premises

Time and Day	Limit
0700 to 1900 hours Monday to Saturday	45 dB(A)
0900 to 1900 hours Sunday and public holidays	40 dB(A)
1900 to 2200 all days	40 dB(A)
2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 dB(A)

Modelling carried out by SVT (2003) indicates that it is possible that the assigned noise levels could be exceeded at all four of the six noise sensitive receivers for day-time and all of the receivers for night-time operation under worst-case sound propagation conditions greater than 10% of the time. The particular locations affected, and the degree of the exceedances varies with the operating scenario considered. A summary of predicted noise levels at each receiving residence is outlined in Table 18. The percentages of time the limits are exceeded are shown in Table 19.

Table 18: Predicted Noise Levels at Adjacent Noise Sensitive Conditions under the Worst-Case Scenario

Noise Sensitive Premise	Day-Time Noise Levels	Night-Time Noise Levels
Residence A	42 dB(A) to 51 dB(A)	41 dB(A) to 47 dB(A)
Residence B	44 dB(A) to 50 dB(A)	34 dB(A) to 37 dB(A)
Residence C	38 dB(A) to 51 dB(A)	38 dB(A) to 42 dB(A)
Residence D	33 dB(A) to 48 dB(A)	27 dB(A) to 37 dB(A)
Residence E	41 dB(A) to 50 dB(A)	34 dB(A) to 38 dB(A)
Golf Club	37 dB(A) to 52 dB(A)	31 dB(A) to 39 dB(A)

Table 19: Worst Case Percentage Exceedances

Location	Day / Night	Worst Case Percentage Exceedance		
		Hopper Location 1	Hopper Location 3	Hopper Location 5
Residence A	Day	10	0	0
Residence B	Day	**19**	8	0
Residence C	Day	0	0	**21**
Residence D	Day	0	0	5
Residence E	Day	7	**14**	0
Golf Club	Day	**15**	0	0
Residence A	Night	**15**	0	0
Residence B	Night	**22**	**15**	0
Residence C	Night	**16**	**16**	**32**
Residence D	Night	0	0	**16**
Residence E	Night	**16**	0	0
Golf Club	Night	**19**	0	0

The principal sources of noise will be from fixed plant, conveyors and mobile equipment. The fixed plant does not significantly contribute to noise levels with the noise treatments modelled. Results of the modelling show that additional bunding will be required on the north side of the screen house to minimise noise emitted in that direction. This will limit the noise time exceedances at residence C.

The mobile equipment was modelled with noise attenuated ore scrapers. The remaining equipment (overburden scrapers and haul trucks) has not been modelled with noise attenuation. Further noise modifications to this equipment will be investigated.

The weather conditions will be monitored continuously at the plant site. Continuous noise monitors linked to the control room will be installed near the noise sensitive premises, depending on hopper location. This will allow for machinery to be relocated or stood down when noise regulations are exceeded.

In addition to the above, Iluka has used the following methods to reduce the noise levels at the residences adjacent to its other operations. These methods will be deployed at Gingin as required:

- use of electrical motors in place of diesel, whenever possible;
- scheduling of mining operations to reduce impacts on surrounding residences;
- confining, where possible, mining equipment, including the feed hopper to the pit floor below ground level; and
- substitution of flashing lights for reversing beepers on mobile mining equipment working on site, depending on authorisation from the DoIR.

A Noise Management Plan has been developed for the site, and is included as Appendix B.

Discussions will be held with all adjoining property owners regarding noise levels during the operation. They will be advised of the sequence of mining and hence when the noise may impact their residence for a limited time.

Commitments

17. Implement the noise management plan.

5.12 Social Environment

5.12.1 Visual Amenity

The mine will be situated adjacent to the Brand Highway making the mine visible to people travelling this road. Tree belts have already been planted to maximise screening from the highway. Topsoil and overburden bunds will be established around the mine perimeter. A fence will be established on the top of the bund. These bunds will be grassed to minimise erosion.

5.12.2 Public Access

For safety provisions, public access to the site will be restricted. Fencing and bunds will be installed around the site. Access will be through security gates. A viewing platform, similar to the layout of Iluka's Stratham West site may be installed in consultation with the Gingin Shire, Main Roads WA and landowners.

5.12.3 Public Road Safety

The current proposal at Gingin is to create the site access road off Brand Highway on Iluka owned property. This will ultimately become the haulage route for HMC trucks off site. Based on 250 tph production rates there will be an average of 12 return truck journeys per day over the life of the project. It is proposed that the transport of the HMC will be on a campaign basis when sufficient stockpiles exist. In comparison to the vehicle usage on the highway (Table 5) the 12 additional truck journeys will be less than six percent increase in truck traffic (using vehicle classes 10, 11 and 12).

5.12.4 Aboriginal Heritage

No Aboriginal archaeological material was identified by survey within the Project Area. Two registered sites in close proximity to the Project Area were not located, and are more likely to occur to the east of the Project Area. A Heritage Management Plan will be developed detailing actions to undertake if heritage material is unearthed. This will include notification to the Department of Indigenous Affairs. Iluka staff and contractors will be provided with cultural awareness and archaeological site identification training.

No ethnographic sites were identified by any of the Aboriginal consultants that would be impacted upon by the proposal, however survey participants expressed concern that mining activities may detrimentally impact upon the drainage system that runs through the mining area and also requested that native vegetation be retained or salvaged, where possible. Iluka has further consulted with the Yued Group following the initial survey. Consultation will be continued as the mine develops.

Commitment

18. Prepare Heritage Management Plan that includes:
    - Discovery of archaeological material
    - Cultural awareness and site identification training.
19. Implement the Heritage Management Plan.

5.12.5 European Heritage

Iluka has relocated the ruins of Beauly's farmhouse into the Gingin townsite through a consultative process with the Shire of Gingin. The Shire of Gingin plans to incorporate stones into a picnic area within the town and accompany them with an explanatory plaque.

6. ENVIRONMENTAL MANAGEMENT SYSTEM

The proposed Gingin Mining Operation would be conducted under the existing Iluka Environmental Health Safety Management System (EHSMS). The existing management plans and procedures for Iluka's Midwest operations will be updated to include the Gingin operation. The existing EHSMS will ensure that the management and mitigation of potential impacts of the project are implemented in a regulated and consistent manner over all areas of operations. All site personnel would undergo an induction course to ensure the procedures and intent of the EHSMS is conveyed to employees. A system of checks and measures will ensure that new issues are addressed and the procedures and intent of the system are regularly re-enforced amongst the site personnel.

7. REHABILITATION AND CLOSURE

7.1 Objectives

Iluka has an existing framework and objectives for mine closure. A Conceptual Closure Plan incorporating these and specific objectives for the Gingin Project has been developed. This Plan will be updated over the life of mine.

Iluka's stated objective for closure is: *"To leave sites in a condition which is safe, stable and minimises environmental impacts, such that the tenements can be relinquished without any future liability for Iluka or the community"* (Iluka, 2002a).

General closure objectives covering public health and safety, landform, vegetation establishment, and end land use have been developed to encompass all closure aspects pertinent to the Project Area (Table 20).

Table 20: Closure Objectives for the Gingin Project Area

Aspect	Objective
Final Landuse	Maximise the beneficial use of the site post-closure.
Safety	Leave the site in a condition where the risk of adverse effects to people, livestock and other fauna, and the environment in general, has been reduced to a level acceptable to all stakeholders.
Stability	Achieve a condition where the processes affecting landform stability are occurring at rates that meet agreed criteria.
Final Landform	Develop final landforms that are compatible with the surrounding rural landscape.
Vegetation	Revegetate the site to meet the agreed criteria.
Groundwater and Soil Contamination	Achieve a condition where contaminants at the site are below agreed criteria. Minimise the potential for off-site pollution.
Socio-economic	Enable all stakeholders to have their interests considered during the mine closure process. Ensure that the closure process occurs in an orderly, cost-effective and timely manner within minimal disruption to the local community. Ensure that the cost of closure is adequately represented in company accounts and the community is not left with a liability.

The Project Area is to be rehabilitated for pastoral use. To achieve this end land use, soil profile and landform will be returned as closely as possible to pre-mining conditions, where appropriate, or improved where the opportunity exists. A post-mining contour plan and end land use plan will be developed in consultation with stakeholders. Paddock layout, pasture and tree establishment and the construction of farm infrastructure will be planned to maximise sustainable productive use as a pastoral property and minimise any impacts on surrounding land uses.

Completion criteria will be developed to reflect the unique set of environmental, social and economic circumstances of the Project Area. The criteria will address pertinent regulatory requirements, Iluka's corporate objective for closure, contemporary industry standards and stakeholder requirements. The completion criteria will be periodically reviewed and modified in light of improved knowledge or changed circumstances such as changes in adjacent land

use, commercial opportunities, community values, knowledge or technological advances. This review will be undertaken on an annual basis or more frequently as the need arises.

7.2 Rehabilitation Activities

Rehabilitation will be progressive throughout the life of the operation and follow closely behind mining where possible.

To achieve the end land use and landform design, mining pits will be backfilled with tailings, oversize, clay fines and overburden to recreate, as closely as possible, the pre-mining soil profile. The soil management plan developed prior to mining will be utilised to stockpile the soils during mining and ensure soils are returned to a profile reflecting the baseline environment.

Clays will be incorporated into the subsoil to improve the moisture and nutrient retention capabilities, thereby improving the long term pasture productivity. Disturbed areas will be shaped to the contour plan and ripped on the contour to control water movement and soil erosion, reduce subsoil compaction and facilitate the infiltration of water and root penetration. Topsoil will be replaced directly over the backfilled and contoured mine pits and disturbed areas where possible, or stockpiled for later use. Fertilisers will be used during rehabilitation where necessary. The soil management plan identified a need for liming in some areas to provide optimal growth of agricultural species. Where fertilisers and herbicides are used the Material Safety Data Sheets and instructions will be adhered to. Particular attention will be given to fertilisers used adjacent to the watercourses. Where necessary, additional information will be sought from the Department of Agriculture and DoE regarding fertiliser usage.

The drainage lines disturbed during mining will be recreated to their original courses as soon as the reconstructed drainage channels are stabilised and the risk of sediment transport is minimised. The reconstructed watercourses will be constructed with low and high flow channels with gentle meanders consistent with the surrounds. Erosion control measures will include grassing of the watercourse and use of erosion matting. Water quality and quantity upstream and downstream of the diversions will continue to be monitored post mining. The areas will be fenced to keep out stock and will be planted with native riparian vegetation. Stock crossings and watering points will be established in the rehabilitated watercourses. Assistance from the DoE and the Gingin LCDC will be sought during the rehabilitation of the watercourses.

In addition to the rehabilitation of those areas disturbed by mining, the North stream will be fenced off for a further 1 km upstream on the Iluka owned property. The area will be infill planted with native species and a weed control program implemented. This will be an ongoing program during operations and rehabilitation.

It is anticipated that these improvements will enhance the post-mining environment and encourage a more diverse flora and fauna population. Interaction with the Gingin LCDC is expected to benefit both parties with learning experiences on stream recreation.

Pasture species, tree shelter belts, wetland and riparian vegetation will be developed on the rehabilitated land. Farm infrastructure such as fencing, gates and laneways will be constructed. Tree belts established on Dewar Road and the Brand Highway will remain post mining. In total over 12 ha of revegetation using native species, along the streams and in tree shelter belts, will be established.

During rehabilitation dust will continue to be controlled in the same processes as during operations.

It is anticipated that a minimum of three years (post mining) will be required for Iluka to rehabilitate the land to a level commensurate with the completion criteria. During this time there may be controlled access for grazing. A post-mining agricultural report will be undertaken by an independent agricultural consultant to assess if pre-mining productivity levels have been re-established and are sustainable.

A revegetation scheme supporting the restoration of the surrounding catchments has been proposed as an offset for mining the resource enhancement category wetlands. Such a scheme would actively sponsor:

- Fencing of wetlands and waterways from stock;
- Planting of riparian vegetation to maintain or enhance wetland values; and
- Planting of native vegetation in degraded areas to enhance biodiversity.

In developing the scheme, Iluka would work closely with the Shire of Gingin and local landcare groups in order to complement their catchment restoration activities.

7.3 Monitoring and Maintenance

Monitoring procedures will be developed for the Project Area to:

- comply with licence requirements;
- assess if completion criteria have been met;
- identify positive trends towards meeting completion criteria; and
- identify where remedial action is required.

Iluka will implement maintenance activities aimed at improving the performance of the operating procedures at the site where inspections and monitoring results indicate this is necessary. Maintenance activities may include:

- modification or maintenance of drainage and erosion control structures;
- application of fertiliser;
- planting of additional seedlings, supplementary seed application;
- weed control measures;
- repair of erosion or subsidence; or
- fencing.

The timeframe for closure will depend on the time required for the completion criteria to be achieved. Monitoring will need to continue until positive trends emerge which indicate that no further management of vegetation (both pasture and native), water resources and landform is required than would be necessary for similar properties in the area.

7.4 Documentation

Iluka will provide annual reports on the Gingin operation to the relevant government agencies such as the DoIR and the DoE as part of its annual reporting process. These reports cover, among other items, pollution compliance, rehabilitation performance and mining progress.

7.5 Decommissioning and Closure

Decommissioning of the plant and associated infrastructure will occur at the completion of mining.

Iluka has developed a draft conceptual closure plan for the Gingin Project that is attached as Appendix C.

Commitments

20. Implement the Closure Plan.

8. REFERENCES

Australian Minerals Industry (2000) *Code for Environmental Management.*

Bureau of Meteorology (2002) Western Australian Regional Office.

Dames & Moore (2000) *Preliminary Groundwater Studies Gingin Deposit.* Unpublished report prepared for Iluka Resources Limited, July 2000.

Department of Conservation and Land Management (2000) *Declared Rare and Priority Flora List.* Publicly available list prepared by the Department of Conservation and Land Management, Perth.

Environment Protection and Biodiversity Conservation Act (1999) *Threatened Species/Threatened Ecological Communities Department of Environment and Heritage*, Australia (Online), Available World Wide Web: http://www.ea.gov.au/ (Accessed 18 July 2002).

Iluka Resources Limited (2001a) *Group Policy: Operation Closure*, Iluka Resources Limited, Internal Document, Perth. November, 2001.

John Wise Consultancy (2001). *Agricultural Assessment. Swan Locations 506, Pt Swam Locs 128,354 & 508 being Lot 2. Pt Swan Locs 128, 354, 355 & 506 being Lot 9. Pt Swan Locs 128 & 304 being Lot 3. Pt Swam Locs 511 & 536 being Lot 7. Brand Highway & Dewar Road Gingin.* Unpublished Report prepared for Iluka Resources Limited, August 2001.

Mattiske Consulting Pty Ltd (2001) *Flora and Vegetation Survey – Proposed Mineral Sands Mine Gingin.* Unpublished report prepared for URS.

Oracle Soil and Land Pty Ltd (2002) *Pre-mining Soil Survey and Characterisation in the Proposed Gingin Minesite: Final Project Report.* June, 2002.

Shire of Gingin (2002) (Online) World Wide Web: http://members.iinet.net.au/~ginginwa/news.html. (Accessed 18 July 2002 and 30 June 2003).

Smolinski, H.J. and Scholz, G.G.H. (1997) *Soil Assessment of the West Gingin Area, Land Resources Series No. 15, Natural Resources Assessment Group.* Agriculture Western Australia, Perth.

SVT (2003) *Update of Environmental Noise Assessment of the Proposed Iluka Mineral Sands Mine at Gingin*. Unpublished reported prepared for Iluka Resources Ltd, November 2003.

URS (2002a) *Gingin Deposit Groundwater Supply Development.* Unpublished report prepared for Iluka Resources Limited, September 2002.

URS (2002b) *Gingin Deposit Impacts of Mining on Shallow Groundwater Resources.* Unpublished report prepared for Iluka Resources Limited, September 2002.

URS (2003a) *Diversion of Streams at the Iluka Gingin Deposit.* Unpublished report prepared for Iluka Resources Limited, 2003.

URS (2003b) *Extended Water Resource Studies, Gingin Deposit*. Unpublished report prepared for Iluka Resources Limited, November 2003.

Water and Rivers Commission (2002) (Online) Available World Wide Web: http://www.wrc.wa.gov.au. (Accessed 27 August 2002).

9. GLOSSARY

AADT	Average Annual Daily Traffic
bcm	Bank cubic metre
DAWA	Department of Agriculture Western Australia
CALM	Department of Conservation and Land Management
DoE	Department of Environment (comprising the former Department of Environmental Protection and Water & Rivers Commission)
DFS	Definitive Feasibility Study
DoIR	Department of Industry and Resources
EPBC Act	*Environment Protection and Biodiversity Act* 1999
GGA	Gingin Groundwater Area
GL	Gigalitres
GWL	Groundwater Licence
ha	Hectares
HM	Heavy Minerals
HMC	Heavy Mineral Concentrate
KV	Kilo Volts
m	Metres
mm	Millimetres
ML	Megalitres
MW	Mega Watts
PFS	Pre Feasibility Study
SMMU	Soil Material Management Unit
t	tonnes
tph	tonnes per hour

APPENDIX A

Water Resources Management Plan

ILUKA

Iluka Resources Limited

Water Resources Management Plan

Gingin Mineral Sands Project

March 2004

REV	DESCRIPTION	AUTHOR	DATE
1.0	GINGIN WATER RESOURCES MANAGEMENT PLAN	LS	4/03/2004

Table of Contents

Table of Tables

Table of Figures

1 INTRODUCTION

Iluka Resources is proposing to establish a mineral sands mine 2 km west of the Gingin township (Figure 1). Groundwater abstraction from the Yarragadee Formation is required to provide a process water resource. Dewatering of the superficial formations is required to keep pits dry during mining.

Several studies have been completed to investigate the hydrogeology of the Project Area and assess the impacts of abstraction from the superficial formations and the Yarragadee Formation.

The Gingin Deposit occurs within the Gingin Groundwater Area (GGA), which is managed by the Swan-Goldfields-Agricultural regional office of Department of Environment (DoE) in accordance with an interim Sub-Regional Allocation Strategy released in 2001. The deposit is also within a surface water management area proclaimed under the *Rights in Water and Irrigation Act 1914*.

1.1 Objective

The objective of this Water Resources Management Plan is to ensure that environmental and social water provisions are maintained during mining. This plan aims to inform landowners in the vicinity of the Gingin Project.

The Plan outlines the existing surface and groundwater environment, the potential impacts on the resources, management of water issues and a water monitoring program. The plan incorporates information from various water resource investigations that have been conducted over the past four years.

1.2 Iluka Values

As part of the Company Mission and Values, Iluka will continue to operate in a responsible manner which minimises our impact on the environment.

1.3 Environment, Health and Safety Policy

Iluka values the safety and health of our employees, customers and the communities in which we operate and is committed to operating in a responsible manner which minimises our impact on the environment. We believe that continuous improvement in the areas of Environmental Health and Safety (EHS) is fundamental to our ongoing business success.

We will:

- not compromise on safety;
- comply with all legislative requirements;
- work closely with our customers and maintain a product stewardship approach to our products to enable their ongoing use;
- identify, assess and manage environmental, health and safety hazards, risks and impacts of our operations;
- maintain an EHS management system to apply uniform standards to all operations and personnel;
- promote continuous improvement practices;
- minimise workplace exposure to hazards, ecosystem disturbance or degradation;
- re-establish disturbed areas as sustainable ecosystems and community assets;
- strive to use resources more efficiently by reducing, reusing and recycling waste products;
- encourage and support our employees to make positive lifestyle changes;
- understand and work to meet the expectations of the community; and

- provide appropriate training to employees and contractors to ensure environmental, health and safety issues and responsibilities are clearly understood.

2 COMPLETED STUDIES

The following studies have been conducted on groundwater and surface water for the Gingin Project. Copies of these reports are available on request.

- Preliminary Groundwater Studies (URS, 2000)
  - Desktop review to gain understanding of the local hydrgeology, existing water uses and potential issues, associated with mine development.
- Impacts of Mining on Shallow Groundwater Resources (URS, 2002a)
  - Detailed field program installing test production bores and 23 multipeizometers. This study included a bore census.
- Process Water Supply Investigation (URS, 2002b)
  - Program investigating the use and availability of Yarragadee Formation groundwater resources.
- Diversion of Streams (URS, 2003a)
  - Stream diversion plans for surface water management across the site.
- Extended Water Resource Studies (URS, 2003b)
  - Review of baseline monitoring data, a wider water-use census and definition of options for providing suitable make-up water to potentially affected water users.

3 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Groundwater Environment

The Tertiary to Quaternary aged sediments within the Perth Basin are commonly referred to as the superficial formations. Locally, the superficial formations are up to 25 m in thickness and are underlain by the deeper groundwater systems in the Parmelia Formation and Yarragadee Formation.

Groundwater flow within the local superficial formations is predominantly in a westerly direction, with subtle variations that reflect the surface topography, particularly in areas of higher relief on the eastern side of the Gingin Deposit.

Deeper groundwater resources beneath the Gingin Deposit occur within sandstone beds of the Yarragadee Formation, below about 450 m. These resources are isolated from the superficial formations by thick clay and siltstone sequences of the Parmelia Formation. Groundwater levels in the Yarragadee Formation are about 32 to 39 m below ground.

Groundwater within the Yarragadee Formation is brackish (1,300 mg/L TDS), slightly alkaline and of a sodium-chloride type.

Groundwater exploration bores were installed within the superficial formations in November 2000 and regular monitoring of groundwater levels and water quality commenced in January 2001. Figure 2 shows the location of the groundwater monitoring sites.

Superficial formations hydrographs are presented on Figure 3(a to c). The hydrographs are grouped according to location in the Gingin Deposit (northern, central and southern) and display both absolute (mAHD) and relative (metres below ground) groundwater levels.

The groundwater level data collected since January 2001 are consistent and indicate that:

- groundwater levels predominantly occur in the range from 75 to 85 mAHD;
- depths to groundwater typically range from 10 to 20 m in northern areas, 4 to 14 m in central areas and 2 to 12 m in southern areas;
- perched groundwater, at elevations of about 90 to 95 mAHD, occurs in some areas immediately to the east of the deposit;
- seasonal fluctuations range from about 0.5 to 1.5 m; and
- between November 2000 and September 2003, groundwater levels have typically remained seasonally consistent.

The baseline groundwater quality data indicate that the local superficial groundwater resources are:

- predominantly brackish, ranging from about 1,200 to 5,000 mg/L TDS;
- slightly acidic, with pH ranging from about 5.3 to 6.5; and
- of a sodium-chloride type.

3.2 Surface Water Environment

The Gingin Deposit is drained by a number of small streams, tributaries of the Gingin Brook. A small permanent wetland depression exists in the central portion of the Gingin Deposit. Surface water is evident from the onset of winter rains through to early summer. Streams and the location of surface water monitoring sites are shown on Figure 2.

The streams generally flow from the east to the west or southwest, passing through culverts on Brand Highway or Dewar Road. The largest streams, the North and South streams have channel lines (NS2 and SS3) extending back toward the hinterland of the catchment. Three smaller streams (CS3, CS2 and an unnamed stream) drain the permanent wetland in the central Gingin Deposit.

The North Stream and permanent wetland in the central Gingin Deposit are mapped as Conservation Category Wetlands. Both of these domains are degraded, being accessible to livestock and subject to weed invasion. Elsewhere locally the surface water resources are categorised as Sustainable Use, Multiple Use.

The existing streamlines in the Gingin Deposit are predominantly erosionally stable. However, the road crossings on the South Stream and North Stream on Dewar Road and Brand Highway appear to be linked to some erosion. The streambed below the crossing on Dewar Road near the monitoring point SS3 appears to be eroded. The profile of the South Stream below the road is considerably narrower and deeper than upstream. The North Stream immediately below the crossing on the Brand Highway also forms an active erosion area.

The NS2 and SS3 streams have broadly parabolic, well grassed cross sections, 30 to 40 m wide at the top and two to three metres deep. A well defined, sandy low-flow channel, typically one

to three metres wide and half to one metre deep, meanders through the broader streamline. The smaller streams are typically shallow channels primarily in grassed depressions.

Most of the streams and the central wetland areas have a baseflow component in winter as a result of groundwater seepage.

Streamflow estimates are shown in Table 1. The 2001 and 2002 streamflows are considered lower than predictive estimates, however, rainfall was significantly below average for these years. Water quality data have been collected for each stream since June 2001. Figure 4 displays TDS, Total Suspended Solids (TSS) and pH from NS2, CS2 and SS3 samples.

TDS in SS3 has been relatively uniform at concentrations of about 500 mg/L. In NS2, TDS has fluctuated between about 500 to 1,500 mg/L, which probably reflects variable proportions of groundwater baseflow and the timing of sample collection in relation to early-winter flows. The TDS in CS2 fluctuates to a lesser degree than NS2, ranging from about 250 to 750 mg/L.

TSS concentrations are typically low (5 to 15 mg/L) for samples collected at CS2 and SS3. TSS is typically highest and variable at NS2, with concentrations ranging from about 20 to 60 mg/L. A value of 700 mg/L was recorded at NS2 on 26 June 2003, which probably represents a first-flow flushing type seasonal event.

Runoff at NS2 and SS3 is typically slightly alkaline (pH of 7 to 8). AT CS2, runoff measurements can be slightly acidic (pH of 6 to 7), which probably reflects the contribution of groundwater baseflow to runoff and catchment soil characteristics.

3.3 Existing Users and Uses of the Local Water Resources

Detailed water censuses were undertaken in 2002 and 2003.

Results from the census provide details of water sources utilised by residences in the vicinity of the Gingin Deposit. Overall there is a high percentage of landowners whom rely on groundwater resources for garden and domestic water supplies. There is relatively minor use of surface water.

Existing use of the shallow groundwater resources for domestic and stock supplies typically occurs from low-yielding windmill bores on the western side of the Brand Highway. These bores are usually less than 30 m deep and abstract 10 to 30 kL/day.

The results of the censuses assist Iluka to determine the potential impacts from the mining operation. These are then discussed with the relevant landowners and suitable make-up options identified.

Table 1: Streamflow Estimates

Date	Monitoring Site and Estimated Streamflow (L/s)							
	SS01	SS02	SS03	NS01	NS02	S01	CS02	CS03
27/06/2001	no flow	0.5	0.5	1.5	1.8	no flow	0.01	no flow
1/08/2001	0.5	2.0	4.0	4.0	6.0	2.0	3.0	full
29/08/2001	0.5	2.0	2.0	4.0	4.0	1.0	1.0	full
3/10/2001	1.0	2.0	4.0	4.0	7.0	1.0	1.0	trickle
31/10/2001	no flow	0.5	trickle	1.0	1.0	no flow	no flow	80% full
26/11/2001	no flow	no flow	no flow	damp	trickle	no flow	no flow	dry
17/04/2002	no flow	no flow	no flow	1.0	1.0	no flow	no flow	dry
22/05/2002	no flow	no flow	no flow	trickle	trickle	trickle	trickle	dry
26/06/2002	no flow	0.5	0.5	0.8	1.0	0.5	0.6	dry
21/07/2002	0.5	1.0	2.0	10.0	15	1.0	1.0	full
28/08/2002	0.2	0.8	1.0	1.5	.0	0.5	0.6	full
25/09/2002	0.1	0.5	0.8	1.5	2.0	0.1	0.2	full
31/10/2002	no flow	no flow	damp	0.2	0.2	no flow	no flow	puddle
27/11/2002	no flow	no flow	no flow	no flow	damp	no flow	no flow	dry
26/03/2003	no flow	no flow	no flow	0.5	0.5	no flow	no flow	damp
30/04/2003	no flow	no flow	no flow	0.5	0.5	no flow	no flow	dry
28/05/2003	no flow	no flow	no flow	0.3	0.4	no flow	no flow	dry
26/06/2003	no flow	1.5	2.0	4.0	5.0	2.0	2.0	50% full
30/07/2003	2.0	3.0	6.0	7.0	8.0	3.0	3.0	full
27/08/2003	0.8	1.5	3.0	6.0	10.0	0.5	1.0	full
1/10/2003	1.0	2.0	3.0	4.0	5.0	1.0	2.0	full

4 MINE OPERATIONS

4.1 Summary of Operations

The Gingin Deposit will be developed using dry mining methods and mineral sands ores will be treated in an onsite processing plant.

Dry mining typically involves a six stage approach of Topsoil Stripping, Overburden Removal, Ore Mining, Primary Concentrating, Tailings Disposal and Rehabilitation, as described below.

Pre-mining work is expected to take six months, commencing in mid 2004. Topsoil will be removed in a staged approach, when weather conditions are favourable, to minimise the area of disturbance.

As topsoil and subsoil removal advances, site establishment work at the feed preparation site commences in conjunction with pre-production overburden mining. Overburden will be stockpiled initially and as the mine progresses, direct placement into the mining void will occur where possible. Ore mining will be conducted using scrapers.

Mining is expected to begin in 2005 and continue for 3 to 4 years. The plan is to commence operations in the southern end of the Deposit and progress north. Anticipated timeframes are shown in Figure 5.

Rehabilitation will be ongoing, progressing as the mine path progresses. It is estimated that three years will be required post-mining to complete the rehabilitation.

4.2 Potential Impacting Processes

4.2.1 Groundwater Dewatering

Dry mining requires the dewatering of the mining profile. The water removed from the pits will be used in the processing plant. Dewatering creates a cone of depression, lowering the local water table. Groundwater studies have been conducted that characterise the pre-mining hydrology, simulate the mine dewatering schedule and model the groundwater contours during mining and after mining. The groundwater studies indicate the maximum drawdown extent on environmental and social water provisions. It is likely that actual impacts are less than those predicted.

Key aspects of the predicted impacts of mining include:

- Rates of groundwater abstraction during mine development that generally vary from 1,000 to 3,500 kL/day.
- Annualised rates of groundwater abstraction range from 282 to 898 ML.
- Drawdown of the water table during the mining period, with a cone of depression that extends up to 1,000 m south and southwest, about 500 m east, about 1,000 m west of the Brand Highway.
- Impacts due to groundwater abstraction during mining include:
    - Potential drawdown effects on other groundwater users in the area;
    - Diminished groundwater baseflow to the streams that transect central areas of the pit;
    - Diminished flow in the perennial North Stream due to lowering of the water table and diversion of the watercourse;
    - Diminished flow in the South Stream due to diversion of the watercourse.

- Recovery of the water table after mining would occur for three to four years.

Modelled groundwater drawdown contours at certain times during mining are shown on Figure 6 (a to g). The mining blocks and timing of mining is shown in Figure 5.

4.2.2 Surface Water Diversions

The diversion of streams is expected to have minimal impact on the water quality or stream flows.

5 PREDICTED IMPACTS ON WATER USERS

5.1 Northern Area

The expanded water census indicates there is insignificant potential for adverse impacts in the northern area of the Gingin Deposit. One bore occurs in an area where about 0.5 to 1.0 m maximum drawdown is predicted. Very few details are known by the owner regarding this bore, including the cased depth.

5.2 Eastern Area

The expanded water census indicates there are no groundwater or surface water facilities likely to be adversely affected by development of the Gingin Deposit.

Within this area the "southwest" golf club bore has the greatest potential to be affected by mine dewatering. Modelling simulations indicate a maximum drawdown of about 1.5 m. The bore is not currently used and may remain so during the project life.

One other bore in this area occurs outside of the predicted 0.5 m drawdown limit. Based on a description of the bore lithology and yield capacity by the driller, a drawdown of less than 0.5 m is unlikely to have an adverse effect.

5.3 Southern Area

The water census indicates that the two bores, S1 and S2, are likely to be adversely impacted by the proposed mine dewatering.

Apart from the two bores outlined above, the other properties that predominantly occur adjacent to the southern area of the Gingin Deposit rely mainly on season surface water resources for stock supplies. The majority of the available surface water resources come from the South Stream. This stream will be diverted around the southern end of the Gingin Deposit, streamflows will be largely unaffected by mining and associated dewatering. The potential temporary loss of some groundwater baseflow is not considered detrimental to the seasonal stock water supply potential of the southern landholdings.

5.4 Southwestern Area (Frogmore Estate)

Apart from a few properties in the very northwestern corner of the Frogmore Estate, there is negligible potential for any adverse impacts on the water resource users of the estate. The estate area occurs at considerably lower elevations than the project area and groundwater resources in the shallow tannic water table aquifer are expected to be sustained by throughflow from catchment areas south and southwest of the census areas.

The potential for adverse impacts in the northeastern corner of the Frogmore Estate is considered low. The predicted drawdowns on the closest properties range from about 0.2 to 0.3 m. Drawdowns of this magnitude are unlikely to cause adverse effects.

5.5 Western Area

Reductions in groundwater levels are expected within the following bores; B1, B3, B5, G1 and G3.

It is uncertain if these drawdowns would affect the capacity of the bores to meet their stock water demands. Actual drawdowns above those predicted would probably generate adverse impacts.

In terms of surface water users, there are unlikely to be any significant impacts upon users drawing water resources from the North Stream. Whilst groundwater baseflow contributions to streamflow will be diminished for several years, the diversion of the stream around the north end of the deposit will maintain the majority of the ephemeral streamflows.

The reductions to streamflow from the central permanent wetland as a result of mine dewatering are likely to temporarily reduce streamflows on the properties downstream on the west side of Brand Highway. Not all streamflow will be intercepted; runoff is still expected to be generated from the Iluka tree-belt area and the Brand Highway itself, as well as from within the abovementioned properties.

6 MANAGEMENT

6.1 Operating Strategy

An Operating Strategy for the project has been prepared that outlines Iluka's commitments to the effective monitoring and management of water resources in the vicinity of the Gingin Deposit.

It is likely that three DoE licences will be required. These will be:

Groundwater Well Licence for abstraction of groundwater from the Yarragadee Formation.

Groundwater Well Licence for dewatering of pit water from the Superficial Formations.

Permit to Interfere with Beds and Banks for diversion of the North and South Streams.

The Operating Strategy will supplement conditions in the above licence documents.

6.1.1 Operating Rules

The key operating rules for the Gingin Deposit will include:

- Adherence to regulatory licences and the Operating Strategy.
- Preservation of the rights of existing water resources users, culminating in the make-up of supplies where existing amenity is lost or partially reduced. Predominant areas of focus will be the bores that are identified as potentially impacted, as is appropriate based on the findings of technical studies and the completed censuses.
- Use of the monitoring and management programmes to enable transient comparison between predicted and actual drawdowns in pit-perimeter and regional piezometers, particularly in the identified sensitive areas.
- Comparisons between predicted and actual drawdown distributions will be undertaken every six months and the findings included in Water Resources Review reports submitted to regulatory authorities.
- Drawdown impacts of more than 1 m on the existing amenities of landowner bores, through monitoring of Iluka piezometers between the mining and landowners, will trigger proactive measures to mitigate any shortfalls in supply. Initial measures will be to consult with these stakeholders to appraise them of the drawdown circumstances and to evaluate any known adverse impacts caused by the drawdown at that time.

- Subsequently, consultation with the stakeholders on a regular monthly basis will continue until the potential for adverse impacts to existing supplies is diminished. Each stakeholder will also be encouraged to contact a selected Iluka representative if they perceive their water supplies are being adversely affected by the mining operations. Make-up supplies will be provided immediately once a common understanding has been reached that existing supplies have been compromised by the mining operations.
- Provision of the make-up supplies will continue until the local recovery of the water table mitigates the observed adverse drawdown impacts.

6.2 Monitoring

The water resources monitoring program is outlined in Table 2. This program incorporates monitoring of groundwater resources of the superficial formations, regional Leederville Formation and Yarragadee Formation and local surface water resources. The program will be reviewed annually in the Water Resource Review reports to ensure an ongoing appropriate monitoring focus.

Table 2: Monitoring Program

Source	Locations	Monitoring Parameters[1]	Monitoring Frequency
Streamflow	NS2, CS3, SS3	Streamflow	Continuous
	NS1, NS2, CS1, CS2, CS3, SS1, SS2, SS3	EC, TDS, TSS, turbidity, pH, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, HCO_3, Total Alkalinity, Ammonia, NO_3, NO_2, Total P, Total Kjeldahl, Nitrogen and Filterable Reactive Phosphorous	Quarterly
	NS2, CS3, SS3	Erosion stability – visual assessment	Bi-annually[2]
	Gingin Deposit	Rainfall	Minimum daily
	Dewar Dam	Dam water content	Weekly in summer
Superficial Formations	Sump-pumps	Abstraction volumes, operating hours	Weekly
		Cumulative abstraction	Monthly
	GS1 to GS23, inclusive	Groundwater levels	Monthly
	RG1, RG2, RG3, RG4, RG5	Groundwater levels	Monthly
	B1, W1, Golf Course	Groundwater levels	Monthly
	GS3, GS8, GS9, GS13, GS17	pH, TDS, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, Total Alkalinity, HCO_3	Quarterly
Yarragadee Formation	GYP1	Abstraction rates and volumes	Weekly
		Operating hours	Weekly
		Groundwater levels	Weekly
	GY1	Groundwater levels	Weekly
	GB1, AM6A, GB5, AM4, AM4A, AM6	Groundwater levels	Monthly
	GYP1	EC, pH, temperature, pH, TDS, Cl, Na, SO_4, K, Ca, Mg, Fe, SiO_2, Al, Mn, Total Alkalinity, HCO_3	Quarterly

Notes: 1: After initial monitoring it is likely that the qualitative parameters can be scaled back, focussing on likely indicators of pollution and off-site impacts.

2: Also after large runoff events.

7 REPORTING

A review against predictions will be conducted every six months and results will be made available to landowners in the vicinity.

All monitoring and management records relevant to the local surface water and groundwater resources will be collated and assessed on an annual basis. The report will be referred to as the Water Resources Review.

Included in the Water Resources Review will be the magnitude of drawdown that compromised the existing supply capabilities, the source of make-up supplies and rates of make-up supply delivered to affected properties. The Water Resources Review will also address any outstanding issues and include forecasts of the duration that provision of make-up supplies to individual properties will be required. A summary of the Water Resources Review will be provided to the relevant stakeholders.

8 REFERENCES

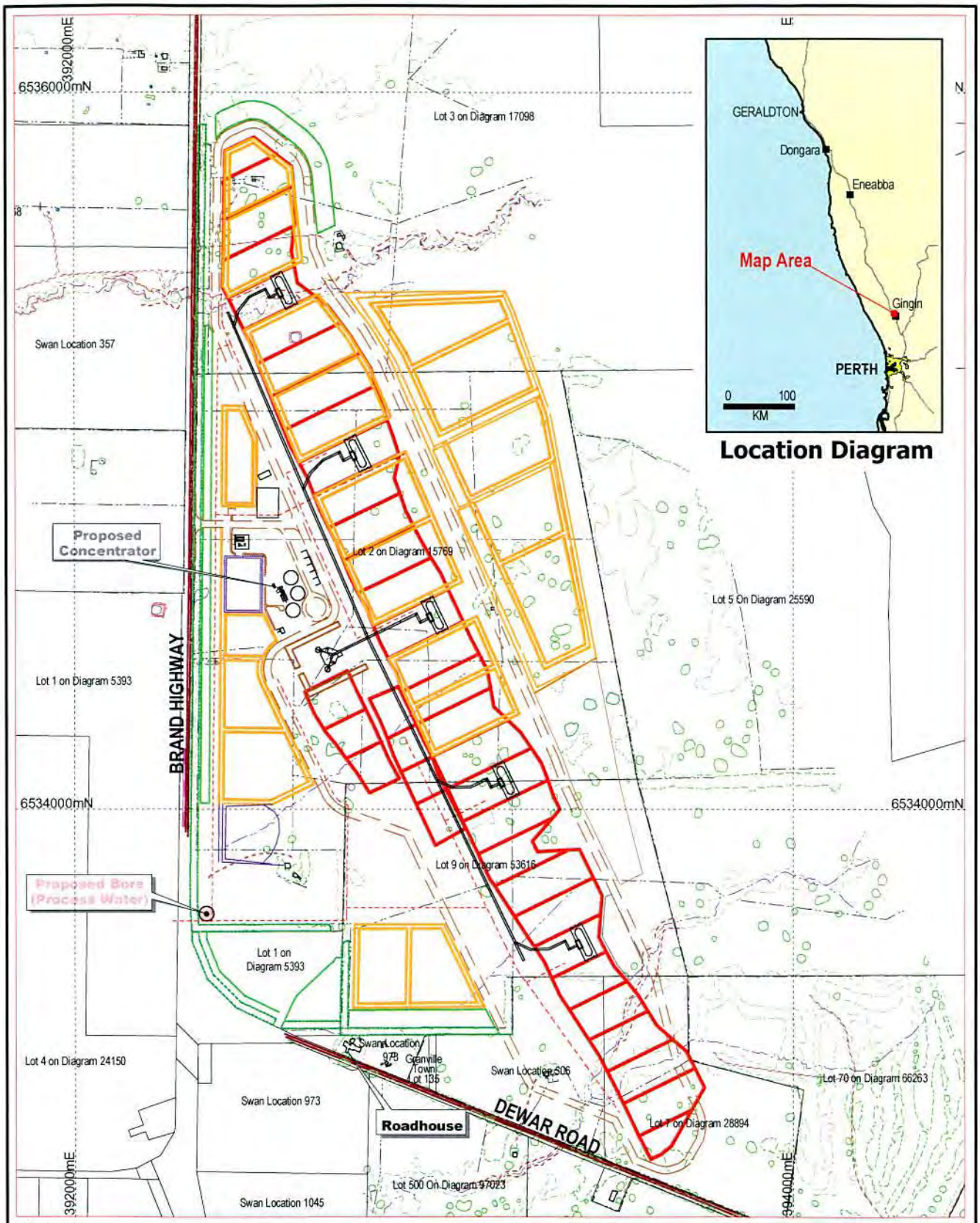
URS (2000). Gingin Deposit. Preliminary Groundwater Studies. July 2000

URS (2002a). Gingin Deposit. Impacts of Mining on Shallow Groundwater Resources. September 2002.

URS (2002b). Gingin Deposit. Process Water Supply Investigation. September 2002.

URS (2003a). Diversion of Streams at the Iluka Gingin Deposit. October 2003.

URS (2003b). Extended Water Resource Studies Gingin Deposit. December 2003.



Legend

- Water Dam
- Infrastructure
- Mine Road
- Mining Area
- Noise Bund
- Ore Stockpile
- Power
- Solar Drying Dam
- Stockpile
- Topsoil Stockpile
- Tree Belt
- Proposed process water bore

0 400 800 Meters

MGA Coordinates, GDA94

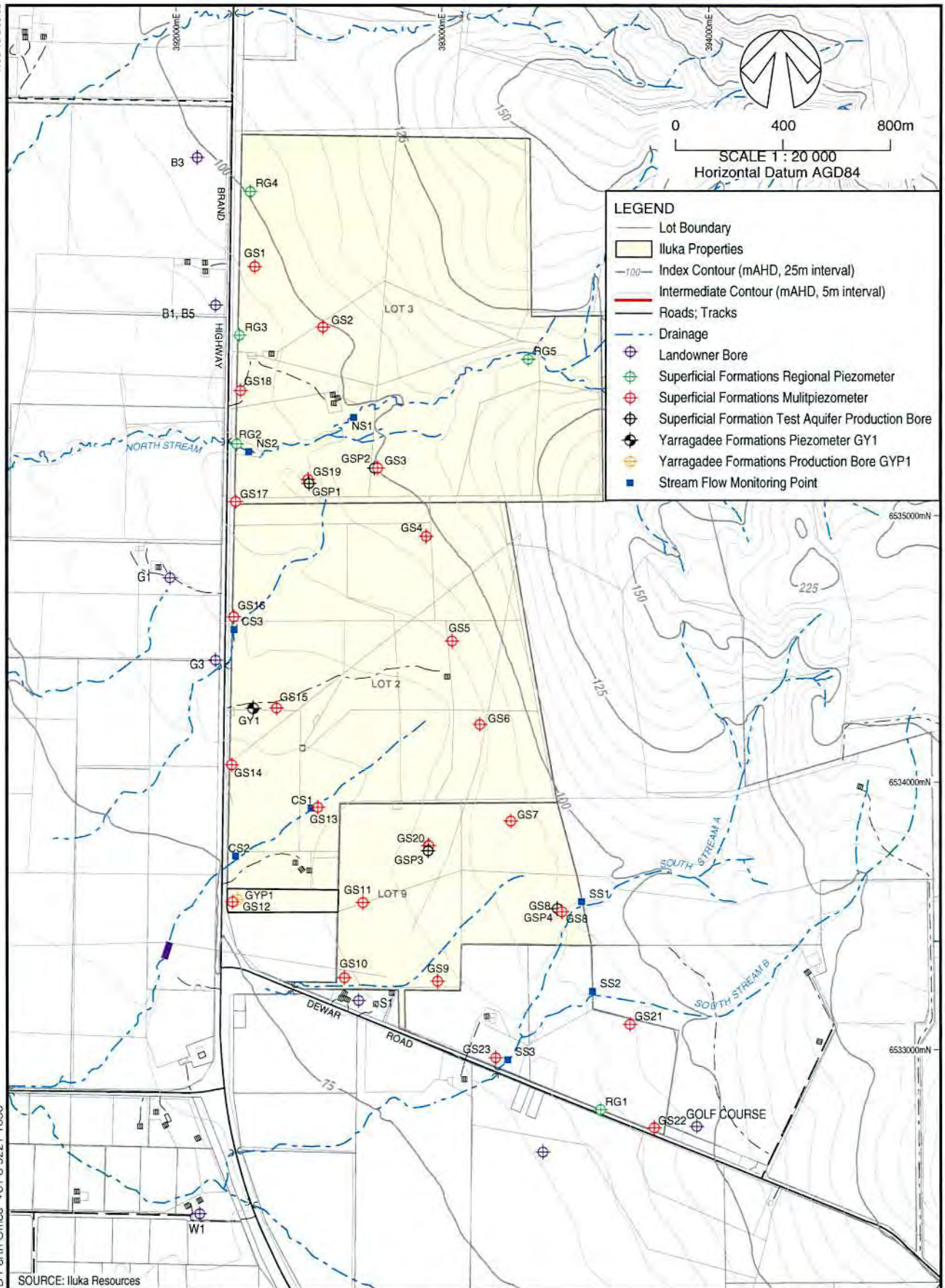
N

ILUKA

GINGIN DEPOSIT

SITE LAYOUT

ORIG :	L.Sadler		
DRAWN :	S.P.		
SCALE :	1:15,000		
DATE :	12 DEC 2003	DWG No : 122175 ver.02	FIGURE : 1



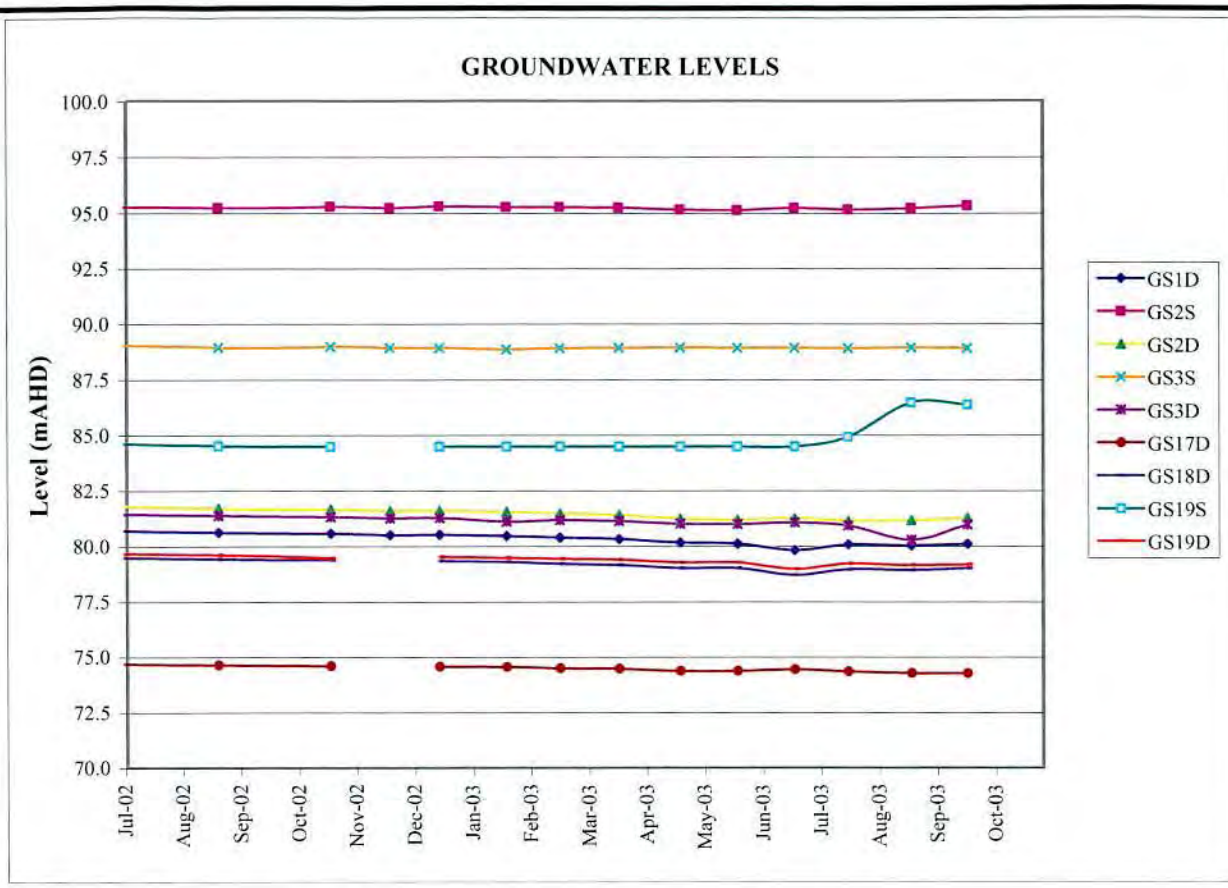
Job No.	44047-071-562	
Prep. By	TH	22 Oct 03
Chk'd By	IGB	22 Oct 03
Revision No.		0

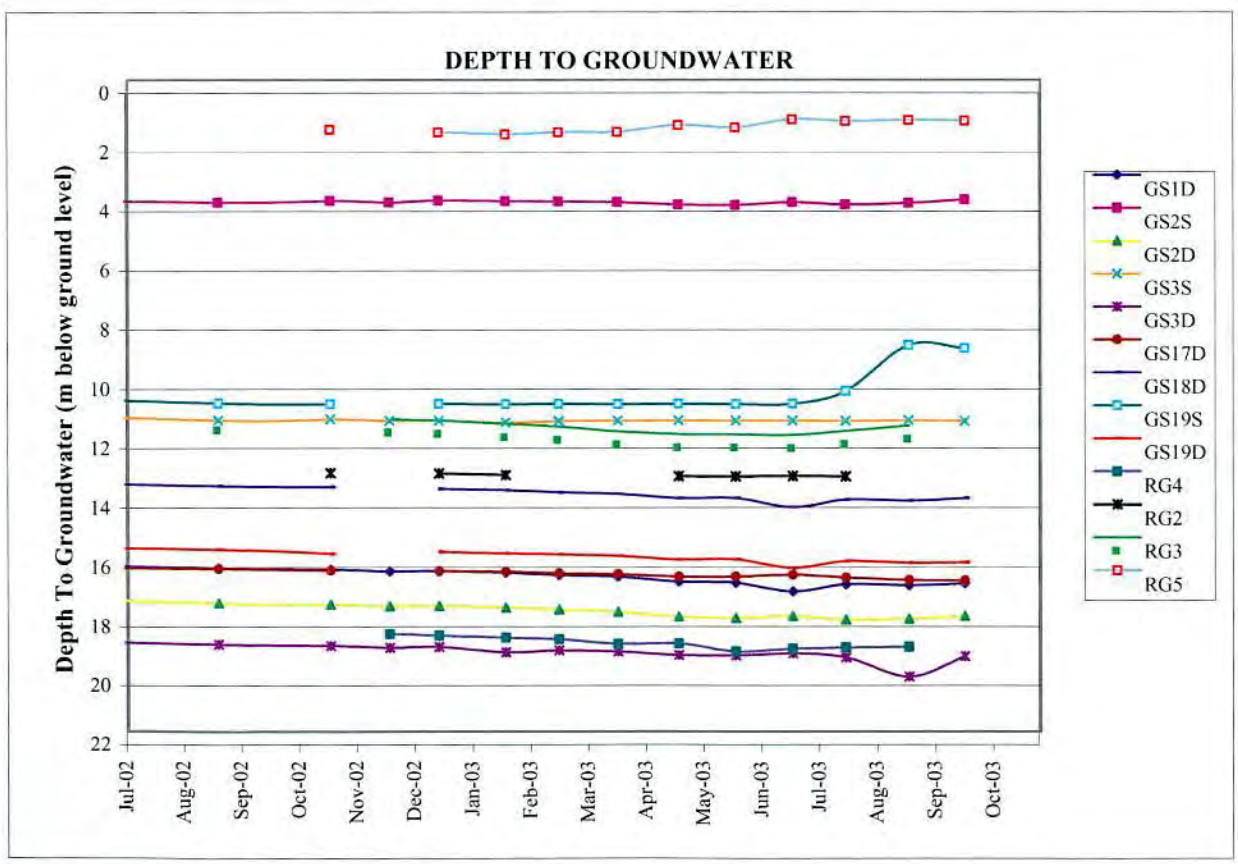
Iluka Resources Limited
GINGIN DEPOSIT - EXTENDED WATER RESOURCE STUDIES

GROUNDWATER AND SURFACE WATER MONITORING SITES

Figure 2

URS





Job No.	44047-071-562	
Prep. By	TH	8 Nov. '03
Chk'd By	IGB	8 Nov. '03
Revision No.		1

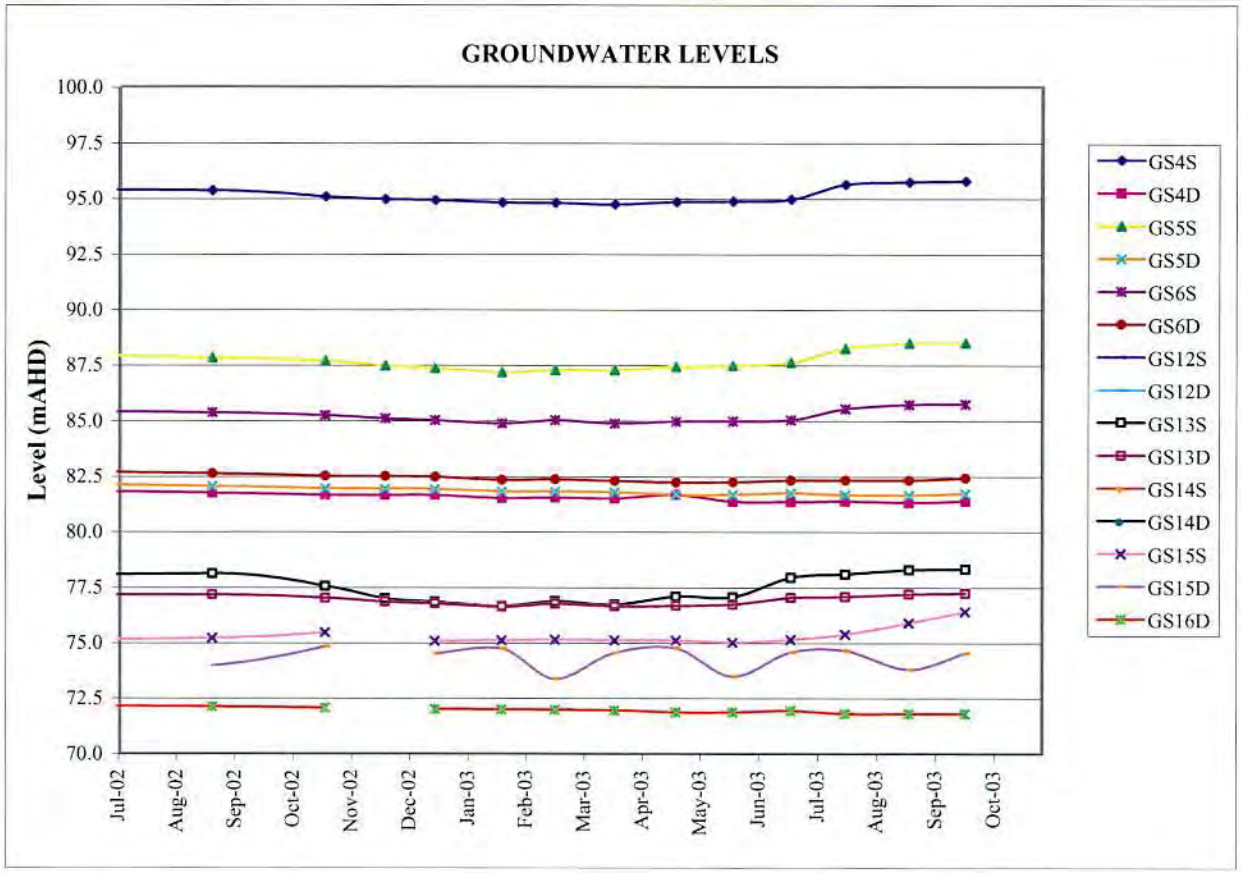
Iluka Resources Limited
GINGIN DEPOSIT - EXTENDED WATER RESOURCE STUDIES

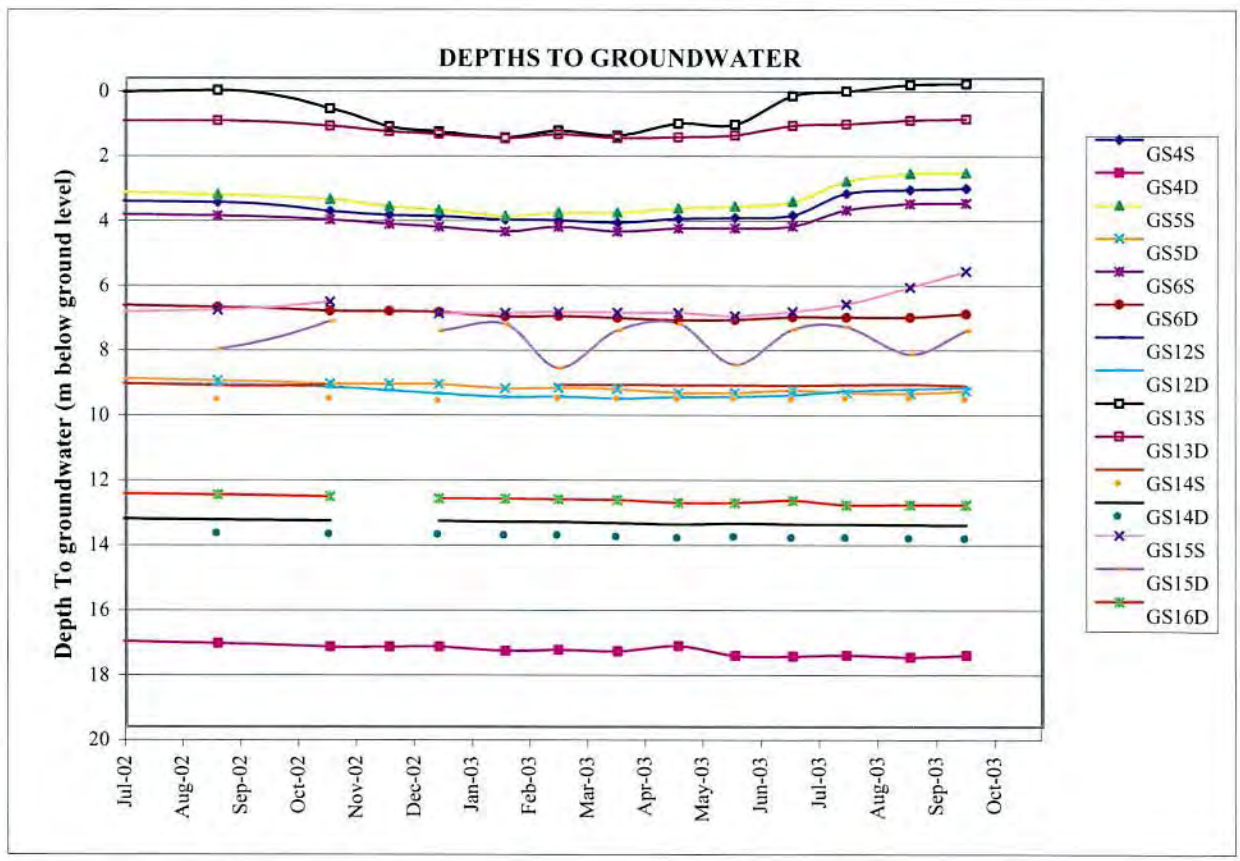
SUPERFICIAL FORMATIONS GROUNDWATER LEVELS

NORTHERN AREA

URS
Dames & Moore
Woodward Clyde

Figure 3a



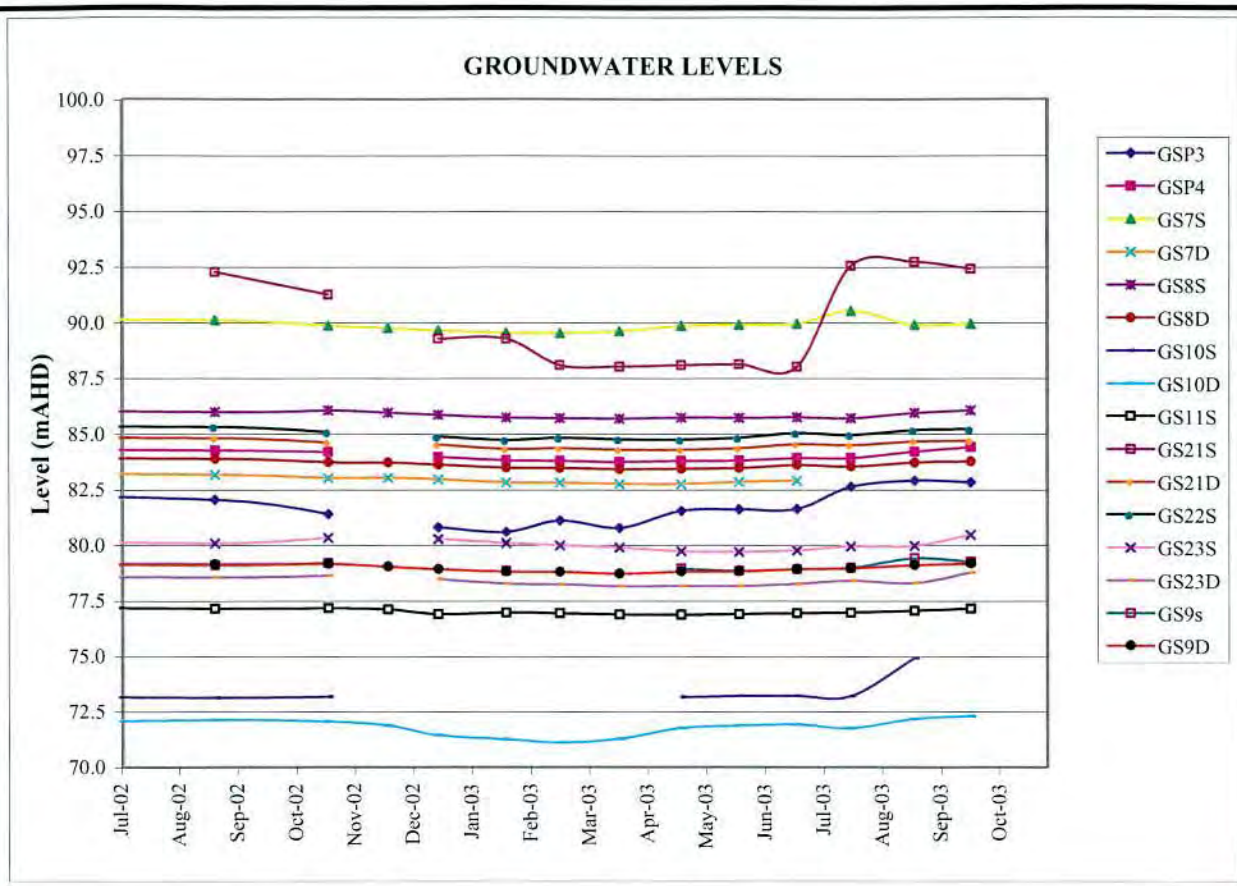


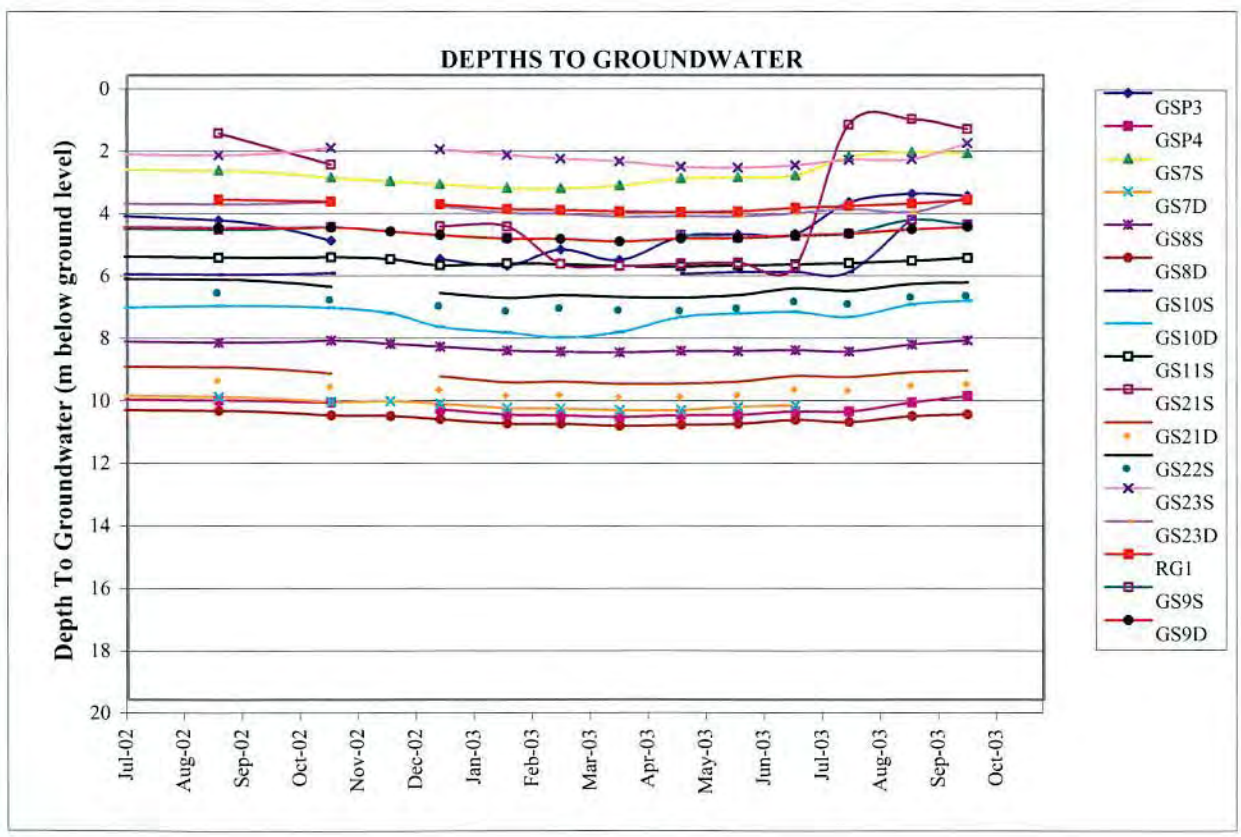
Job No.	44047-071-562	
Prep. By	TH	8 Nov. '03
Chk'd By	IGB	8 Nov. '03
Revision No.	1	

Iluka Resources Limited
GINGIN DEPOSIT - EXTENDED WATER RESOURCE STUDIES
SUPERFICIAL FORMATIONS GROUNDWATER LEVELS
CENTRAL AREA

URS
Dames & Moore
Woodward Clyde

Figure 3b



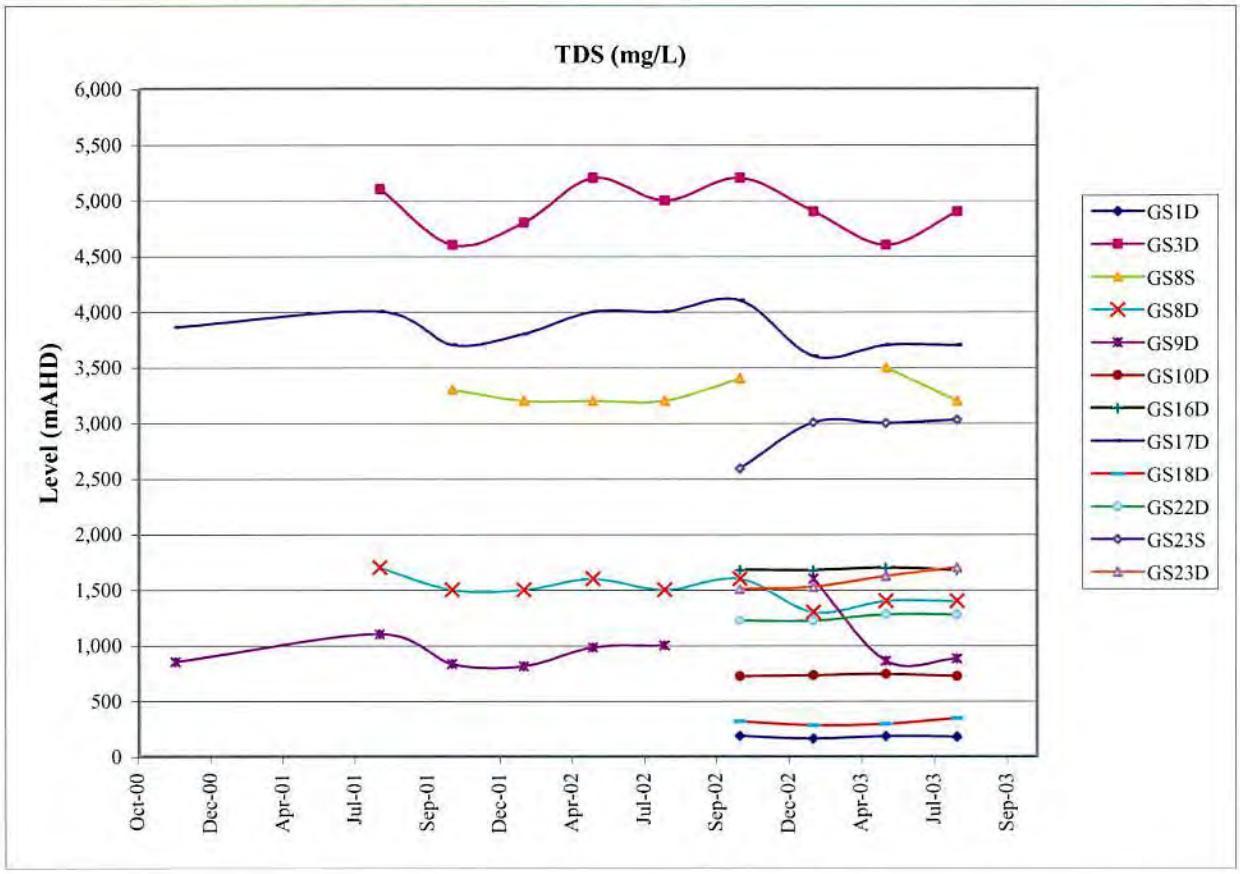


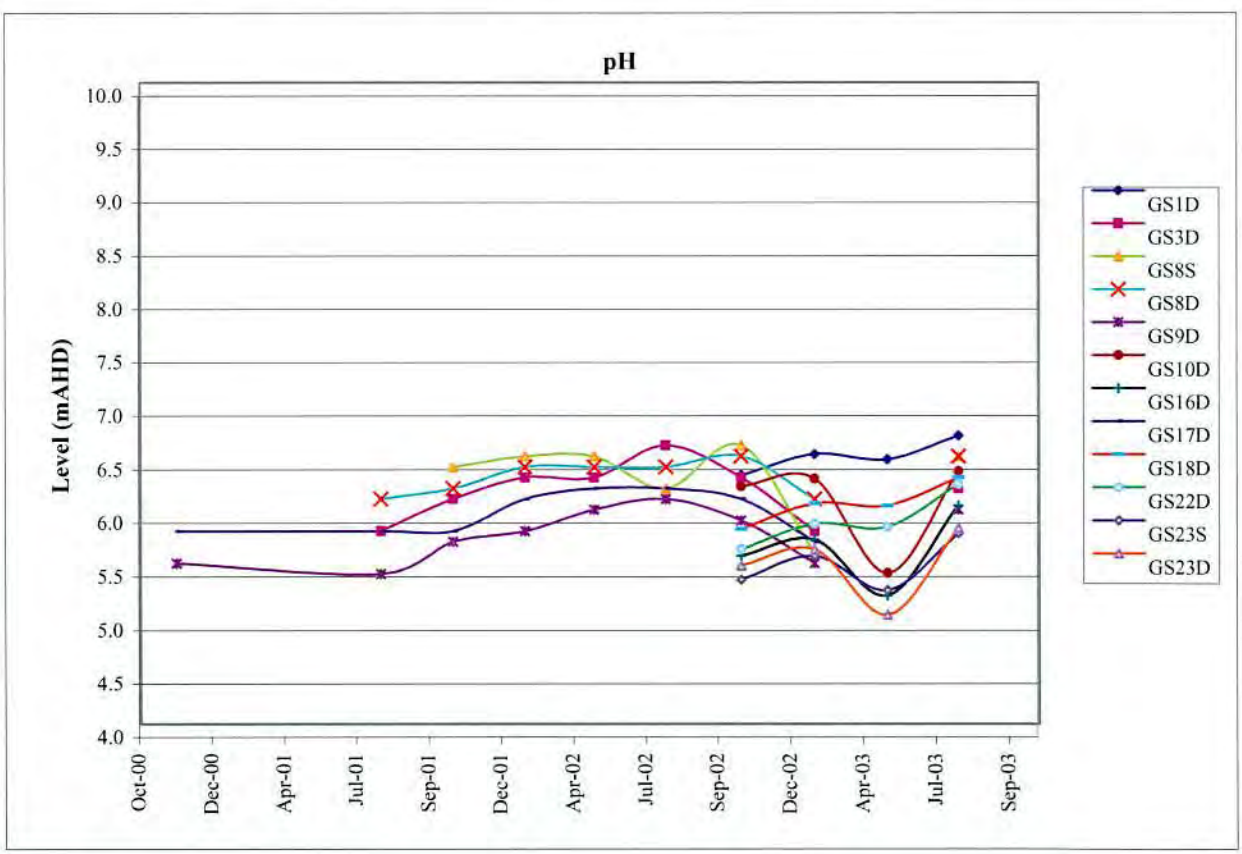
Job No.	44047-071-562	
Prep. By	TH	8 Nov. '03
Chk'd By	IGB	8 Nov. '03
Revision No.		1

Iluka Resources Limited
GINGIN DEPOSIT - EXTENDED WATER RESOURCE STUDIES
SUPERFICIAL FORMATIONS GROUNDWATER LEVELS
SOUTHERN AREA

URS
Dames & Moore
Woodward Clyde

Figure 3c



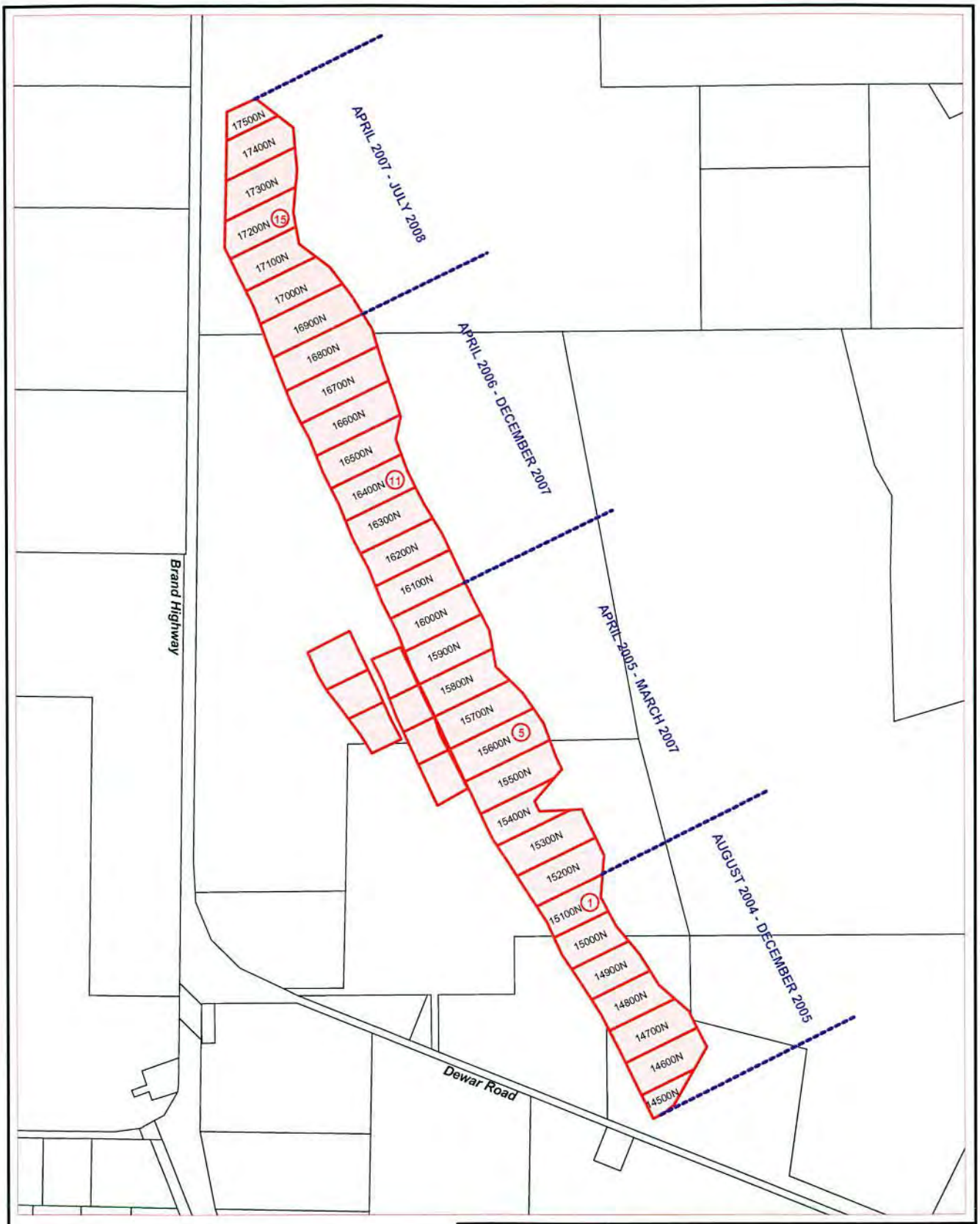


Job No.	44047-071-562	
Prep. By	TH	8 Nov. '03
Chk'd By	IGB	8 Nov. '03
Revision No.		0

Iluka Resources Limited
GINGIN DEPOSIT - EXTENDED WATER RESOURCE STUDIES
SUPERFICIAL FORMATIONS GROUNDWATER QUALITY
pH and TDS

URS
Dames & Moore
Woodward Clyde

Figure 4



Legend

(11) Mining Blocks

Cadastre

N

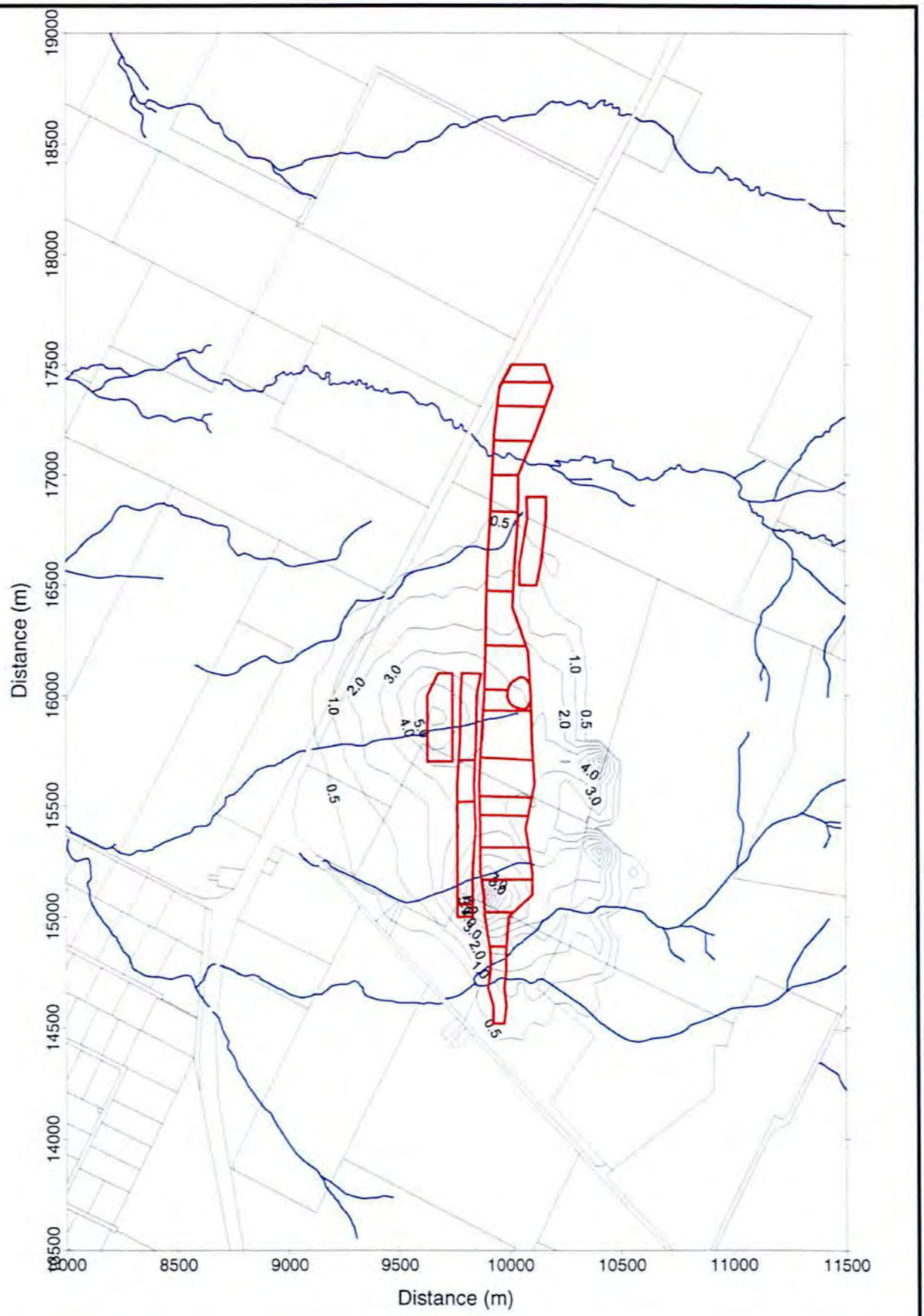
0 250 500 750 1000 Meters

ILUKA

GINGIN MINERAL SANDS PROJECT

PROPOSED MINING SEQUENCE

ORIG : L.Sadler			
DRAWN : S.P.			
SCALE : 1:15,000			
DATE : 20 FEB 2004	DWG No : 136876 ver.00	**FIGURE : 5**	



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

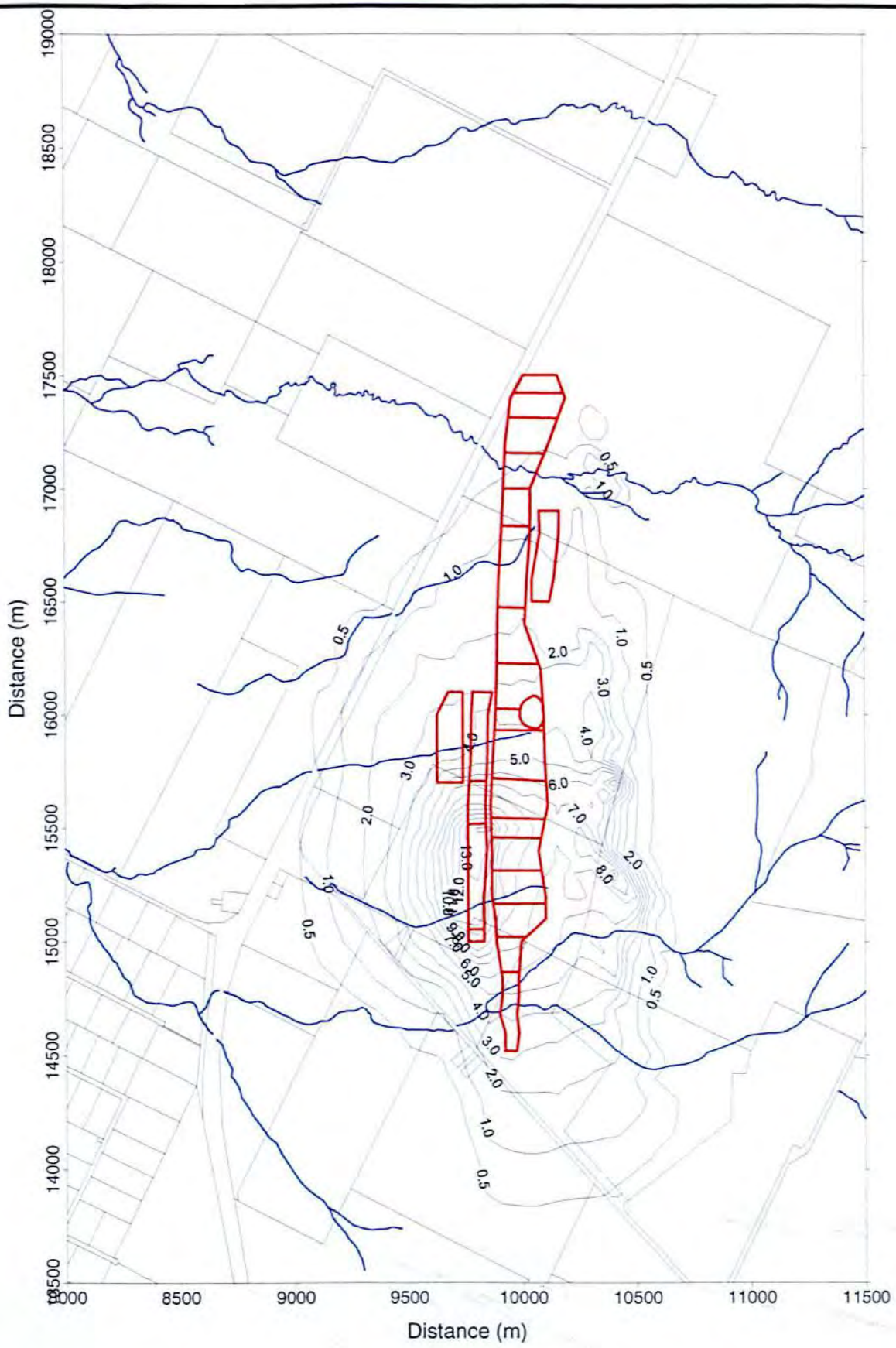
SIMULATED DRAWDOWN MINING MINE BLOCK 1 - AUG 2003

Figure 25a

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig25a.srf



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

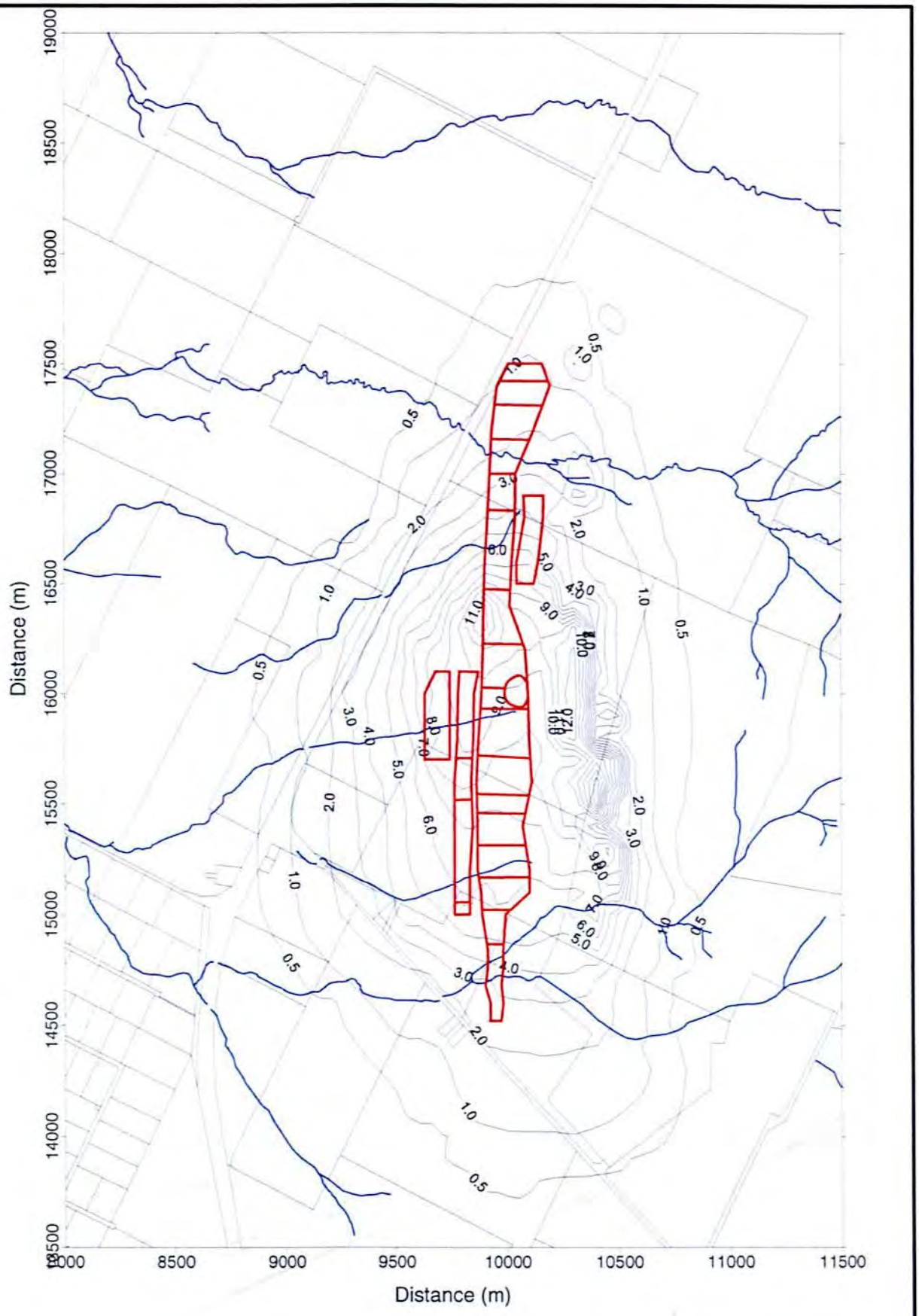
SIMULATED DRAWDOWN MINING MINE BLOCK 5 - APR 2004

Figure 25d

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig25d.srf



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

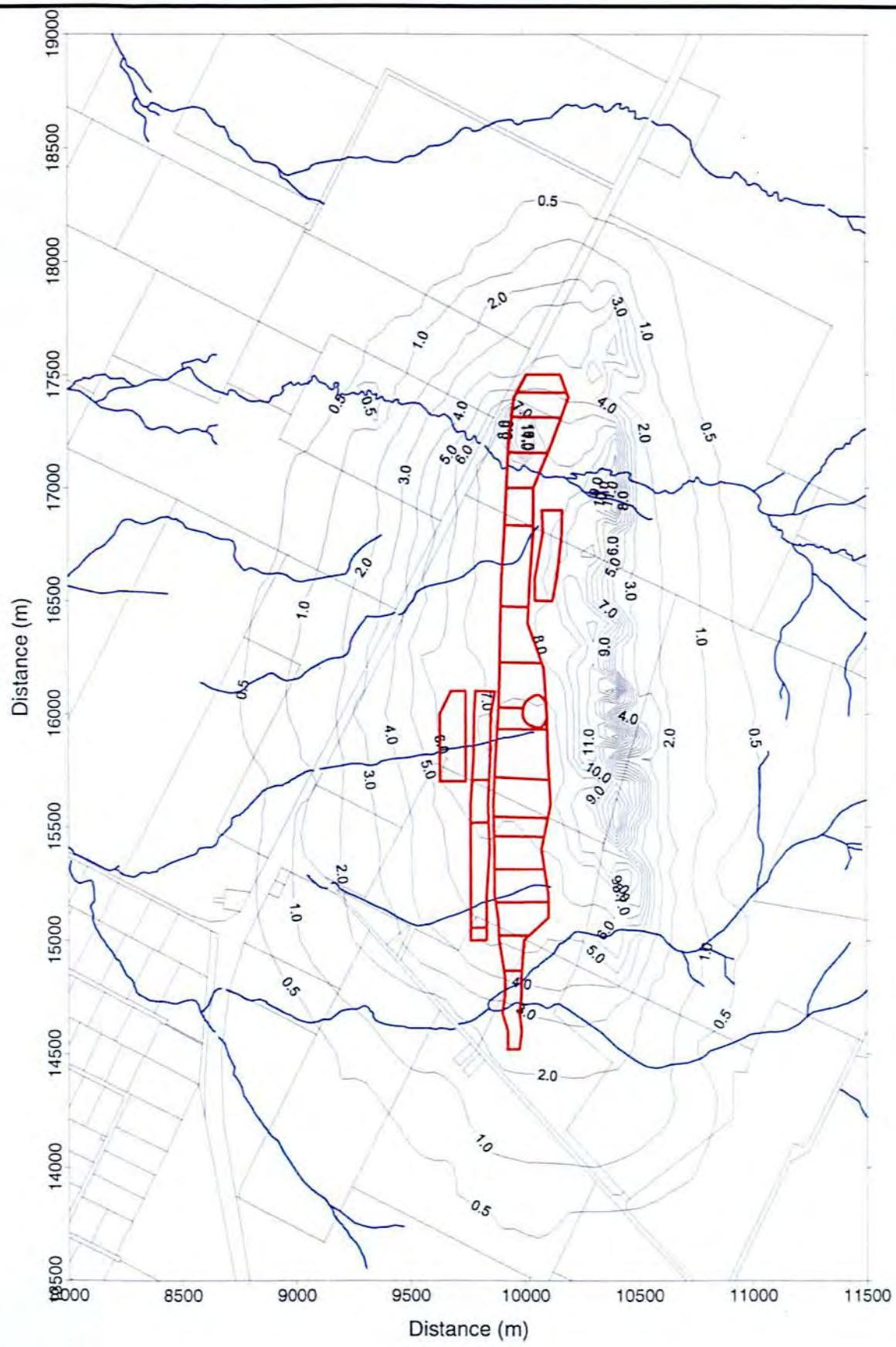
SIMULATED DRAWDOWN MINING MINE BLOCK 11 - APR 2005

Figure 25e

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig25e.srf



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

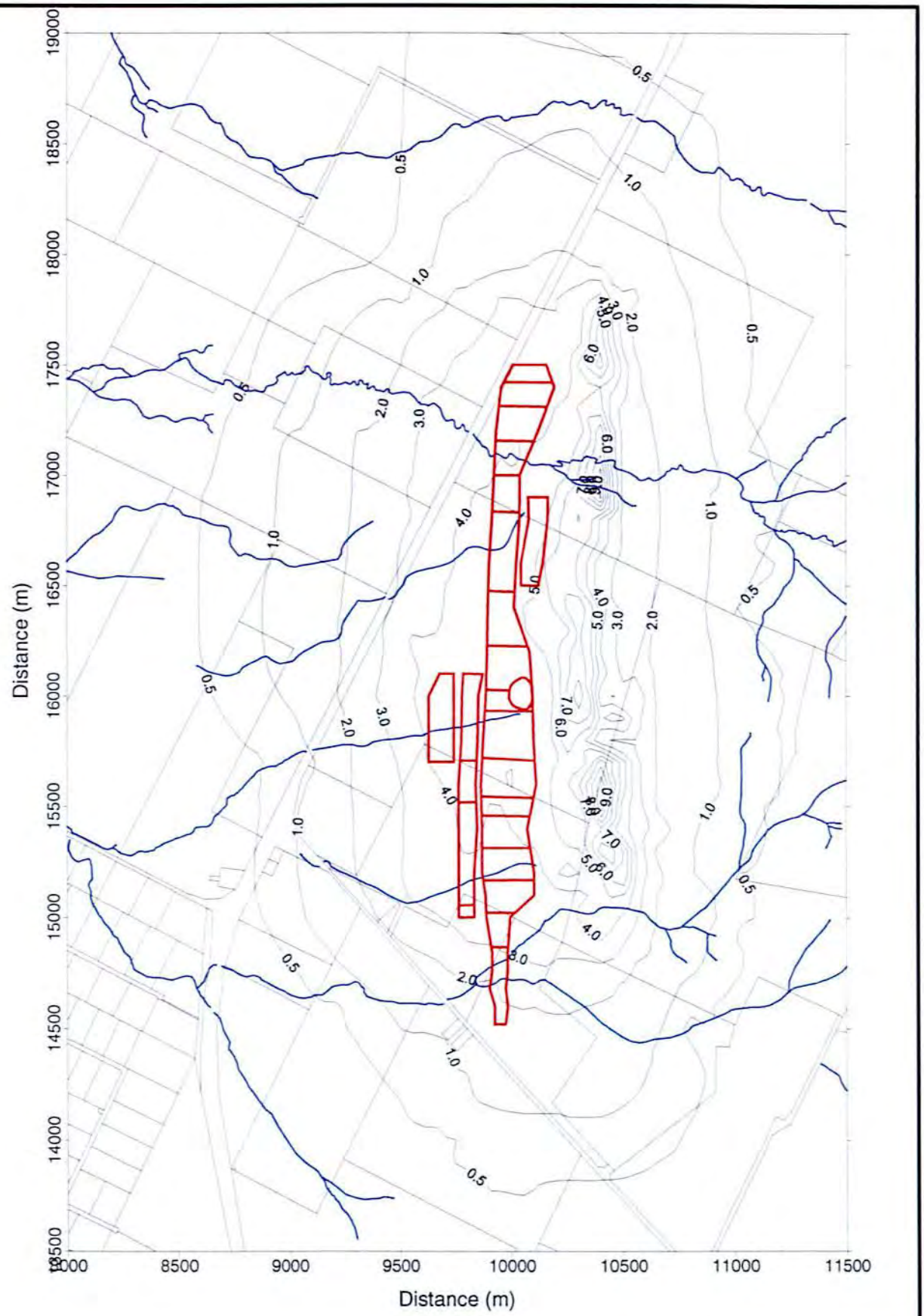
SIMULATED DRAWDOWN MINING MINE BLOCK 15 - DEC 2005

Figure 25f

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig25f.srf



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

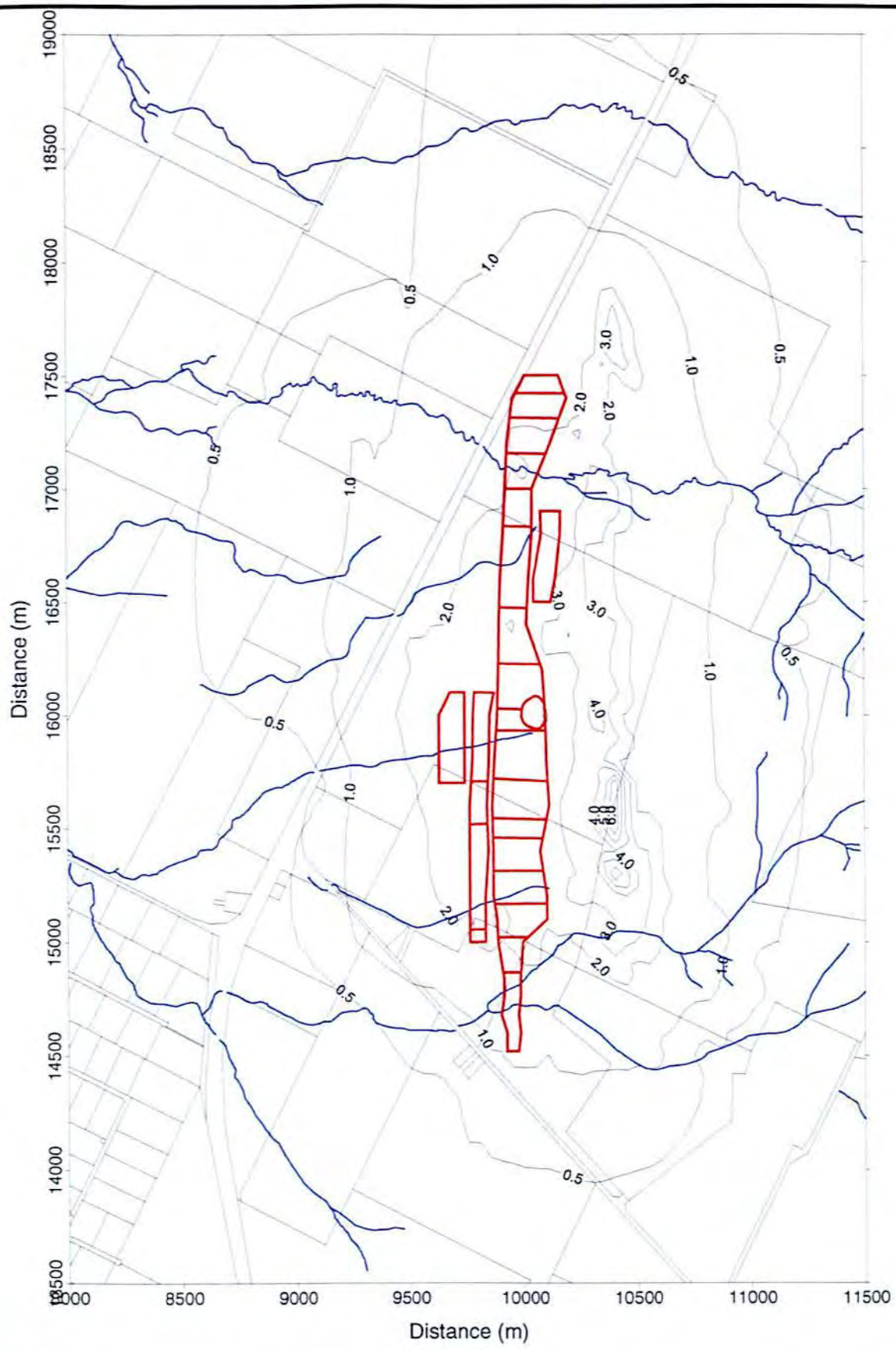
SIMULATED WATER TABLE RECOVERY
RESIDUAL DRAWDOWN ONE YEAR AFTER MINING

Figure 26a

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig26a.srf



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

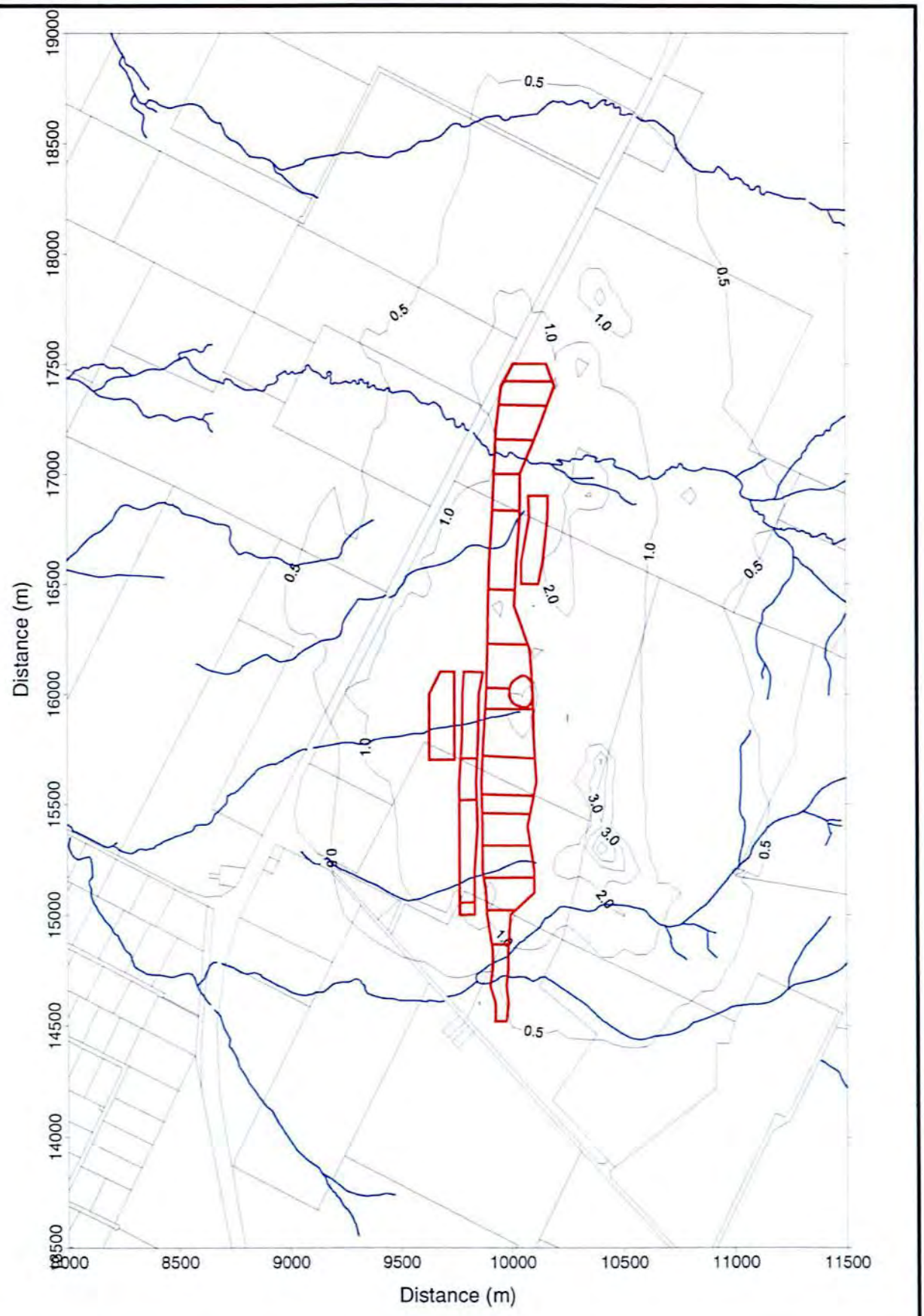
SIMULATED WATER TABLE RECOVERY
RESIDUAL DRAWDOWN THREE YEARS AFTER MINING

Figure 26c

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig26c.srf



Job No.	44047-018-071	
Prep. By	ECPL	26 Apr '01
Chk'd By	IGB	26 Apr '01
Revision No.		0

Iluka Resources Limited

GINGIN DEPOSIT - IMPACTS OF MINING ON SHALLOW GROUNDWATER RESOURCES

SIMULATED WATER TABLE RECOVERY
RESIDUAL DRAWDOWN FIVE YEARS AFTER MINING

Figure 26e

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

fig26e.srf

APPENDIX B

Noise Management Plan

ILUKA

Iluka Resources Limited

Noise Management Plan

Gingin

May 2004

Rev	Description	Author	Date
0.1	Noise Management Plan	LS/SJ	18/05/2004

TABLE OF CONTENTS

Table of Figures

Appendices

1. INTRODUCTION

Iluka Resources is proposing to establish a mineral sands mine at Gingin. The Pre-Feasibility Studies (PFS) in which the option for the Project is selected has been completed. The Detailed Feasibility Studies (DFS) in which the selected option is fully detailed and costed are underway. The DFS will be completed by the end of 2004. Following the receipt of all external and internal approvals, the project will be implemented in 2005.

The *Environmental Protection (Noise) Regs 1997* stipulate noise levels within which operations must operate. Iluka Resources Limited (Iluka) has committed in the Environmental Assessment of the Proposed Gingin Mineral Sands Project, to ensure that noise emissions comply with statutory requirements, and to investigate any complaints received. Furthermore, Iluka's Environment, Health and Safety Policy states that the Company will:

- comply with all legislative requirements; and
- understand and work to meet the expectations of the community.

Noise from the Gingin operations is expected to originate from fixed plant, conveyors and mobile equipment (URS, 2003).

1.1 Purpose

This plan is designed to provide for the management of noise caused by operations at the Gingin Mineral Sands Deposit.

The purpose of this document is to define a management strategy whereby Iluka can be successful in preventing noise from the operations exceeding regulatory levels and/or causing a nuisance to adjacent residences.

The implementation of the management strategy will result in the operation staying within the regulatory limits for noise emissions.

This management plan will be kept under review using information from ongoing monitoring and observation. Should it be found to be beneficial to adjust either the monitoring regime or management strategy, or implement other remedial measures, this will be done in consultation with the Noise Branch of the DoE.

2. BASELINE NOISE MODELLING

2.1 Background

An environmental noise assessment of Iluka's proposed mineral sands mine at Gingin was undertaken by SVT Engineering Consultants in October 2002, and an update to that study was conducted in October 2003.

In the original study, an acoustic model of the proposed facility was developed and used to provide noise contours for the area surrounding the mine. The noise

model was also used to predict noise levels at six noise sensitive locations in the vicinity of the mine site under worst-case meteorological conditions for sound propagation towards each of the noise sensitive locations (SVT, 2002). These locations can be seen in Figure 1. Location C is a temporary residence.

The assumed operating conditions used in the model (SVT 2002) were:

Item	Operating conditions assumed: Daytime	Operating conditions assumed: Night-time
Overburden Stripping	2 scrapers and 2 trucks south of hopper 1 scraper and 1 truck north of hopper	
Ore Mining	1 scraper south of hopper	1 scraper south of hopper
HMC Transport	1 road train at entrance to mine site	
Screenhouse	Operational	Operational
Concentrator	Operational	Operational
Conveyor	Southern section operational for hopper locations 1-3; northern section operational for hopper locations 4-5	Southern section operational for hopper locations 1-3; northern section operational for hopper locations 4-5

The noise levels used in the acoustic model in 2002 for the fixed plant, conveyors and the mobile equipment assumed no specific noise control treatments. This original study found that noise levels would exceed regulatory noise limits at all locations unless significant noise mitigation measures were included. It was found that noise reduction was required for all equipment at the mine site including the screen house, concentrator plant, conveyors and mobile equipment (SVT, 2002).

The 2003 noise assessment comprised of updating the 2002 model using noise level data collected for similar equipment at existing Iluka operations. That is, noise control treatments were included in the 2003 assessment. Treatments modelled included:

- 5 m high bunds on either side of the conveyor;
- modelling assumed the conveyor is designed and operated to run using a combination of low noise idlers and low belt speed to emit less than 70 dB(A);
- 12 m high bunds on the southwest and southeast side of the screen house; and
- modified ore scraper and/or loader operating at night to a 105 dB(A) limit.

The remaining mobile equipment (overburden scrapers and haul trucks) has not been modelled with noise attenuation.

The updated assessment included conducting ambient noise monitoring at two locations and a review of weather conditions that may result in noise exceedances (SVT, 2003). The conditions assumed for the noise assessment

were the default conditions defined in the EPA Draft Guidance Note No. 8 for assessing noise impacts for new proposals (URS, 2003).

The sound power levels used in the model are displayed in Table 1 below.

Table 1: Sound Power Levels used in 2003 SVT noise assessment

	Octave Band Sound Power Levels – dB (lin)								Overall	
Item	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(lin)**	**dB(A)**
Concentrator	103	102	100	95	99	97	95	88	108	103
Screenhouse	116	113	109	108	106	105	101	95	119	112
Conveyor (1km)	106	107	101	104	101	94	88	80	112	105
Hoppers	105	97	93	95	97	93	87	75	107	100
Overburden Scrapers	111	111	111	112	110	107	102	94	118	115
Ore Scraper / Loader	103	110	101	103	99	99	94	88	112	105
Haul Trucks	112	110	105	107	105	103	98	90	116	110
Road Truck	108	109	108	105	104	105	100	94	116	110

Taking into account land use surrounding the proposed mine and traffic volume on the Brand Highway, the noise limits that apply at all of the six noise sensitive premises adjacent to the mine have been summarised in Table 2. These noise limits must be met 90% of the time (URS, 2003).

Table 2: Noise Limits at Surrounding Noise Sensitive Premises

Time and Day	Limit
0700 to 1900 hours Monday to Saturday	45 dB(A)
0900 to 1900 hours Sunday and public holidays	40 dB(A)
1900 to 2200 all days	40 dB(A)
2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 dB(A)

2.2 Results

Modelling carried out by SVT in 2003 indicates that it is possible that the assigned noise levels could be exceeded at four of the six noise sensitive receivers for day-time and all of the receivers for night-time operation under worst-case sound propagation conditions greater than 10% of the time. The particular locations affected, and the degree of the exceedances varies with the operating scenario considered (URS, 2003). Table 3 below summarises the predicted noise levels at each noise sensitive receiver (URS, 2003), and the percentage of time the limits are exceeded is shown in Table 4.

Table 3: Adjacent Noise Sensitive Conditions under the Worst-Case Scenario

Noise Sensitive Premise	Day-Time Noise Levels	Night-Time Noise Levels	Worst-case wind direction	Hopper Location
Residence A	42 dB(A) to 51 dB(A)	41 dB(A) to 47 dB(A)	north	1
Residence B	44 dB(A) to 50 dB(A)	34 dB(A) to 37 dB(A)	north-east	1
Residence C	38 dB(A) to 51 dB(A)	38 dB(A) to 42 dB(A)	south-west	5
Residence D	33 dB(A) to 48 dB(A)	27 dB(A) to 37 dB(A)	south-west	5
Residence E	41 dB(A) to 50 dB(A)	34 dB(A) to 38 dB(A)	north-east south-east	1,3 1
Golf Club	37 dB(A) to 52 dB(A)	31 dB(A) to 39 dB(A)	north	1

The following summary of SVT's results has been adapted from the updated noise assessment (SVT, 2003). Shaded cells represent those locations which are expected to receive noise levels exceeding the assigned levels greater than 10 per cent of the time.

Table 4: Worst Case Percentage Exceedances

Location	Day / Night	Worst Case Percentage Exceedance		
		Hopper Location 1	Hopper Location 3	Hopper Location 5
Residence A	Day	10	0	0
Residence B	Day	**19**	8	0
Residence C	Day	0	0	**21**
Residence D	Day	0	0	5
Residence E	Day	**15**	0	0
Golf Club	Day	7	**14**	0
Residence A	Night	**15**	0	0
Residence B	Night	**22**	**15**	0
Residence C	Night	**16**	**16**	**32**
Residence D	Night	0	0	**16**
Residence E	Night	**19**	0	0
Golf Club	Night	**16**	0	0

The principal sources of noise will be from fixed plant, conveyors and mobile equipment. Noise from mobile plant (scrapers, haul trucks, loaders, etc) is the major contributor to noise above the assigned levels. SVT recommended that low noise equipment should be sought, particularly for night time operations (SVT, 2003). The modelling indicates that noise modifications are necessary for mobile equipment, namely overburden scrapers and haul trucks.

Even with low noise equipment it may not be possible to achieve compliance with the *Environmental Protection (Noise) Regulations 1997* at all times. Therefore it was recommended that a noise management program be developed which incorporates both noise and weather monitoring to ensure that noise levels remain below the assigned levels (SVT, 2003).

The fixed plant does not significantly contribute to noise levels with the noise treatments modelled, with the exception of location C, where the screen house can be a significant contributor under worst-case meteorological conditions (SVT, 2003).

Modelling shows that bunding on the southwest and southeast sides of the screenhouse lowers noise emissions from that source. Additional bunding will be required on the north side of the screen house to minimise noise emitted in the direction of residence C.

3. NOISE MITIGATION

The noise mitigation measures detailed below include those which were incorporated into models in the 2003 noise assessment (SVT 2003) and those

which were determined by this assessment to be necessary additions in order to achieve compliance with noise regulations.

3.1 Bunding

Overburden and topsoil bunds will be established at several locations. These are generally between 2 and 5 m high (Figure 1). These bunds may reduce the noise levels at some residences.

5m high noise barriers will also be used to limit noise impacts from the conveyor (Figure 2). It is proposed to establish either an earth bund or constructed wall of Hebel blocks or colorbond fencing. These options are being studied and costed as part of the DFS.

Bunding will also be used to mitigate noise from the screen house (refer to section 3.3.1).

3.2 Mobile Equipment

Low noise equipment will be sought for all mobile equipment. Iluka will aim to limit noise levels from each individual piece of mobile equipment to a sound power level of105 dB(A).

Possible modifications to mobile equipment may include high attenuation exhaust silencers and reducing noise breakout from engine casing and cooling fans (SVT, 2003). Discussions have been initiated with the mining contractor on the selection of mobile equipment for the Gingin Project. The Sound Power Levels of any new mobile equipment with be reviewed and signed off prior to purchase.

Liaison will be undertaken with the DoIR regarding an alternative safety system to reversing beepers on mobile mining equipment, for example flashing lights.

3.3 Fixed Plant

During the detailed design and construction phase, attention will be paid towards ensuring appropriate noise controls are designed within the equipment. These are outlined for the key sources of fixed plant noise in the following sections.

3.3.1 Screen House

Noise mitigation measures on the screenhouse will be implemented with the aim of achieving a total sound power level of less than 100 dB(A)). Proposed initiatives include:

- installing 12 m high bunds on the southwest and southeast sides of the screen house as modelled;
- installing additional bunding on the northern side – a continuation of the modelled bunds; and

- orientating the screen house such that the highest noise levels are directed away from location C.

Materials for building the bunds are being assessed as part of the DFS. Due to the height requirement of the bunds it is likely that these will be a non-earthen wall (ie Hebel blocks).

3.3.2 Concentrator

Two sides of the concentrator proposed for Gingin are fully enclosed with noise cladding affixed. No further noise mitigation measures are required for the concentrator at this stage.

3.3.3 Conveyor

Noise from the conveyor must be reduced to 70 dB(A) or less. This will be achieved by:

- a combination of low noise idlers and low running speeds will be used to minimise noise from the conveyor;
- conveyor drive motors will be reduced noise units; and
- 5m high bunds made of non-earthen materials will run parallel to the conveyor on both sides.

3.3.4 Hopper

The location of the hopper 5 to 10 m below the surface of the mine will reduce noise from this source.

Feed chutes and hoppers may require resilient linings to reduce impact noise.

3.3.5 Stationary Engines

Sump pumps and other stationary engines will preferentially be electric rather than diesel. In procuring stationary engines for site, noise emissions will be taken into consideration.

3.3.6 Maintenance Workshop

The maintenance workshop will be open on one side. This side will be directed away from the nearest residence. General maintenance activities will be conducted during daytime only. Where emergency maintenance is required to be carried out during night-time, noise emissions will be minimised and monitored.

3.4 Transport

HMC trucks will be required to switch engines when not in use.

HMC truck noise will be monitored during operations and further noise mitigation measures implemented if necessary. At this stage it is not considered to be a significant noise contributor.

3.5 Commencement Testing

All mobile equipment will be noise tested prior to acceptance from the manufacturer.

All equipment, fixed and mobile, will be tested on commencement of operations to highlight the high Sound Power Level equipment and determine areas that may require further modification.

4. CONSTRUCTION

Under Regulation 13 (Construction Sites) of the *Environmental Protection (Noise) Regulations 1997*, Regulation 7 (Prescribed Standard for Noise Emission) does not apply to noise emitted from a construction site as a result of construction work carried out between 7 am and 7 pm on any day excepting Sundays and public holidays, provided that:

- construction work is carried out in accordance with control of environmental noise practices set out in section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites;
- the equipment used is the quietest reasonably available; and
- a noise management plan in respect of the construction site is prepared, approved by the CEO and adhered to during construction.

Noise levels during the construction phase prior to the completion of noise bunds may not comply with the noise regulations, however the above conditions will be adhered to. This Plan encompasses the construction and operational phases.

5. OPERATION

During operations noise levels will be monitored and managed to ensure that noise requirements are met. The modelling shows which premises are noise sensitive at hopper locations 1, 3 and 5. This can be used to extrapolate which premises are likely to be noise sensitive at hopper locations 2 and 4. A continuous noise and weather monitoring system will be used in conjunction with the modelling to enable noise levels to be monitored.

Where noise levels are exceeded, the number of items of equipment operating simultaneously will be reduced until noise limits are reached; and/or relocated to another section of the mine.

5.1 Continuous Monitoring System

Weather conditions (wind direction and speed) will be monitored continuously at the plant site in order to identify unsuitable weather conditions which result in noise exceedances and allow appropriate management measures to be implemented.

Monitoring of wind direction will also enable locations known to be susceptible to noise impact under certain weather conditions to be monitored more closely under these conditions.

It is proposed to have continuous noise monitors throughout the life of the mine to monitor noise levels at noise sensitive locations. The monitors will need to be able to be placed at the most sensitive locations for each hopper location. Possible noise monitoring equipment is currently being reviewed as part of the DFS.

The system will be required to enable the control room operator to determine when equipment needs to be relocated or shutdown to meet noise levels. An appropriate system is currently being investigated as part of the DFS. Once an appropriate system is developed control room operating procedures will be put in place.

5.2 Managing Noise

Hopper locations 1, 3 and 5 were modelled to determine which receiving locations were at risk of exceedances. The locations susceptible to exceedances greater than 10 per cent of the time, and the most appropriate location for noise monitors under whilst operating at these hopper locations are shown below, under each hopper location.

In addition, each location modelled to exceed noise limits under worst case sound propagation conditions for each of the eight cardinal wind directions is shown in tables for day time and night time, for each of the 3 modelled hopper locations. These tables will be used as the basis for the management of operations, to prevent noise at noise sensitive locations, however, over time will be superseded by monitoring data obtained from the monitoring system from the commencement of operations.

5.2.1 Hopper Location 1

When the hopper is in location 1, Residence B and Residence E are susceptible to exceedances greater than 10 per cent of the time during the day and all locations except Residence D are susceptible to exceedances greater than 10 per cent of the time at night, under the treatments modelled in 2003 (SVT, 2003). The addition of bunding on the north side of the Screen House, as outlined in section 3.3.1 should prevent night time noise exceedances at Residence C.

It is proposed that when the hopper is in location 1, continuous noise monitors are placed near residents E and B.

Based on point calculations performed at each receiving location for calm conditions and worst case sound propagation conditions (4 m/s) in each of the eight cardinal wind directions (SVT, 2003), the following conditions have been found to represent a potential noise exceedance at hopper location 1:

Table 5: Potential noise exceedances at hopper location 1 during day time

Wind Direction	Residences at Risk of Exceedance	
	Monday to Saturday	Sundays and Public Holidays
Calm	-	B and E
N	A, B and Golf Club	A, B, E and Golf Club
NE	A and B	A, B, E and Golf Club
E	B and E	B and E
SE	E	B and E
S	E	B and E
SW	-	E
W	-	B and Golf Club
NW	A and Golf Club	A, B and Golf Club

Table 6: Potential noise exceedances at hopper location 1 during night time

Wind Direction	Residences at Risk of Exceedance	
	7 pm to 10pm	After 10 pm
Calm	-	-
N	-	A, B and Golf Club
NE	-	A and B
E	-	B and E
SE	-	E
S	-	E
SW	-	-
W	-	-
NW	-	Golf Club

5.2.2 Hopper Location 3

When the hopper is in location 3, the Golf Club is susceptible to exceedances greater than 10 per cent of the time during the day and Residences B and C are susceptible to exceedances greater than 10 per cent of the time at night, under the treatments modelled in 2003 (SVT, 2003). The addition of bunding on the north side of the Screen House, as outlined in section 3.3.1 should prevent night time noise exceedances at Residence C.

It is proposed that when the hopper is in location 3, continuous noise monitors are placed at Residence B and the Golf Club.

Based on point calculations performed at each receiving location for calm conditions and worst case sound propagation conditions (4 m/s) in each of the eight cardinal wind directions (SVT, 2003), the following conditions have been found to represent a potential noise exceedance at hopper location 3:

Table 7: Potential noise exceedances at hopper location 3 during day time

Wind Direction	**Residences at Risk of Exceedance**	
	Monday to Saturday	**Sundays and Public Holidays**

Calm	-	-
N	B	A, B and Golf Club
NE	B	A, B, E and Golf Club
E	-	B and E
SE	-	-
S	-	-
SW	-	-
W	-	-
NW	-	A, B and Golf Club

Table 8: Potential noise exceedances at hopper location 3 during night time

Wind Direction	**Residences at Risk of Exceedance**	
	7 pm to 10pm	**After 10 pm**
Calm	-	-
N	-	B and Golf Club
NE	-	B
E	-	-
SE	-	-
S	-	C
SW	-	C
W	-	C
NW	-	-

5.2.3 Hopper Location 5

When the hopper is in location 5, Residence C is susceptible to exceedances greater than 10 per cent of the time during the day and Residences C and D are susceptible to exceedances greater than 10 per cent of the time at night, under the treatments modelled in 2003 (SVT, 2003).

It is proposed that when the hopper is in location 5, continuous noise monitors are placed at Residences C and D.

Based on point calculations performed at each receiving location for calm conditions and worst case sound propagation conditions (4 m/s) in each of the eight cardinal wind directions (SVT, 2003), the following have been found to conditions represent a potential noise exceedance at hopper location 5:

Table 9: Potential noise exceedances at hopper location 5 during day time

Wind Direction	**Residences at Risk of Exceedance**	
	Monday to Saturday	**Sundays and Public Holidays**
Calm	C	C
N	-	A, B, C and Golf Club
NE	-	B and C
E	-	C
SE	C	C
S	C	C and D
SW	C and D	C and D

W	C and D	C and D
NW	-	B and C

Table 10: Potential noise exceedances at hopper location 5 during night time

Wind Direction	Residences at Risk of Exceedance	
	7 pm to 10pm	After 10 pm
Calm	-	-
N	-	-
NE	-	-
E	-	-
SE	-	C
S	C	C and D
SW	C	C and D
W	C	C and D
NW	-	-

5.3 Model Verification and Review

Data collected from the continuous weather and noise monitoring will be used to review the noise model and improve operational efficiencies. This will include reviewing what weather conditions cause noise exceedances, defining what equipment causes the noise exceedances and reviewing what combination of weather conditions and noise exceedances result in lodged complaints.

This continuous improvement program will improve noise management at the Gingin site over the life of the operation and improve Iluka understanding of noise issues for future mining operations.

5.4 Workforce Awareness

All company employees and contractors are inducted to ensure that they are aware of their safety, environmental and social obligations. Iluka provides training to develop an understanding of risk management, safe working practices and duty of care. This message is reinforced in a variety of ways, including the implementation of reporting procedures for issues and incidents on site. These reporting procedures ensure that issues and incidents are resolved swiftly. Noise management and awareness will be a specific focus in site inductions at Gingin, to ensure that all employees consider noise emissions as part of their normal daily activities.

5.5 Complaint Management

Iluka has a complaints management procedure already in place for its existing operations, which will also apply to the Gingin operation. The procedure consists of a flow chart outlining the procedure and a public complaint form, completed when a complaint is received. The flow chart and complaint form are included as Appendix 1.

6. CONTINGENCIES

In the event that noise mitigation measures implemented do not reduce noise levels at receiving locations to acceptable levels, the addition of noise treatments to those receiving locations will be investigated.

7. CONSULTATION

Iluka conducts ongoing liaison with the adjoining landowners. This consultation commenced during the feasibility studies and will be continued throughout the construction, operation and closure phases. Landowners will be advised of the sequence of mining and hence when the noise may impact their residence for a limited time.

A 24 hour phone contact name and number will be given to the landowners.

8. REPORTING

The Annual Environmental Report for the Gingin operation will detail compliance with this management plan and noise regulations, activities conducted and monitoring results over the reporting period.

9. REVIEW

This management plan will be reviewed internally by Iluka Environmental personnel on commencement of mining and on an annual basis or more frequently if required due to a change in circumstances.

10. CONCLUSION

The modelling conducted by SVT (2003) represented the worst case scenario. It is believed that the noise mitigation measures that have been incorporated into the project design to date, and those which are currently being investigated and developed will allow the Project to operate within the prescribed limits. Furthermore, the operational management practices described will ensure that, should an exceedance still occur the issue will be addressed.

Actual noise emissions will be quantified on commencement of the operation, to build on the predictions made by the SVT model. These actual noise levels will be used to assess whether the noise mitigation measures and noise management practices implemented are sufficient. Where it is shown that mitigation measures are insufficient, there will be further investigation into, and development of, mitigation and management practices.

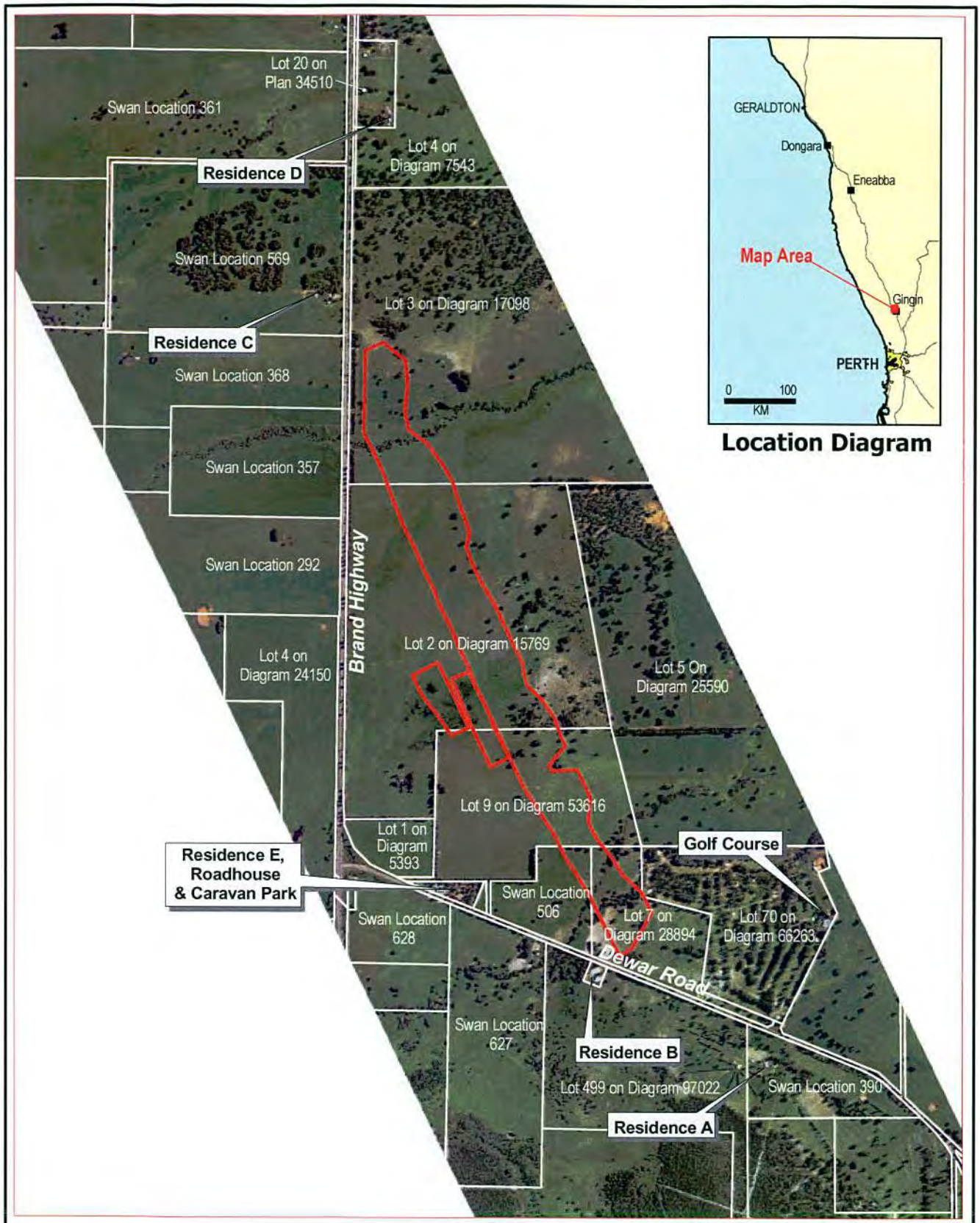
Monitoring of noise produced by the operation will be ongoing, throughout the life of the operation. Continued monitoring will enable early identification of noise sources as the operation develops and allow management practices to be instigated. In addition, continuous monitoring will enable the operations to track their compliance with the Plan.

11. REFERENCES

SVT Engineering Consultants (2002) *Environmental Noise Assessment of the Proposed Iluka Mineral Sands Mine at Gingin.* Prepared for URS Australia Pty Ltd

SVT Engineering Consultants (2003) *Update of Environmental Noise Assessment of the Proposed Iluka Mineral Sands Mine at Gingin.* Prepared for Iluka Resources

URS (2003) *Environmental Assessment of the proposed Gingin Mineral Sands Project: Environmental Referral and Environmental Referral Supporting Document*, URS, East Perth, Western Australia.



LEGEND

Pit Limits

N

0 500 1000 Meters

Date of Photography - 22 Sep 2000

ILUKA

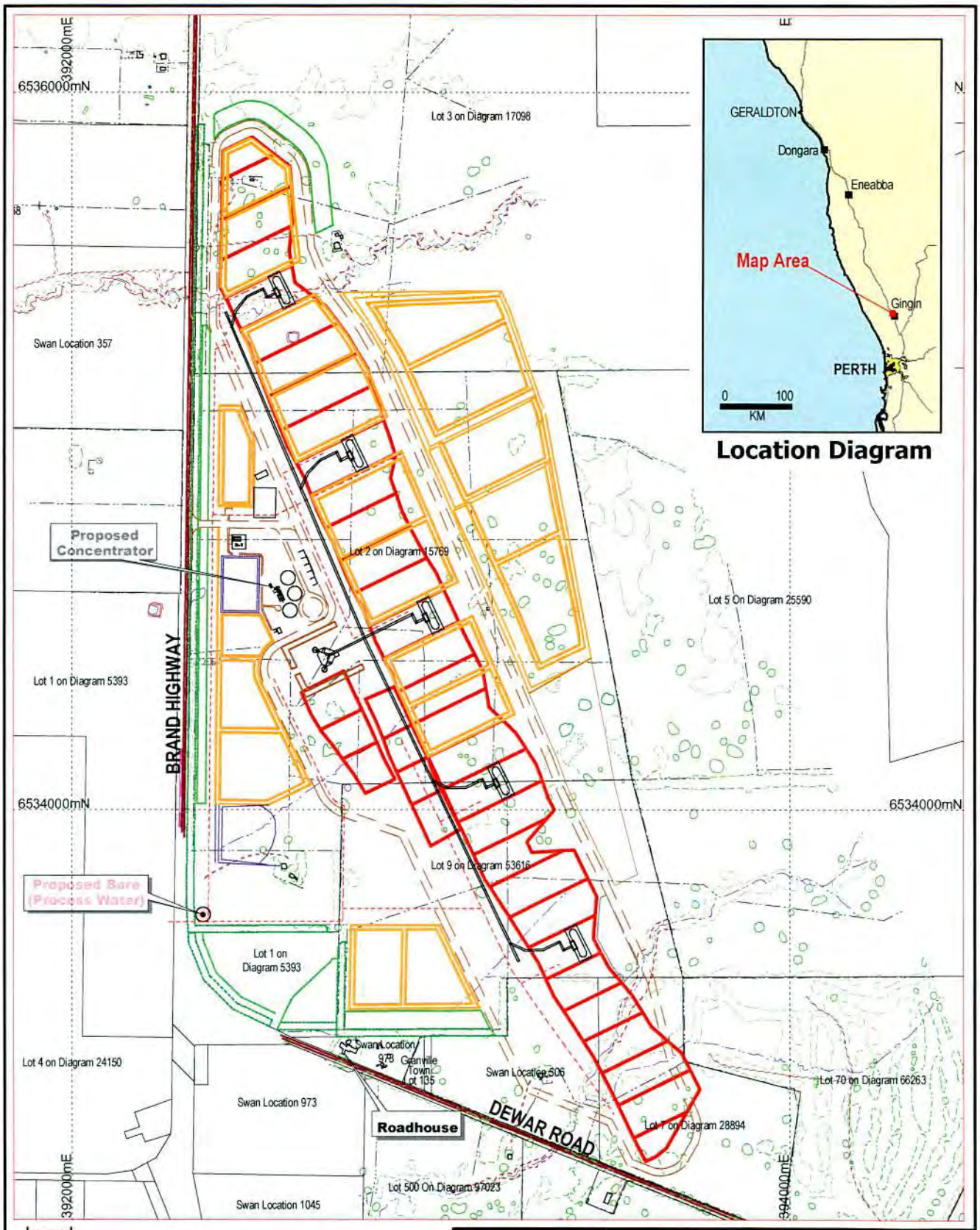
ORIG :	L.SADLER
DRAWN :	S.P.
SCALE :	1:25 000
DATE :	9 DEC 2003

GINGIN DEPOSIT

RESIDENCE LOCATION

DWG No : 125185 ver.00

FIGURE : 1



Legend

- Water Dam
- Infrastructure
- Mine Road
- Mining Area
- Noise Bund
- Ore Stockpile
- Power
- Solar Drying Dam
- Stockpile
- Topsoil Stockpile
- Tree Belt
- Proposed process water bore

0 400 800 Meters

MGA Coordinates, GDA94

N

ILUKA

GINGIN DEPOSIT

SITE LAYOUT

ORIG :	L.Sadler		
DRAWN :	S.P.		
SCALE :	1:15,000		
DATE :	12 DEC 2003	DWG No : 122175 ver.02	FIGURE : 2

COMPLAINT RECEIVED

PUBLIC COMPLAINT FORM

WHO ?

Receiver to collect all details, acknowledge caller, & ask for a convenient day & time to call back

Receiver to immediately advise relevant area Shift Supervisor (otherwise Area Manager or On-Call Manager) & give them the Public Complaint Form (with Section 1 complete)

PART A

Section 1 - Details

Within 1 hour of complaint being made

Receiver

Shift Supervisor -

- Advise relevant area **Manager** (or On-Call Manager), site **EH &S Adviser** (mobile phone).
- Carry out any immediate actions agreed to, which will stop or modify the situation
- Complete Section 2 of the Public Complaints Form & then forward it to the relevant area **Supervisor** or **Manager**

PART A

Section 2 – Immediate Actions

Shift Supervisor

Area Supervisor or Manager -

- Plan actions required to address complaint
- Contact Site **IATS Administrator** to determine if an investigation is already underway.

Is there already a relevant investigation underway?

YES

Enter IATS database number of existing investigation into Section 3 of the Public Complaints Form

NO

Proceed with new investigation

Call back complainant to advise of actions undertaken and complete Section 2 of Public Complaints Form.

Make **ONE** copy of Public Complaints Form & attach to the Investigation Form.

Forward **ORIGINAL** Public Complaints Form to site **EH&S Adviser**

PART A

Section 3 – Follow up

Investigate Complaint

Contact Complainant

Forward Form to EH&S

By end of 2nd working day following complaint

Area Supervisor/Manager

EH&S Adviser to make TWO COPIES of Public Complaints form and Forward one **COPY** to **Community Relations Officer** and forward **ORIGINAL** to **IATS** Administrator

PART B

EH&S and Community Relations - Close Out

3rd work day

EH&S Adviser & Community Relations Officer

EH&S Adviser & Community Relations Officer to coordinate ongoing liaison with complainant & relevant site personnel to ensure outcomes and closure

Until complaint closure

EH&S to advise Community Relations Officer

APPENDIX C

Conceptual Closure Plan

ILUKA

Iluka Resources Limited

Conceptual Closure Plan

Gingin Mineral Sands Project

May 2004

0.1	Gingin Conceptual Closure Plan	URS/Iluka	7/4/2004
Rev	Description	Author	Date

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

Iluka Resources Limited (Iluka) proposes to mine mineral sands at the Gingin Deposit in Western Australia. The Deposit is located approximately 2.5 kilometres (km) west of the township of Gingin and 80 km north of Perth.

1.2 Iluka Policy and Standards

Iluka Resources Limited (Iluka) is committed to ensuring that there is clear accountability, and adequate resources, for the implementation of this Conceptual Closure Plan. Roles and responsibility for managing the technical and financial implementation of this Plan will be undertaken by the Mid-West Environment and Rehabilitation Teams.

The Iluka Group Policy for Operation Closure (Iluka, 2001a) requires that each site prepare and maintain a closure plan appropriate to the circumstances associated with its operations, and that the plan be integrated with the overall operating strategy of the site. As Iluka is currently seeking approval for the Project, the appropriate level of closure plan is a Conceptual Closure Plan.

Iluka is committed to achieving environmentally and socially acceptable closure of all operations. Our desired closure is to prevent adverse long-term environmental impact and to create self-sustaining natural ecosystems or land uses, which are acceptable to the community and other stakeholders. In carrying out our activities, during planning, commissioning, operation, decommissioning and closure phases, Iluka will aim to:

- Consult with all stakeholders during the closure decision making processes;
- Ensure effective planning is undertaken so that closure occurs in an orderly, cost – effective and timely manner;
- Ensure the cost of closure is adequately represented in company accounts;
- Ensure there is clear accountability and adequate resources for the implementation of closure plan;
- Establish a set of criteria and indicators, which will demonstrate the successful completion of each closure project and are agreed with the responsible authority;
- Reach a point where we have met agreed completions criteria, to the satisfaction of the responsible authority, so that we may relinquish the area; and
- Ensure the community is not left with a liability.

This Policy is supported by the following documents:

- Group Policy: Operation Closure (Iluka, 2001a);
- Group Environmental Guideline: Schedule of Closure Rates (Iluka, 2001b);
- Group Environmental Guideline: Operation Closure (Iluka, 2002a); and
- Group Environmental Procedure: Closure Plan Development (Iluka, 2002b).

These documents describe Iluka's commitment to managing its activities in an environmentally responsible manner and to maximise future land use options.

1.3 Purpose and Structure of this Plan

This Conceptual Closure Plan has been prepared to facilitate satisfactory closure of the Gingin Project that prevents adverse long-term environmental impacts and restores a land use that is acceptable to regulators, post-mining land users and other local stakeholders.

The objective of this plan is to provide a framework for closure planning for the mine and mineral processing facilities at Gingin and to identify those issues that need to be addressed as the closure planning process continues.

This is a working draft of the Conceptual Closure Plan. It has been produced for discussion purposes and to obtain further input from Iluka. This report is structured as follows:

Section 1	Introduction	Identifies the Conceptual Closure Plan structure, Iluka management and financial accountability for the development and implementation of the Plan; defines the ownership of the Gingin Project Area and establishes the broad context within which closure will be effected.
Section 2	Project Description	Provides a description of the Gingin Project Area, including a facility description, site history, details on land tenure and environmental characteristics.
Section 3	Closure Objectives	Establishes clear objectives to guide both the further development and implementation of the closure planning for the Project.
Section 4	Completion Criteria	Establishes the final land use and outcomes for successful rehabilitation during and after the mining phase of the Gingin project.
Section 5	Legal and Other Requirements	Summarises the key legislative, company and other requirements relevant to the closure of the Gingin site.
Section 6	Stakeholder Consultation	Identifies the internal and external stakeholders such as employees, Government departments, landholders, the local community and other parties that should be consulted as part of the conceptual closure planning process for the Gingin site and defines their interest in the project; and identifies the stakeholder consultation process.
Section 7	Rehabilitation	Describes the progressive rehabilitation that will be implemented during the operational phase of the site and the "end of life" restoration that will be carried out once production has ceased.
Section 8	Decommissioning	Describes the physical closure of the facility post-mining, including any deconstruction, remediation and reclamation requirements; and identifies maintenance and monitoring required for the site through to relinquishment.
Section 9	Mine Closure Costs and Provisioning	Identifies assumptions made during costing and the basis on which these costs and provisions have been calculated and care taken to ensure rehabilitation funding is provided for.
Section 10	Documentation	Identifies the environmental documentation required in relation to the different stages of planning for, and implementing, site closure; and outlines the review period for this plan.
Section 11	References	Lists those references cited in this report.

2 PROJECT DESCRIPTION

The proposed minesite located in a rural setting is characterised by a gently sloped, undulating plain at the base of the Darling Escarpment. The soils are predominantly sandy and the surface is dominated by pasture and small patches of remnant vegetation, restricted to the small on site water catchment areas. The site previously housed Buely's Ruins and these have been relocated to the Gingin townsite and surveys have shown that there is no Aboriginal Heritage known to exist within the vicinity. The proposed minesite is currently used for livestock grazing.

The viable ore reserve within the Gingin deposit is contained within five southeast to northwest trending mineral sand strands located adjacent to each other on properties owned by Iluka and the Kitson Estate. Property ownership is outlined in Table 1.

Table 1: Gingin Landholders

Landholder	Crown Grant No.	Total area (ha)
Iluka Resources Limited	Part Swan Locations 128, 354 & 508, Lot 2 Part Swan Locations 128 & 340, Lot 3 Part Swan Locations 128, 354, 355, 506, Lot 9	375
Kitson Estate	Swan Location 506 Portion of each of Swan Locations 354 and 508, Lot 1 Part Swan Locations 511 & 536, Lot 7	51

It is proposed that the ore be processed through a 250 tph concentrator. The Gingin Project is therefore scheduled to run for a total of 48 months, of which 7 months are allocated for onsite establishment and a further 41 months for mining. Rehabilitation will be undertaken progressively over the course of the Project, however it is expected that an additional three years of ongoing rehabilitation work will be required post mining.

The Project is scheduled to commence production in May 2005 subject to receipt of environmental and planning approvals with site establishment work commencing approximately seven months earlier. Commencement of the production phase is dependent on completion of mining at Iluka's Yoganup Extended minesite. The proposed activity schedule for the Gingin Project is outlined in Table 2.

Table 2: Proposed Activity Schedule for the Gingin Project

Activity	Timing
Pre-production	January 2005 – April 2005
Production	May 2005 - September 2008
Phased Final Rehabilitation of site	September 2008 – December 2013

Table 3 outlines the phases of rehabilitation and the sequence in which rehabilitation and decommissioning works will be implemented within each phase.

Table 3: Rehabilitation Phases and Anticipated Works

Construction Phase (Pre-mining)	Operational Phase (Progressive Rehabilitation)	Closure Phase (Post Operational)
Revegetation of earthen perimeter bunding to stabilise it for the life of the mine.	Move pre-mining stockpile by backfilling southern portion of pit and rehabilitate.	Allow time for drying of dams. Remove buildings and other infrastructure such as concentrator. The concentrator will be moved to another mine site.
Reclaim and rehabilitate temporary laydown areas.	Restructure South Stream diversion, stabilise and revegetate.	Return subsoil to pits and mix with fines from dry solar drying dams.
	Reclaim section of southern overburden stockpile area and rehabilitate.	Restructure North Stream diversion, stabilise and revegetate.
	Periodical backfilling of mine void with subsoil and re-contouring.	Return topsoil to pits and begin removal of solar drying dam walls and stabilise.
	Conduct restoration works associated with North Stream outside the mining area.	Remove roads and road infrastructure that traverses north to south.
		Install fencing to each of the lots and rearrange exterior fencing where required.
		Re-plant stabilising pasture land and tree belts designated for specific fence lines.
		Monitor success of rehabilitation.
		Cap bores not designated for future use with pastoral/grazing applications.

2.1 Construction Phase

The construction phase of the project will involve the initial set up of the road and office infrastructure and installation of the concentrator with feed conveyors, solar drying dams, process water dams, stockpile areas and earthen bunding around the perimeter of the site. Shade cloth screening will also be installed in conjunction with the earthen bunding around the mine perimeter.

2.2 Operations Phase

It is planned for mining of the Gingin Deposit to begin towards the south of the deposit within Iluka property, and then move southwards onto Kitson's property before advancing in a northerly direction. This south to north development is advantageous for a number of reasons, as it will allow:

- progressive rehabilitation over the life of the mine so that final rehabilitation stages are not extensive and time consuming, making the land available for other land users in a shorter period of time;

- creation of additional solar drying dam space (backfilling to follow mining) so that disturbance to previously undisturbed land will be limited if utilising the surface of a backfilled void;
- the return of the properties to pre-mining contours to return the land use of the site to its previous function;
- diversion of south then north streams so that the south stream can be re-diverted as mining is occurring at the northern end of the property; and
- mining through the two watercourses to occur during the summer months.

There will be no internal concentrator or screen plant relocation required during the mine life however, the in-pit feed hopper will be relocated several times as mining progresses.

Rehabilitation of the Gingin mine site will be progressive with the movement of operations from the south of the pit to the north. Rehabilitation will commence with the re-establishment of initial mine void utilising the overburden stockpile.

The solar drying dams will be mined out progressively as the pit develops. Replacement solar drying dams will be constructed on the backfilled mining void as mining progresses. This will occur to the north of Lot 1 to allow for rehabilitation and stream re-establishment.

2.3 Closure Phase

The final aim will be to fill the final mining void at the north of the pit and achieve final surface levels similar to pre-mined levels. The rehabilitated profile will be slightly lowered and blended into the undisturbed landscape.

To complete the process of mining, the following works will be required to return the land to pasture suitable for grazing:

- subsoil replacement;
- removal of the process water dam;
- solar drying dam cleaning;
- solar drying dam removal and reshaping;
- condition soil with clay like materials;
- overburden stockpile rehandling;
- void backfilling;
- surface profiling;
- rehabilitation of roads;
- re-establishment of drainage systems (north stream);
- pasture return;
- establishment of trees where required; and
- replacement of fencing where required.

3 CLOSURE OBJECTIVES

Iluka's stated objective for closure is "To leave sites in a condition which is safe, stable and minimises environmental impacts, such that the tenements can be relinquished without any future liability for Iluka or the community." (Iluka, 2002a).

General closure objectives covering public health and safety, landform, vegetation establishment, and end land use have been developed to encompass all closure aspects pertinent to the Project Area (Table 4).

Table 4: Closure Objectives for the Gingin Project Area

Aspect	Objective
Final Landuse	Maximise the beneficial use of the site post-closure.
Safety	Leave the site in a condition where the risk of adverse effects to people, livestock and other fauna, and the environment in general, has been reduced to a level acceptable to all stakeholders.
Stability	Achieve a condition where the processes affecting landform stability are occurring at rates that meet agreed criteria.
Final Landform	Develop final landforms that are compatible with the surrounding rural landscape.
Vegetation	Revegetate the site to meet the agreed criteria.
Groundwater and Soil Contamination	Achieve a condition where contaminants at the site are below agreed criteria. Minimise the potential for off-site pollution.
Socio-economic	Enable all stakeholders to have their interests considered during the mine closure process. Ensure that the closure process occurs in an orderly, cost-effective and timely manner within minimal disruption to the local community. Ensure that the cost of closure is adequately represented in company accounts and the community is not left with a liability.

Iluka is a signatory of the Australian Minerals Industry Code for Environmental Management, which states that signatories commit to progressively implementing the Code by: 'Ensuring resources are adequate to implement the environmental plans during operations and closure;' and 'Planning for closure in the feasibility and design phases of a project and regularly reviewing plans to consider changes to site conditions, technology and community expectations' (Australian Minerals Industry 2000)

The principles contained in the ANZMECC Strategic Framework for Mine Closure (ANZMECC 2000) have also been used within this document to advance Iluka's process of effective mine closure.

4 COMPLETION CRITERIA

The proposed completion criteria described below address pertinent regulatory requirements, Iluka's corporate objective for closure, contemporary industry standards and stakeholder requirements. The completion criteria will be periodically reviewed and modified in light of improved knowledge or changed circumstances such as changes in adjacent land use, commercial opportunities, community values, knowledge or technological advances.

4.1 Final Land Use

At Gingin, the pre-mining land use is cattle and sheep grazing. Following the completion of mining and subsequent rehabilitation, the properties will be returned to grazing. Pre-mining agricultural productivity levels will be used as the baseline for the post rehabilitation assessment during closure planning (John Wise Consultancy, 2001).

4.2 Radiation

The background radiation survey conducted prior to mining will formulate the baseline for the restoration of the land post mining with regards to radiation levels.

The following radiation closure criteria will be further developed if required in conjunction with the final land use and any regulatory controls that may be implemented in the future. Iluka's conceptual radiation closure criteria are:

- to restore land to as close as practicable to background levels;
- to minimise the area of land which will have above background radiation levels; and
- to achieve an upper limit radiation level for all areas such that no member of the public will be exposed to greater than 1 mSv/yr above background levels. These radiation levels will vary from 0.3 μGy/hr to 0.79 μGy/hr, depending on the proposed final land use and institutional/regulatory controls.

4.3 Vegetation

In response to the diminished populations of native remnant vegetation present in the Project Area due to clearing for agricultural purposes, tree shelter belts will be established using native species. Native vegetation will be established along the recreated watercourses (Section 7.1). The inclusion of native vegetation in the rehabilitated profile will attract fauna to the rehabilitated landscape. In total over 12 ha of revegetation using native species, along the streams and in tree shelter belts, will be established.

4.4 Soil and Groundwater Contamination

It is standard practice that Iluka prevents soil contamination from occurring wherever possible. Where contamination is suspected or identified, investigation and remediation is commenced as soon as practical. Remediation of most soil contamination should be completed during the operational life of the mine, minimising the remedial activities required upon closure.

Iluka will adopt the DoE Guidelines, the 'Contaminated Site Management Series' of publications to assess potentially contaminated land with the exception of radiation issues which are controlled by the Department of Health and the DoIR. Iluka's aim is to not affect the local environment or restrict future land use by soil and groundwater contamination issues.

4.5 Final Landform

The final landform of the site is anticipated to have similar contours to the current, pre-mining landform and the drainage lines and streamlines reinstated to the original course profiles with similar vegetation cover. At this stage no void will be left at the cessation of rehabilitation works.

The area designated for pasture land will also be revegetated accordingly.

5 LEGAL AND STATUTORY OBLIGATIONS

Legislation relevant to the environmental aspects of mine closure at the Gingin site include the:

- *Environmental Protection Act 1986;*
- *Mining Act 1978;*
- *Mines Safety and Inspection Act 1994;*
- *Mines Regulation Act 1946;* and
- *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.*

Other relevant legislation includes the:

- *Radiation Safety Act 1975;*
- *Aboriginal Heritage Act 1972;*
- *Bushfires Act 1954;*
- *Soil and Land Conservation Act 1945;*
- *Conservation and Land Management Act 1984;*
- *Rights in Water and Irrigation Act 1914;* and
- *The Contaminated Sites Act 2003 (WA)* that has been approved by both Houses of Parliament but will not be enacted until the first half of 2004.

5.1 Responsible Authority

The Shire of Gingin and Department of Environment (DoE) will be the primary regulatory authorities responsible for overseeing the closure of the Gingin site. Authorities involved in advising the DoE include the Environment Protection Authority (EPA), the Department of Conservation and Land Management (CALM), the Department of Agriculture and Main Roads Western Australia (MRWA).

5.2 Regulatory Instruments

The licences and permits pertaining to closure that are required for the Gingin Project have been summarised in Table 5.

Table 5: Licences and Permits Required for the Gingin Project

Agency	Regulatory Instrument
DoE	Licence to operate a Prescribed Premises
DoE	11/17/21A Permit to Interfere with Bed and Banks
DoE	Groundwater Well Licence for Abstraction of 1,000,000 kL/year from Superficial Aquifer in Deepwater Lagoon Sub-area
DoE	Groundwater Well Licence for Abstraction of 1,500,000 kL/year from Yarragadee Aquifer in Sub-area 3
Department of Agriculture	Notice of Intention to Clear Land
Shire of Gingin	Extractive Industries Licence
Shire of Gingin	Application for Planning Approval

As all of the properties within which the Gingin Deposit occurs are 'Minerals-to-Owner' land alienated from the Crown prior to 1899, Iluka is not required to hold a mining lease over the Gingin Deposit in order to extract the minerals.

Iluka Standard Policy requires acknowledgement of any preceding documentation to their current documents. For the Gingin Mineral Sands Project, there are no pre-existing closure documents addressing closure of the Project.

5.3 Landholder Agreements

An agreement is in place for the Kitson Estate properties on which the deposit lies, including Swan Location 506, parts of Swan Locations 354 and 508, Lot 1 and 511 and 536, Lot 7.

The land will be rehabilitated in accordance with the landowner agreement.

6 THE CONSULTATIVE PROCESS

6.1 Gingin Community Relations Plan

The Gingin Community Relations Plan was developed by Iluka to ensure that an open dialogue between the company and residents was developed and maintained, and to engage the local Gingin community in all aspects of the mine approval process and ongoing management of the operation.

The objectives of the Plan are to:

- identify key stakeholders within the Gingin community;
- consult with the Gingin community and external stakeholders to ensure that all issues and concerns are managed throughout the life of mine;
- continually develop a targeted communication strategy that ensures Iluka's access to mining the Gingin deposit; and
- add value to the Gingin community throughout the life of mine.

6.2 Key Stakeholders

Key stakeholders identified during the Environmental Assessment comprise:

- adjacent landowners;
- Aboriginal groups;
- local community groups (including Gingin District High School, Gingin Golf Club);
- local businesses;
- Shire of Gingin; and
- State Government agencies.

7 REHABILITATION

In the context of this section, the term "rehabilitation" refers directly to the process of restoring the land affected by Iluka's activities to an acceptable state and landform for relinquishment. All activities that form part of the rehabilitation process include revegetation, material handling, surface re-contouring and deposition of tailings. This links the process of rehabilitation closely to mining and the subsequent material handling practices.

Rehabilitation differs from the "decommissioning" of the site as the latter refers to the process of removal, specifically that of equipment or services that have been constructed during the mining activities. Rehabilitation covers the handling and disposal of wastes and the remediation of contaminated land.

Both rehabilitation and restoration will be necessary for the successful relinquishment of the Gingin Project. To ensure that the relinquishment to the owners of the land occurs in the earliest practicable timeframe, progressive rehabilitation will be undertaken during operations, commencing during the early operational phase.

Any rehabilitation not completed during operations that occur during decommissioning is referred to as reclamation. Rehabilitation will be progressive throughout the life of the operation and follow closely behind mining where possible.

To achieve the end land use and landform design, mining pits will be backfilled with tailings, oversize, clay fines and overburden to recreate, as closely as possible, the pre-mining soil profile. The soil management plan developed prior to mining will be utilised to stockpile the soils during mining and ensure soils are returned to a profile reflecting the baseline environment (Oracle Soil and Land, 2002).

Clays will be incorporated into the subsoil to improve the moisture and nutrient retention capabilities, thereby improving the long term pasture productivity. Disturbed areas will be shaped to the contour plan and ripped on the contour to control water movement and soil erosion, reduce subsoil compaction and facilitate the infiltration of water and root penetration. Topsoil will be replaced directly over the backfilled and contoured mine pits and disturbed areas where possible, or stockpiled for later use. Fertilisers will be used during rehabilitation where necessary. The soil management plan identified a need for liming in some areas to provide optimal growth of agricultural species. Where fertilisers and herbicides are used the Material Safety Data Sheets and instructions will be adhered to. Particular attention will be given to fertilisers used adjacent to the watercourses. Where necessary, additional information will be sought from the Department of Agriculture and DoE regarding fertiliser usage.

Pasture species, tree shelter belts, wetland and riparian vegetation will be developed on the rehabilitated land. Farm infrastructure such as fencing, gates and laneways will be constructed. Tree belts established on Dewar Road and the Brand Highway will remain post mining.

During rehabilitation dust will continue to be controlled in the same processes as during operations.

It is anticipated that a minimum of three years (post mining) will be required for Iluka to rehabilitate the land to a level commensurate with the completion criteria. During this time there may be controlled access for grazing. A post-mining agricultural report will be

undertaken by an independent agricultural consultant to assess if pre-mining productivity levels have been re-established and are sustainable.

7.1 Re-establishment of Watercourses

The drainage lines disturbed during mining will be restored to their original courses as soon as the reconstructed drainage channels are stabilised and the risk of sediment transport is minimised. The reconstructed watercourses will be constructed with low and high flow channels with gentle meanders consistent with the surrounds. Erosion control measures will include grassing of the watercourse and use of erosion matting. Water quality and quantity upstream and downstream of the diversions will continue to be monitored post mining. The areas will be fenced to keep out stock and will be planted with native riparian vegetation. Stock crossings and watering points will be established in the rehabilitated watercourses. Assistance from the DoE and the Gingin LCDC will be sought during the rehabilitation of the watercourses.

In addition to the rehabilitation of those areas disturbed by mining, the North stream will be fenced off for a further 1 km upstream on the Iluka owned property. The area will be infill planted with native species and a weed control program implemented. This will be an ongoing program during operations and rehabilitation.

It is anticipated that these improvements will enhance the post-mining environment and encourage a more diverse flora and fauna population. Interaction with the Gingin LCDC is expected to benefit both parties with learning experiences on stream restoration.

7.2 Rehabilitation Maps

All rehabilitation maps will conform to the requirements of the land use plan and agreed completion criteria. As rehabilitation is planned and progresses, the exact location of particular surface features, vegetation and contouring will be consolidated and presented on rehabilitation maps. These maps will incorporate all of the rehabilitation requirements and will be the basis of the rehabilitation process following cessation of mining.

8 DECOMMISSIONING AND RESTORATION PLANS

Decommissioning of the site is the process of physical closure of the facility post-mining. It includes the deconstruction, reclamation, maintenance and monitoring of remaining infrastructure and residual landforms. Greater detail of decommissioning will be developed during annual reviews of the closure plan.

8.1 Objectives

Objectives for decommissioning of the Gingin Project Area comprise:

- Carry out decommissioning of the plant and associated infrastructure at the completion of mining.
- Remove or bury within mined out pits (such that it will not be exposed through erosion) all infrastructure not required for the end land use of the Project Area.

8.2 Contaminated Sites

The 'Contaminated Sites Bill 2000' has been passed and is now the 'Contaminated Sites Act 2003' under State Parliament. The Act is not yet enforced however, this Act on Iluka's Gingin operations are likely to have a significant effect on the requirements regarding contaminated site management and land relinquishment.

Contaminated sites will be assessed and remediated as a part of the closure and restoration process.

8.3 Post Closure Monitoring

The timeframe for closure will depend on the time required for the completion criteria to be achieved. Monitoring will need to continue until positive trends emerge which indicate that no further management of vegetation (both pasture and native), water resources and landform is required than would be necessary for similar properties in the area. An appropriate monitoring period will be determined in liaison with government authorities and will be reviewed in light of monitoring results reported in Annual Environmental Reports (AERs).

8.4 Final Closure Program

It is anticipated that the mine closure program would commence around 18 months prior to the cessation of the mining process. This program will extend for, but not be bound by, a target of three years after mine closure for post closure monitoring.

For the commencement of the closure program, a detailed Final Closure and Decommissioning Plan will be prepared and reviewed prior to mine closure.

9 CLOSURE COSTS & PROVISIONING

Iluka has developed rehabilitation provisioning procedures to suit mine sites with large areas being continually opened (cleared) and closed (rehabilitated). The ongoing rehabilitation of mining areas is treated as an operation cost, however, provision for the rehabilitation is maintained on the basis of the area cleared for mining purposes and the cost per hectare for rehabilitation.

An area is classified according to its basic rehabilitation requirement such as native vegetation or pasture and the estimated cost per hectare for rehabilitation is multiplied to calculate the provision required. Inflation is accounted for by regular review of the costings as are changes in the rehabilitation techniques.

With this provision, rehabilitation could occur at any time and there would be sufficient funding to re-contour, topsoil, mulch, seed and plant the areas affected by mining.

Rehabilitation provisioning only covers the open rehabilitation areas, excluding long term access areas such as the administration areas and mining roads.

Iluka's rehabilitation provisioning includes:

- Topsoil management (removal from stockpile and contouring);
- Final landform contouring;
- Revegetation (excluding agricultural planting and ongoing native vegetation maintenance which are provided for in the Agricultural Activities budget and Restoration Provisioning respectively);
- Rehabilitation monitoring during mining;
- Salaries and add-on costs; and
- Machinery maintenance.

Essentially, rehabilitation provisioning provides funds for the first pass rehabilitation of areas affected by normal mining activities.

9.1 Cost Estimates

As this version of the Gingin Conceptual Closure Plan is being appended to a public document, closure costs are not included.

10 DOCUMENTATION

10.1 Reporting

This closure plan and subsequent revisions will be reported in the AER and updated within the current Closure Plan.

The current Closure Plan will require review and enhancement once the timeframe of mine closure has been set. The revised plan will include more precise details on restoration and decommissioning.

The Iluka Group Environmental Procedure for Closure Plan Development (Iluka, 2002b) requires that:

- the reporting schedule be clearly defined, and accountabilities allocated, in relation to the preparation and approval of documentation relevant to site closure;
- the closure process is well documented, particularly in relation to decision-making processes and external programs;
- a secure document archival/retrieval system is developed; and
- key documents are linked to the site's Environmental Management System.

10.2 Closure Files

Files and documents used to collate information regarding closure commitments, licences, approvals and other information concerning closure at Gingin will be catalogued and maintained in accordance with standard Iluka practices.

10.3 Closure Plan Review

The Gingin Conceptual Closure Plan will be reviewed annually and re-issued and approved triennially in accordance with Iluka's reporting program.

11 REFERENCES

Iluka Resources Limited (2001a) *Group Policy: Operation Closure*, Iluka Resources Limited, Internal Document, Perth. November, 2001.

Iluka Resources Limited (2001b) *Group Environmental Guideline: Schedule of Rates for Closure*, Iluka Resources Limited, Internal Document, Perth. July, 2001.

Iluka Resources Limited (2002a) *Group Environmental Guideline: Operation Closure*, Iluka Resources Limited, Internal Document, Perth. April, 2002.

Iluka Resources Limited (2002b) *Group Environmental Procedure: Closure Plan Development*, Iluka Resources Limited, Internal Document, Perth. April, 2002.

John Wise Consultancy (2001). *Agricultural Assessment. Swan Locations 506, Pt Swam Locs 128,354 & 508 being Lot 2. Pt Swan Locs 128, 354, 355 & 506 being Lot 9. Pt Swan Locs 128 & 304 being Lot 3. Pt Swam Locs 511 & 536 being Lot 7. Brand Highway & Dewar Road Gingin.* Unpublished Report prepared for Iluka Resources Limited, August 2001.

Oracle Soil and Land Pty Ltd (2002) *Pre-mining Soil Survey and Characterisation in the Proposed Gingin Minesite: Final Project Report.* Unpublished Report for Iluka Resources Limited, June, 2002.