PROGRAM FOR ENVIRONMENTAL PROTECTION AND REHABILITATION

for

THE PORTIA GOLD PROJECT

ML 6346

Submitted by Benagerie Gold Pty Limited

(A.C.N. 121 124 427)

a subsidiary of

HAVILAH RESOURCES NL

August 2014

Version 3.3

APPENDICES

TABLES

FIGURES

Executive Summary

Gold mineralisation at Portia was originally discovered by the Pasminco-Werrie Gold joint venture in the late 1990's. The joint venture obtained some spectacular drilling results for gold using conventional assay methods but had considerable difficulty in repeating them in subsequent drillholes, owing to the "nugget" effect of abundant coarse-grained gold in the drill samples.

When Havilah Resources (100% owner of Benagerie Gold Pty Ltd) acquired the area from the receivers of Pasminco in 2003, it adopted a different approach, using, a small gravity wash plant to process the entire drill samples in order to obtain a more statistical representative result. This methodology produced quite consistent results, allowing estimation of a JORC Inferred Resource for the base of Tertiary gold mineralisation of 720,000 tonnes @ 2.9g/t for 67,000 ounces of gold. At current gold prices, this base of Tertiary gold can be economically exploited by conventional open pit mining methods.

The Portia Deposit occurs to the north of the Olary Ranges on flat land consisting of low dunes and interdune corridors. Watercourses are not present within the ML (6346), and vegetation is limited to some black oak woodland away from the pit area, low bluebush on the plains, and bladder saltbush on the low dunes. Other less common vegetation types include tall shrublands on sand plains and cane-grass in swampy areas. Soils are thin on the flats and if dune sand is considered to be soil, then thicker on the dunes. The condition of the land is poor, with over grazing having significantly diminished environmental values. Weeds are common, as are feral animals including rabbits and goats. None of the resident species of birds expected to be present on the ML area are threatened.

Groundwater occurs in basement rocks but not at recoverable rates within the basal Tertiary age Eyre Clay unit and the overlying Namba Formation. Groundwater salinity is high to very high, preluding its use for stock watering. The deposit occurs outside of the Yarramba Palaeochannel.

Operations are to include the excavation of an open pit, followed by the recovery of particulate (nuggetty) gold from the Eyre Clays using a gravity separation and washing plant. The ore zone is at a depth of about 70 m. Overburden will be placed in an overburden waste dump, whilst materials won from the ore zone will be passed through a trommel and gravity separation / wash plant to recover the gold. Other infrastructure on site will include a camp, office facilities, workshops, go bay, two tailings storage cells, a pit dewatering dam and a raw water dam. Tailings materials are inert, as potentially acid forming minerals are not expected to be encountered. Blasting will not be required. Water for processing will be provided by dewatering operations to maintain dry pit floor conditions.

It is planned that the approximately 7 million cubic metres of overburden will be removed within twelve months, and the 355,000 tonnes of gold bearing silts will be mined and processed within a further six months.

Rehabilitation and closure will involve the removal of infrastructure including the camp, office, and processing equipment, and the rehabilitation of all areas disturbed by site activities.

Rehabilitation will involve the placement of an amelioration layer of the tailings in the two TSF's cells pushing and covering of the raw water and pit dewatering dam, the backfilling of drains and surface water retention features, the placement of stockpiled topsoil on all disturbed areas, planting with locally derived seedstock and the successful establishment of vegetative cover. The pit will remain open but access will be restricted by the placement of an abandonment bund and perimeter fencing. Warning signage will also be installed. Post mining land use will revert to pastoral.

1 Introduction

This Program for Environmental Protection and Rehabilitation (PEPR) has been prepared for the Portia Gold Project (the project). The project consists of the mining of gold via an open pit and processing of the ore through a small gravity separation plant. It has been prepared to satisfy the requirements of the Department of Primary Industries and Resources South Australia (PIRSA), now the Department for Manufacturing, Innovation, Trade, Resources and Energy (DSD) and to comply with Regulation 42 (b) (1) of the *South Australian Mining Act 1971*.

A Mining Lease Proposal (MLP) was prepared in 2009 to satisfy the requirements provided by the PIRSA '*Guidelines for the Preparation of a Mining and Rehabilitation Program* (MARP)' (PIRSA Version 4.8) and submitted for approval in 2009. It was subsequently approved on 7 October 2009. This PEPR has been prepared in accordance with version 4.11 of the guidelines (PIRSA 2011).

1.1 PROPONENT AND DECLARATION OF ACCURACY

The Proponent is Benagerie Gold Pty Limited (Australian Company Number 121 124 427), a wholly owned subsidiary of Havilah Resources NL (Havilah).

Benagerie Gold Pty Limited (Benagerie Gold) is registered in South Australia.

The proponents contact details are shown in Table 1 below.

Table 1 Benagerie Gold contact details

Contact Address	Contact Details
31 Flemington Street Glenside SA 5065 ***www.havilah-resources.com.au***	Dr Chris Giles 0428610557 Dr Bob Johnson 0428400160 Telephone: (08) 8338 9292 Facsimile: (08) 8338 9293

Havilah and Benagerie Gold have common directors, namely:

- Dr Bob Johnson Chairman - Geologist
- Dr Chris Giles, Technical Director - Geologist
- Mr Ken Williams Non-executive Director - Finance Expert

All are residents of Adelaide, well experienced in the mining industry and long-standing members of appropriate professional bodies.

Havilah was formed in 1996 by Dr Chris Giles and Dr Bob Johnson to explore for metals in South Australia. In 2002, Havilah successfully undertook an Initial Public Offering. The Company then progressively built an exploration portfolio focused on the Curnamona Province in the north eastern part of South Australia, adjacent to the Broken Hill area. All of its operations are based in South Australia.

Declaration of Accuracy

The following declaration is made in accordance with section 35(1) of the Mining Act 1971:

I, Dr Chris Giles declare that I have reviewed this document and confirm that the information provided is to the best of my knowledge, accurate.

Name: Dr Chris Giles

Position: Technical Director

Signature 

1.2 EXISTING LAND TENURE

Details of underlying land tenure and tenure holders are shown in Table 2.

Table 2 Land tenure and tenement details

MINING LEASE 6346		
Land tenure	Pastoral	
Certificate of Land Title/Lease Number	Crown Lease	CL 1292/4
Pastoral Number	Mulyungarie (Benagerie Block)	121
Name of Leaseholder	Mutooroo Pastoral Company Pty Limited	
Address of Leaseholder	5 King William Rd Unley SA 5061	
Phone number of Leaseholder(s)	James Morgan	(08)8373 1515
Facsimile	James Morgan	(08)8373 5775

This region is not covered by a District Council or Corporation.

1.3 LOCATION

The Portia Deposit is located in the vicinity of latitude 31°26' S and longitude 140°27' E (447,000E, 6522500N-MGA94). It occurs within Exploration Licence No. 3586 **(**Benagerie) that encompasses the Benagerie Pastoral Block.

The New South Wales - South Australia border is located 60 km to the east, and the Barrier Highway about 85 km south (Figure 1.1).

Access to the site is by road from the Barrier Highway via Mulyungarie Station.


Coober Pedy
Marree
Andamooka
Leigh Creek
Portia
Deposit
location
Tarcoola
Woomera
Hawker
Broken Hill
Port Augusta
Orroroo
Whyalla
Peterborough
Kimba
Kadina
Berri
Port Lincoln
Adelaide
Murray Bridge
Victor Harbor
0
200
kilometres
Scale: 1 : 3 500 000
BENAGERIE GOLD
Figure 1.1
Portia Project
Location
SCALE: 1 : 3 500 000
DATE: 13/09/2011

2 Description of the environment

The existing environment is described in this section.

2.1 LOCAL COMMUNITY

The Portia Deposit is located in north eastern South Australia, about 105 km North West of Cockburn. Cockburn is the nearest community to the site, with the only other relatively close population centres being pastoral station homesteads (see below) and the Honeymoon and Oban uranium mine sites (also referred to below).

2.2 LAND USE

ML 6346 lies on the Benagerie Pastoral Block, which forms part of Mulyungarie Station.

Historically the land has been used as unimproved pasture and for mineral exploration. The area has been described as being in fair rather than good condition, and has been subject to heavy grazing by native animals as well as livestock in the past (Badman 2008). Post-mining, land will be returned to pastoral use.

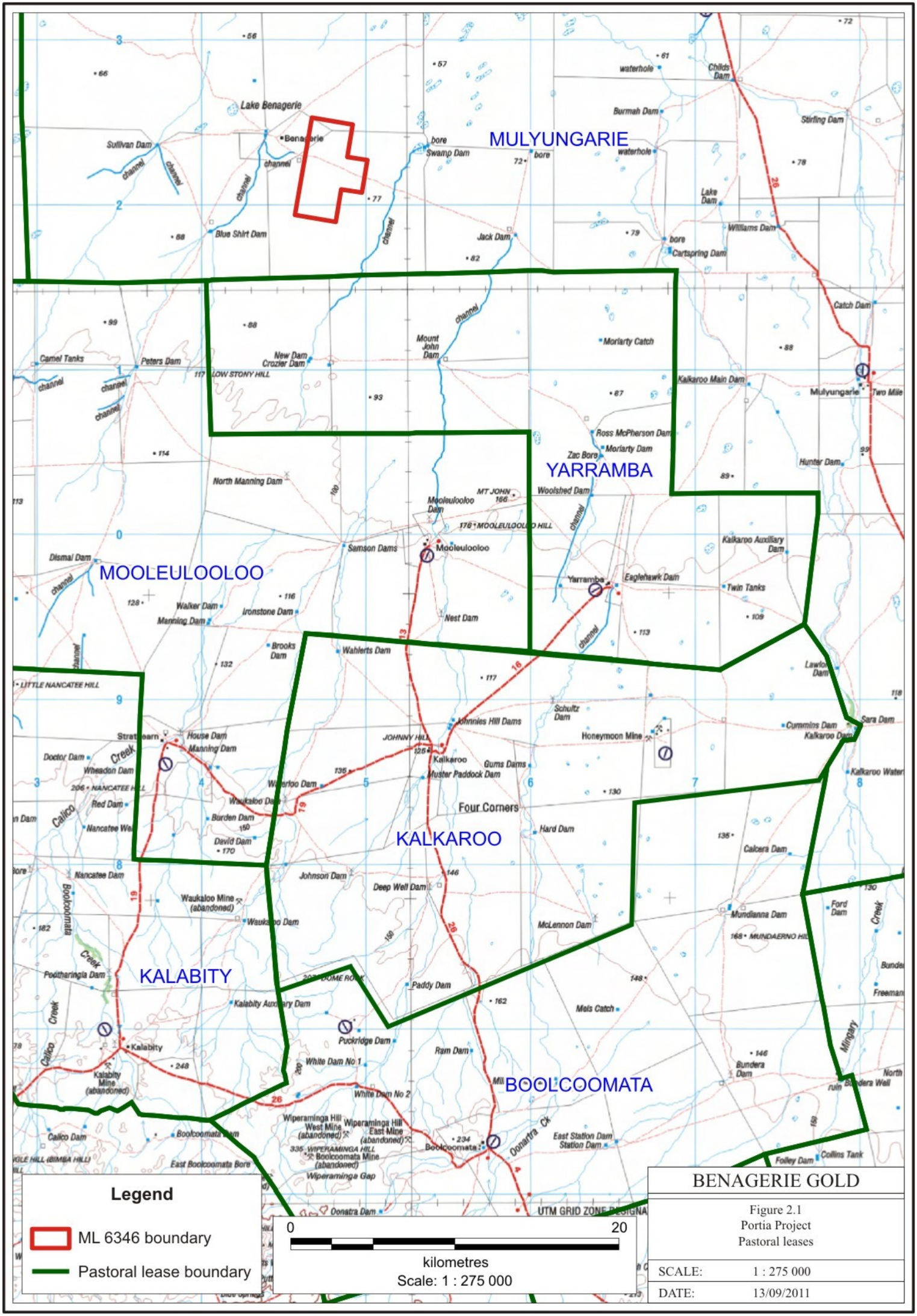
Given the location, hydrology, soil characteristics and vegetation of the land, the potential uses for the land are limited to pastoral, mining and mineral exploration. Public amenity is low and there are no unusual habitats, sites of significance or other items that are likely to make the area suitable for conservation.

Agricultural productivity is described as very low and generally only supports about 12 sheep per square kilometre. There are no known plans for future changes in land use.

2.3 PROXIMITY TO HOUSING AND INFRASTRUCTURE

The nearest dwellings to the project area are associated with the Mooleulooloo Homestead located approximately 20 km to the south. Other nearby homesteads are Mulyungarie, located 30 kms to the east, Yarramba located 30 kms to the south-east and Kalkaroo which lies 50 kms to the south of the project site.

The nearest small population centres are Cockburn, some 105 km south east of the project site and Olary, about 110 km to the south west. The site is currently accessible only by existing station tracks on pastoral leases as shown on Figure 2.1.


MULYUNGARIE
YARRAMBA
MOOLEULOOLOO
KALKAROO
KALABITY
BOOLCOOMATA
Four Corners
Lake Benagerie
Sullivan Dam
Blue Shirt Dam
Swamp Dam
Jack Dam
Childs Dam
Burmah Dam
Stirling Dam
Williams Dam
Cartspring Dam
Lake Dam
Catch Dam
Moriarty Catch
Kalkaroo Main Dam
Mulyungarie
Two Mile
Ross McPherson Dam
Moriarty Dam
Zac Bore
Hunter Dam
Mount John Dam
New Dam
Crozier Dam
Camel Tanks
Peters Dam
LOW STONY HILL
North Manning Dam
Mooleulooloo Dam
MT JOHN
MOOLEULOOLOO HILL
Samson Dams
Mooleulooloo
Woolshed Dam
Kalkaroo Auxiliary Dam
Yarramba
Eaglehawk Dam
Twin Tanks
Nest Dam
Dismal Dam
Walker Dam
Manning Dam
Ironstone Dam
Brooks Dam
Wahlerts Dam
LITTLE NANCATEE HILL
Johnnies Hill Dams
Schultz Dam
Honeymoon Mine
Cummins Dam
Kalkaroo Dam
Sara Dam
Kalkaroo Water
Kalkaroo
Muster Paddock Dam
Gums Dams
Waterloo Dam
Waukaloo Dam
Burden Dam
David Dam
Red Dam
Nancatee Dam
Hard Dam
Calcera Dam
Johnson Dam
Deep Well Dam
Waukaloo Mine (abandoned)
McLennon Dam
Mundianna Dam
Ford Dam
Poothariga Dam
Paddy Dam
Kalabity Auxiliary Dam
Mels Catch
Puckridge Dam
Ram Dam
Kalabity
Kalabity Mine (abandoned)
White Dam No 1
White Dam No 2
Bundera Dam
Bundera Well
Wiperaminga Hill West Mine (abandoned)
Wiperaminga Hill East Mine (abandoned)
Boolcoomata Mine (abandoned)
Boolcoomata
East Station Dam
Station Dam
Calico Dam
Boolcoomata Dam
East Boolcoomata Bore
Wiperaminga Gap
Donatra Dam
Folley Dam
Collins Tank
Legend
ML 6346 boundary
Pastoral lease boundary
0
20
kilometres
Scale: 1 : 275 000
BENAGERIE GOLD
Figure 2.1
Portia Project
Pastoral leases
SCALE: 1 : 275 000
DATE: 13/09/2011

2.4 AMENITY

The Portia Deposit is located in an area of low visual and cultural amenity. There are no commercial or recreational facilities within 100 km (the privately owned Honeymoon Mine excepted), and features of outstanding or noteworthy natural beauty do also not exist in this part of South Australia.

2.5 NOISE, DUST, AIR QUALITY

The area in which the Portia Deposit occurs is sparsely populated, and devoid of sources of industrial noise and noise associated with human habitation and movement.

It is also an area of low rainfall and high evaporation, resulting in vegetation being sparse. Overgrazing by native and introduced animals has led to soils becoming exposed, resulting in the generation of large amounts of dust in periods of strong winds.

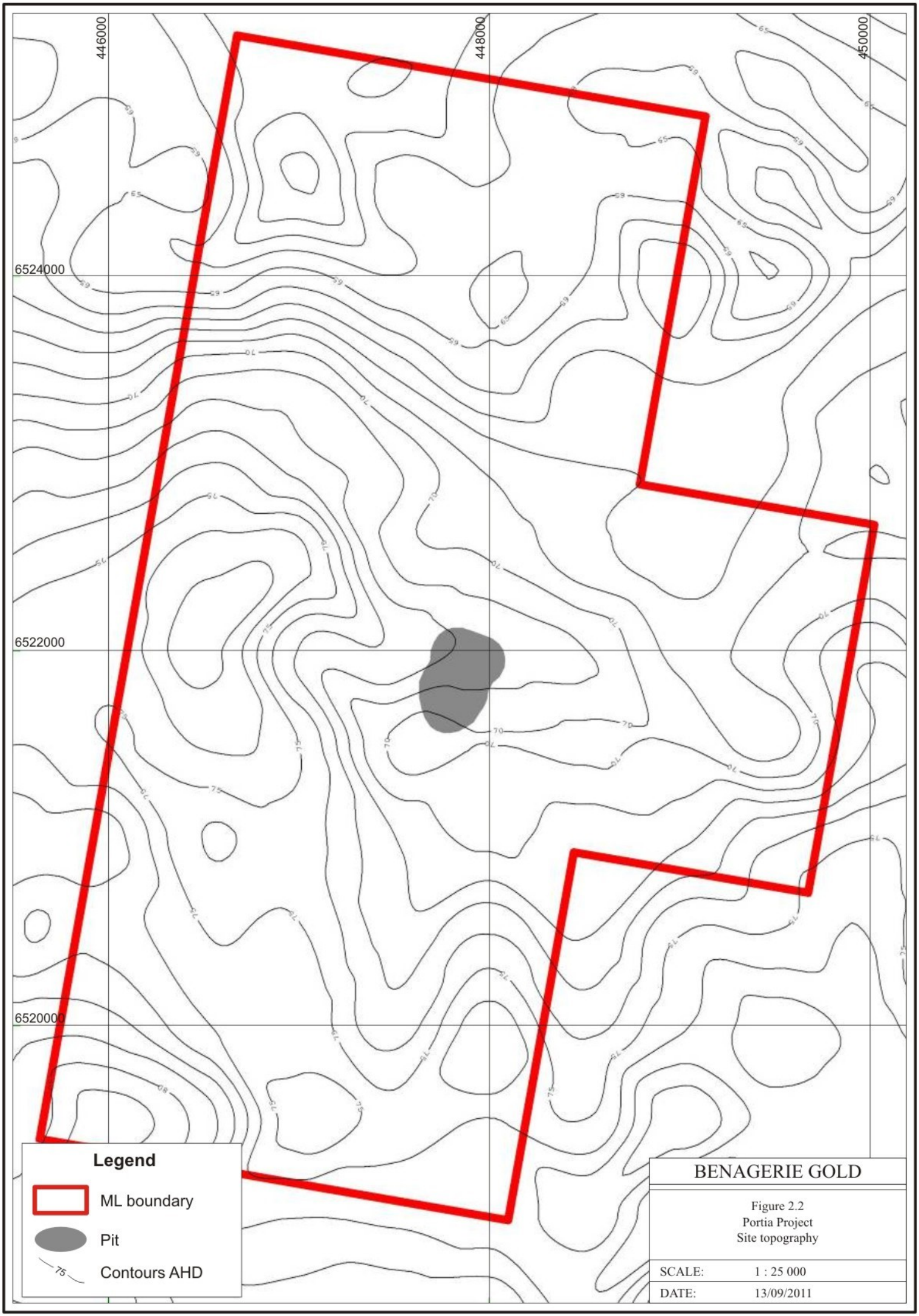
There are no sources of airborne pollution on site, apart from dust and emissions from mineral exploration activities.

2.6 TOPOGRAPHY AND LANDSCAPE

The project site lies within the plains of the Lake Frome Basin. The plains are flat, with the land surface falling gradually at a gradient of about 1 in 1,000 towards Lake Frome, 100 km to the northwest of Portia.

Apart from three isolated ridges near Mooleulooloo homestead and a rocky knoll at Kalkaroo, the nearest areas of elevated topography are the Olary Ranges about 60 km to the south. To the east, the Barrier Range lies beyond the New South Wales border.

The landscape surrounding Portia is characterised by low sandy dunes with a vertical relief of up to 3 m in height, trending in a south westerly - north easterly direction. The dunes are characterised by a cover of saltbush and bluebush. The site is approximately 70 m above sea level. Figure 2.2 shows existing topography of the site.


446000
448000
450000
6524000
6522000
6520000
Legend
ML boundary
Pit
Contours AHD
75
BENAGERIE GOLD
Figure 2.2
Portia Project
Site topography
SCALE: 1 : 25 000
DATE: 13/09/2011

2.7 CLIMATE

Meteorological data have been sourced from the Bureau of Meteorology. The closest weather stations to the project site are Site Number 020026, 'Yunta', located approximately 150 km south west of the project site (Lat -32.5819, Long 139.5611) and Site Number 047039, 'Umberumberka Reservoir', located approximately 90 km east of the project site (Lat -31.8153, Long 141.2090).

A summary of the average monthly climate data for Yunta and Umberumberka Reservoir is presented in Table 3.

Table 3 Climate summary

Month	Average Monthly Rainfall (mm)		Maximum Monthly Rainfall (mm)		Average Daily Pan Evaporation (mm)		Average Daily Maximum Temperature (°C)		Average 9 a.m. Wind Speed (km/h)	
	Y[1]	U[2]	Y	U	Y	U	Y	U	Y	U
January	21.1	18.7	176.5	112.6	N/A[3]	12.5	32.6	32.2	11.4	16.4
February	20.8	18.1	146.9	87.9	N/A	11.8	32.1	31.9	10.8	14.3
March	15.6	14.7	146	93.9	N/A	9.7	29.3	28.7	11.3	12.6
April	15.9	12.7	116	142.2	N/A	6.1	24.2	23.3	10	10.3
May	22.9	19.9	123	90.8	N/A	3.6	19.1	19	9	9.7
June	21.7	15.9	70.9	109	N/A	2.6	15.9	15.3	9.5	9.2
July	16.8	15.4	71.9	62	N/A	2.8	15.4	14.8	10.9	9.2
August	19	14.5	58.3	47	N/A	4.1	17.3	17.4	12.4	10.1
September	18.3	17.7	97.4	91.7	N/A	6.3	20.8	21.1	14.7	13.9
October	22.5	20.2	99	96.2	N/A	7.9	24.3	25	15.9	13.3
November	19.7	19.4	113.5	183.4	N/A	10.3	28.3	28.4	12.9	12.8
December	21.7	19.6	154.2	111.1	N/A	11.9	31.1	31	12.4	14.2

1 Y=Yunta
2 U=Umberumberka
3 N/A= Not Available

While rainfall is evenly spread across the year, there is a peak in evaporation in the summer. In 90 years of records, the highest daily rainfall recorded at Umberumberka in 1933 was 179.3 mm. In 99 years of records the highest daily rainfall recorded at Yunta was 112.3 mm. The calculated 1:100 year AEP 72 hour storm for Benagerie is 156mm (BOM, 2012)[1].

Between May and September, the wind prevails mostly from the western semi-circle, with a roughly even distribution of directions between north and south. Between October and April, southerly winds increase markedly in frequency to become the predominant direction at all times of the day, occurring up to a maximum of nearly 50% of the time in the morning and less frequently in the afternoon when directions are more variable. Easterly component winds also increase in frequency during the hotter semester of the year.

Average wind speeds are higher during the warmest time of the day and year, when atmospheric instability is greatest and lower during the coldest times when the atmosphere is generally most stable. Over the year, surface winds average approximately 6 knots (3.33 m/s).

[1] Intensity Frequency Duration calculator using coordinates for Benagerie returns 156mm for a ARI 100 year 72 hour storm.

2.8 GEOHAZARDS

2.8.1 Seismicity

The Portia Deposit is situated approximately 250 km east of a major geologic structural feature known as the Torrens Lineament. The Flinders Range segment of this lineament is one of the two most active seismic zones in Australia.

Based on published earthquake hazard maps (Love, 1996), the Portia site could experience an earthquake with an acceleration co-efficient exceeding 30 mm/s^2 to 50 mm/s^2 every 500 years. This is substantially lower than the risk experienced in Adelaide where coefficients could reach 70 mm/s^2 every 500 years. Earthquake damage to the proposed mine installations would be minimal due to the small scale nature of fixed plant and infrastructure proposed.

A stability analysis was carried out by Rocktest Consulting to assess how seismic loading may reduce the stabilities of the pit walls. This shows that potential changes in pit wall stability are within acceptable limits (see section 4.2.3 of Appendix C Rocktest Consulting Pit Geotechnical Design Report).

2.8.2 Radioactive minerals

No significant radioactive minerals have been discovered at Portia and measured uranium contents are below the trigger level for further investigation of 80 ppm. The highest average uranium elemental composition occurs within the ore zone and is around 16-31 ppm.

Drilling by uranium explorers, including an associated company (Curnamona Energy Limited) has failed to discover any economic uranium mineralisation within the Portia region.

2.8.3 Karst formations

There are no known karst formations associated with the Portia Deposit.

2.8.4 Minerals hazardous to human health

Ore Material

The results of the geochemical analysis of the ore zone (see section 3.6.2), indicates that only minor enrichment in heavy metals occurs within the ore zones being mined. The current average concentrations for these elements are below the Health based Investigation Levels (HILs) for parks, recreational open space and playing fields as described under Schedule B(1) of the National Environmental Protection Council (NEPC) Guideline on Investigation Levels for Soil and Groundwater.

Arsenic within the weathered saprolitic ore zone, below the main gold bearing layer is the only element exceeding the HIL guideline trigger values for parkland and recreational environments. However, whilst it exceeds this value, it does not exceed the HIL guideline threshold value for commercial/industrial sites of 500 mg/kg which would be equally applicable.

Overburden Waste Rock

No minerals hazardous to human health have been found to occur from geochemical analysis of the overburden material to be mined. Trace element concentrations in the Namba Formation overburden

material are well below the Health based Investigation Levels (HILs) for parks, recreational open space and playing fields as described under Schedule B(1) of the National Environmental Protection Council (NEPC) Guideline on Investigation Levels for Soil and Groundwater.

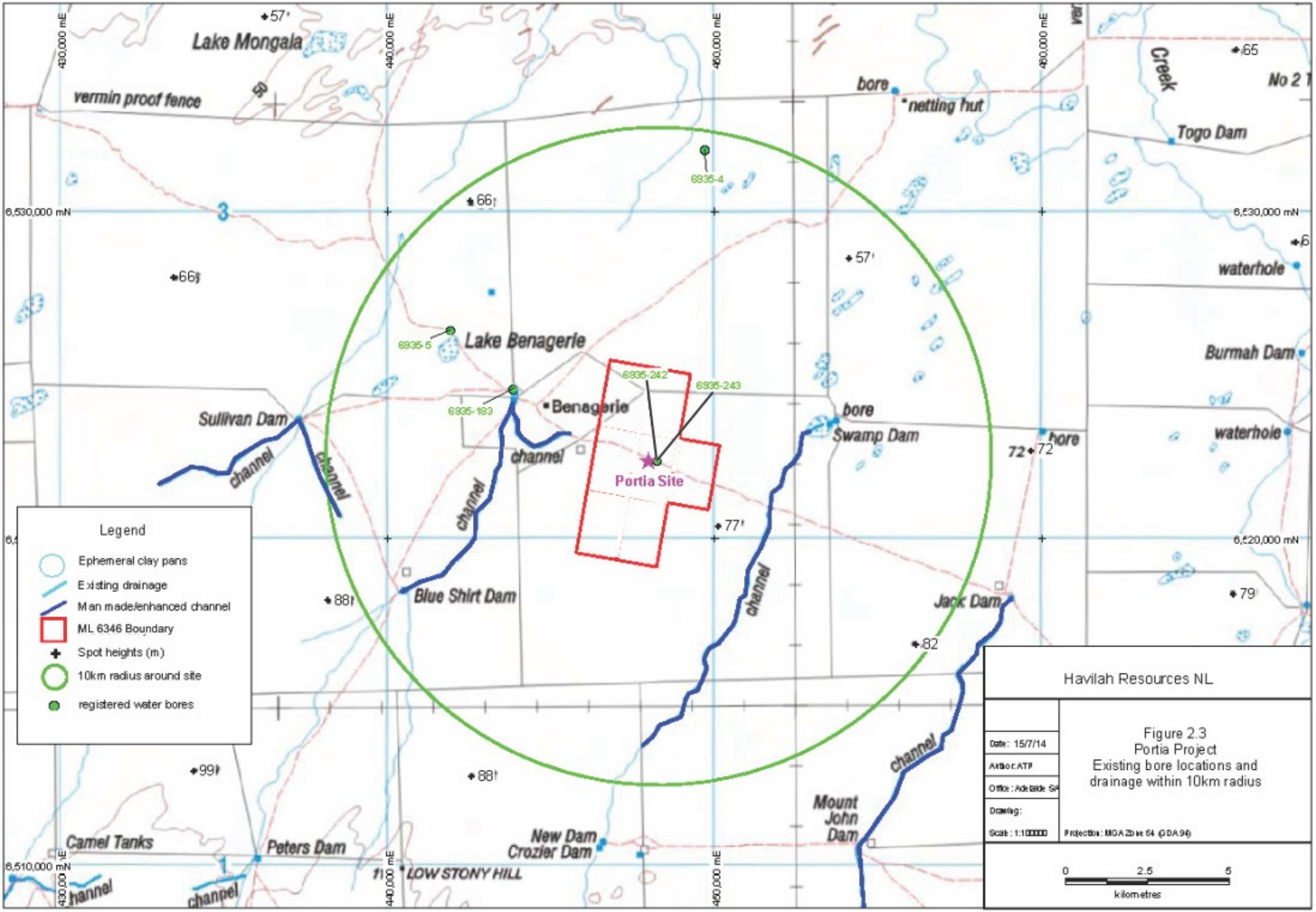
2.9 HYDROLOGY

There are no established water courses within 10 km of the Portia Deposit and no significant drainage channels occur in the ML area, with primary drainages lying well to the north, south and east. The nearest naturally occurring primary drainage is *Billeroo Creek* lying 8.3 kms due north of the project site, which then feeds into Lake Yantaweena, 17.5 km north. Both Billeroo Creek and Lake Yantaweena are ephemeral and unlikely to support aquatic flora and fauna.

In the immediate vicinity of the mine site, the landscape is characterised by a series of low northeast trending dunes separated by flat interdune corridors. Denuded clay pans between the dunes are common in these basins. At Portia, surface water typically occurs only after significant and intense rainfall events. Rainwater generally soaks into surficial soils and sands and may also accumulate on clay pans prior to being evaporated.

Some stock watering dams have been constructed across the existing ephemeral drainage lines, the nearest of these drainage channels feeds Jacks Dam 10 km to the east, Blue Shirt Dam, about 7 km to the west of Portia and Swamp Dam 5 km north west of Portia.

Existing drainage is shown in Figure 2.3.


Lake Mongala
vermin proof fence
bore
netting hut
Togo Dam
Creek
No 2
6935-4
Lake Benagerie
6935-6
6935-183
Benagerie
6935-242
6935-243
Portia Site
Sullivan Dam
channel
Swamp Dam
bore
waterhole
Burmah Dam
Blue Shirt Dam
Jack Dam
Mount John Dam
New Dam
Crozier Dam
Camel Tanks
Peters Dam
LOW STONY HILL
6,530,000 mN
6,520,000 mN
6,510,000 mN
430,000 mE
440,000 mE
450,000 mE
Legend
Ephemeral clay pans
Existing drainage
Man made/enhanced channel
ML 6346 Boundary
Spot heights (m)
10km radius around site
registered water bores
Havilah Resources NL
Figure 2.3
Portia Project
Existing bore locations and drainage within 10km radius
Date: 15/7/14
Author: ATP
Office : Adelaide SA
Drawing:
Scale : 1:100000
Projection : MGA Zone 54 (GDA 94)
0
2.5
5
kilometres

2.10 GROUNDWATER

2.10.1 Portia Deposit

The stratigraphic succession at Portia includes up to 3 m of 'Recent' age sediments associated with aeolian dunes and outwash deposits of the Frome plains underlain by Namba and Eyre Formations of the Tertiary age Lake Eyre Basin sequence.

The Namba Formation consists of about 70 m of grey clay with occasional thin lenses of clayey sand and silt. The Namba Formation is unsaturated, containing approximately 40% by weight water. It is of low permeability, acting as a confining layer rather than an aquifer.

The Eyre Formation occurs beneath the Namba Formation at Portia and consists of light grey silty clay. This unit varies in thickness to about 12 m, but is commonly absent, particularly at locations where the basement rocks occur at shallower depths (basement highs). It is thought to have been formed by the transport and deposition of locally derived materials from the nearby basement highs. At Portia, the Eyre Formation is referred to as Eyre Clays, as it is clayey rather than sandy, and it is not part of the palaeochannel system, nor is it hydraulically connected to them.

The Yarramba Palaeochannel lies more than 3 km distant from Portia (refer Figure 2.4), and extensive drilling shows that in the intervening area, sandy horizons are generally absent, and in many places clays of the Namba Formation, acting as aquitards, lie directly on the bedrock (Figure 2.5)

Sediments of the Eromanga Basin (and hence Great Artesian Basin) do not occur at Portia.

The basement rocks consist of footwall albitite, graphitic pelite and quartz albititite, all of which dip at an angle of approximately 40 degrees to the east. The uppermost 50 m or so of the basement units are highly weathered and are saprolitic. Weathering has also led to the development of small depressions in the basement topography which have been infilled by Eyre Clays. The Portia Deposit sits in one of these small depressions (refer to Figure 2.4).

Small supplies of groundwater occur in the silty sections of the Eyre Clays and also in both the saprolitic and fresh basement rocks. These units are considered to function as a single confined aquifer. Existing wells have been completed in either basement or sedimentary (weathered) units, both of which are low yielding (less than 5 L/s) and brackish to saline.

A search of the Water Connect drillhole data base administered by DEWNR indicates that there are 5 water wells located within a 10 km radius of the Portia site (excluding all investigation water wells completed by Benagerie Gold). Summary data from these wells are presented in Table 4. Well (bore) locations are shown in Figure 2.3.

All existing identified wells are currently inactive because the salinity is too high for stock consumption. None of these wells are currently used for domestic, stock or irrigation water supply. The extremely high TDS and EC values for well 6935-4 are most probably due to data entry error. Unit 6935-243 is used only as a water supply for regional Mineral exploration activities.

Hydrogeological investigations conducted at Portia deposit included the test pumping and monitoring of water wells within the open pit footprint, and the collection of water samples and their laboratory analysis. The findings from these investigations can be found in Appendix E and Appendix P and details from these reports are also summarised in section 3.3.1

Water collected from nine individual wells (Jareds, TJ-1, TJ-5, TJ-8 and PTDW1, PTDW3, PTDW4, PTDW6 and WB1) located within and surrounding the immediate vicinity of the open pit location were submitted to ALS laboratories for hydrochemical analysis. Laboratory results for each individual sample are summarised in Table 20, on page 99 and the average hydrochemical values for these results

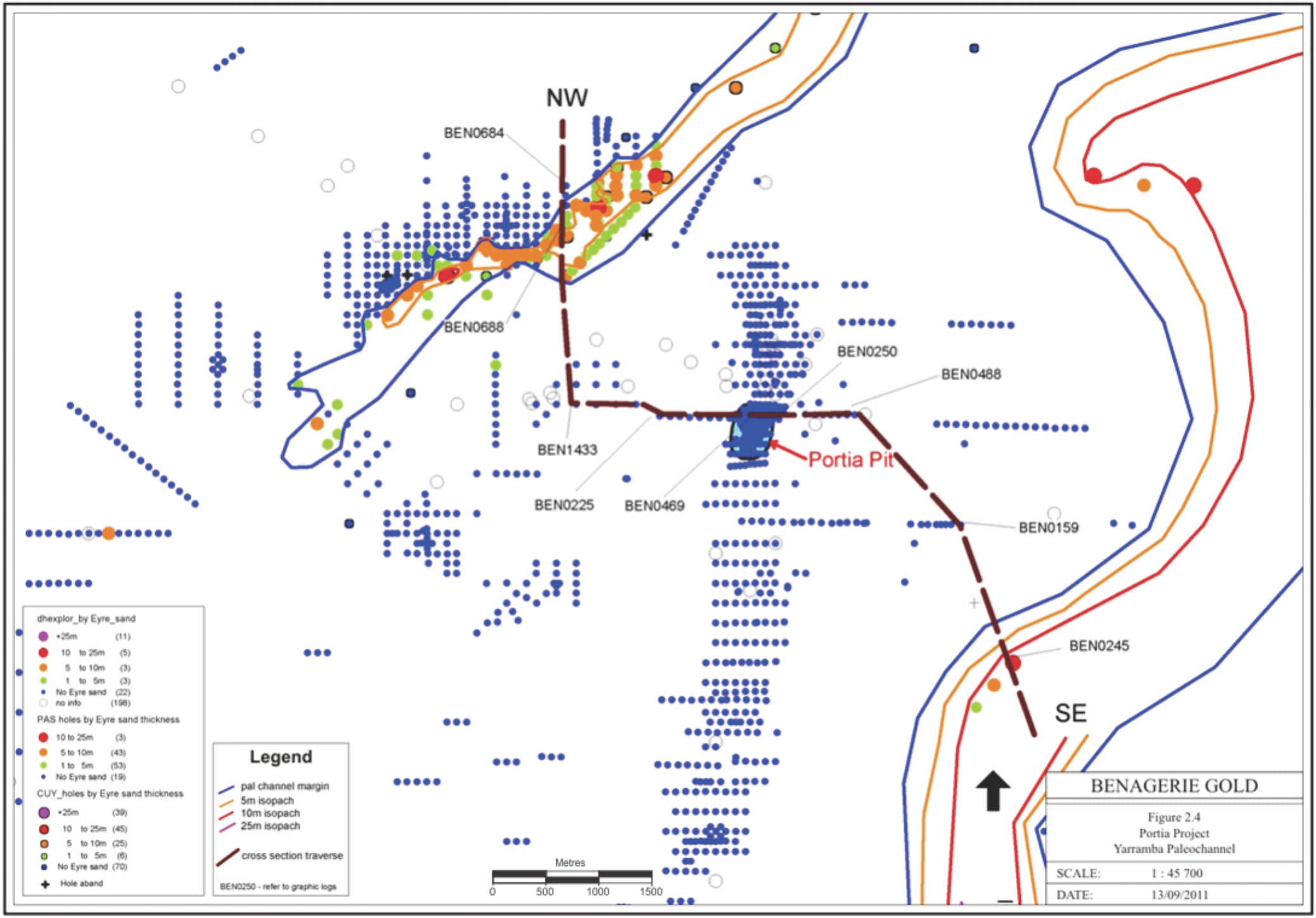
is reported in Table 5. Table 5 shows that groundwater at Portia is saline, with a total dissolved solids concentration (TDS) of 13,625 mg/L (ave.) and a pH of around 7.8 (ave.). Depth to water is about 29 m below ground level (approximately 40 m AHD).

A potentiometric surface map of the Portia area was prepared from depth to water data obtained from Benagerie Gold and other exploration company drillholes, with survey levelling and drill hole orientation data enabling the depth measurements to be converted to water elevations AHD (refer to Figure 2.6). The hydraulic gradient across the Portia site is shown in Figure 2.6 to be approximately 0.005, with flow to the north-west.

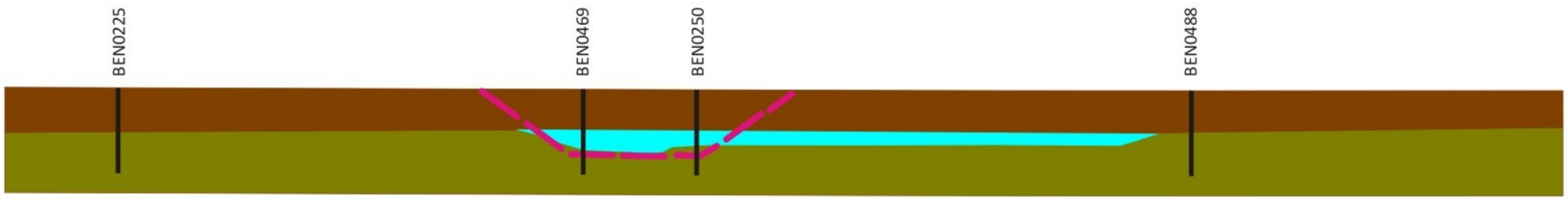
Table 4 Summary existing water well locations

Unit_No drillhole name	**6935-4**	**6935-5** BENAGERIE	**6935-183** 414 B1	**6935-242**	**6935-243**
orig drill depth	-	-	28.96	56	91
orig drill date	-	-	27/10/1970	15/04/1998	16/04/1998
max drill depth	182.88	64.92	28.96	56	91
max drill date	1/01/1977	-	27/10/1970	15/04/1998	16/04/1998
late open depth	182.88	64.92	28.96	0	91
late open date	1/01/1977	-	27/10/1970	15/04/1998	16/04/1998
purpose	-	-	-	DOM	DOM
late status	ABD	ABD	UKN	ABD	-
late status date	-	14/06/2011	27/10/1970	15/04/1998	-
SWL	18.29	-	-	-	18.4
RSWL	34.15	-	-	-	46.88
water level date	1/01/1977	-	-	-	16/04/1998
TDS	200135	-	-	-	-
EC	235453	-	-	-	-
salinity date	1/01/1977	-	-	-	-
pH	-	-	-	-	-
pH date	-	-	-	-	-
yield	-	-	-	-	3.75
yield date	-	-	-	-	16/04/1998

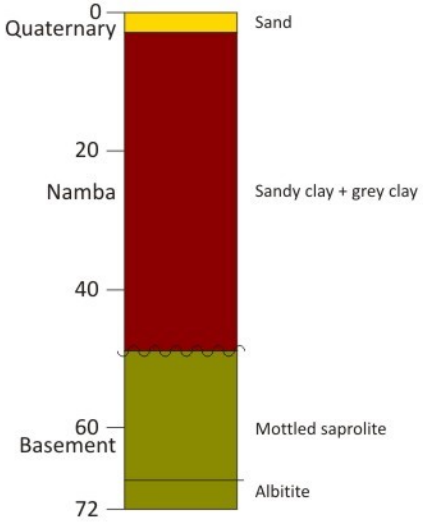
(source Water Connect Drill Hole Enquiry System, August 2014)


NW
SE
BEN0684
BEN0688
BEN0250
BEN0488
BEN1433
BEN0225
BEN0469
BEN0159
BEN0245
Portia Pit
dhexplor_by Eyre_sand
+25m (11)
10 to 25m (5)
5 to 10m (3)
1 to 5m (3)
No Eyre sand (22)
no info (198)
PAS holes by Eyre sand thickness
10 to 25m (3)
5 to 10m (43)
1 to 5m (53)
No Eyre sand (19)
CUY_holes by Eyre sand thickness
+25m (39)
10 to 25m (45)
5 to 10m (25)
1 to 5m (6)
No Eyre sand (70)
Hole aband
Legend
pal channel margin
5m isopach
10m isopach
25m isopach
cross section traverse
BEN0250 - refer to graphic logs
Metres
0 500 1000 1500
BENAGERIE GOLD
Figure 2.4
Portia Project
Yarramba Paleochannel
SCALE: 1 : 45 700
DATE: 13/09/2011

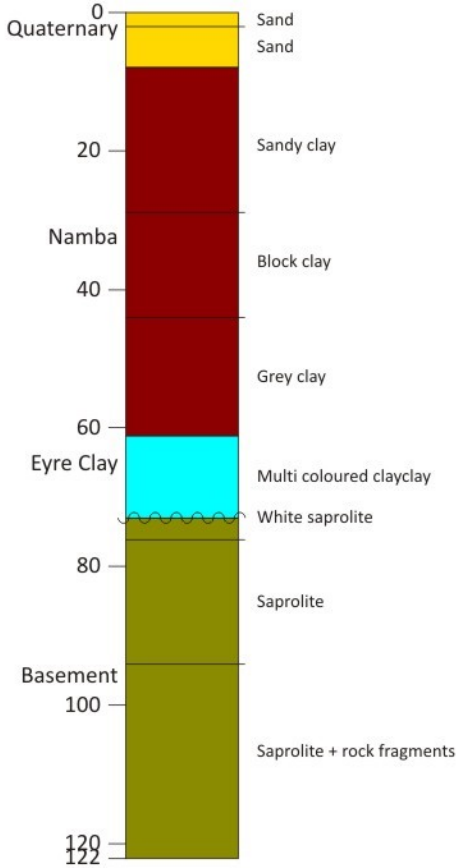
Portia Pit



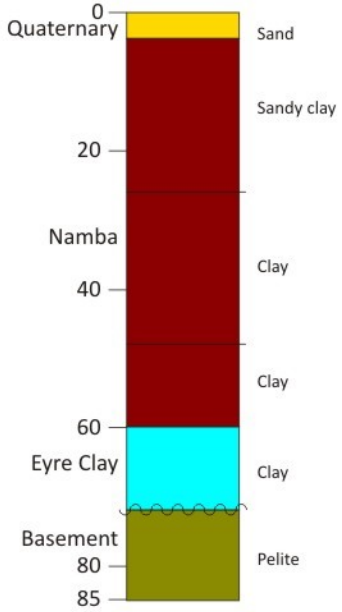
BEN0225 graphic log



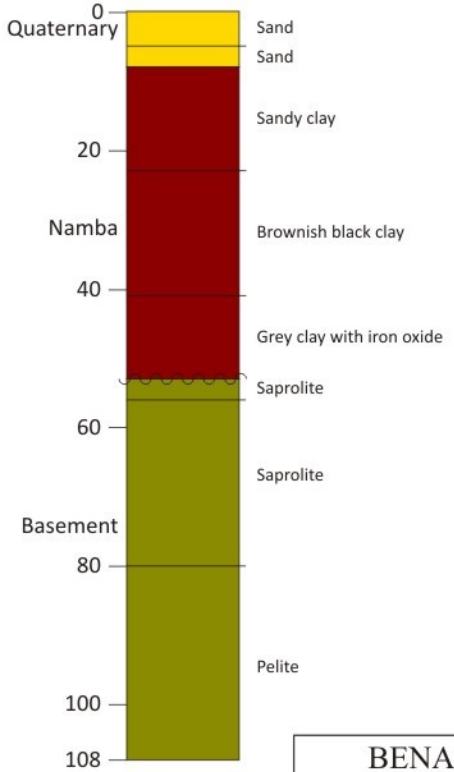
BEN0469 graphic log



BEN0250 graphic log



BEN0488 graphic log



Legend

- Namba Clay
- Eyre Clay
- Basement

BENAGERIE GOLD

Figure 2.5
Portia Project
Regional cross-section and graphic logs

SCALE:	NTS
DATE:	14/09/2011

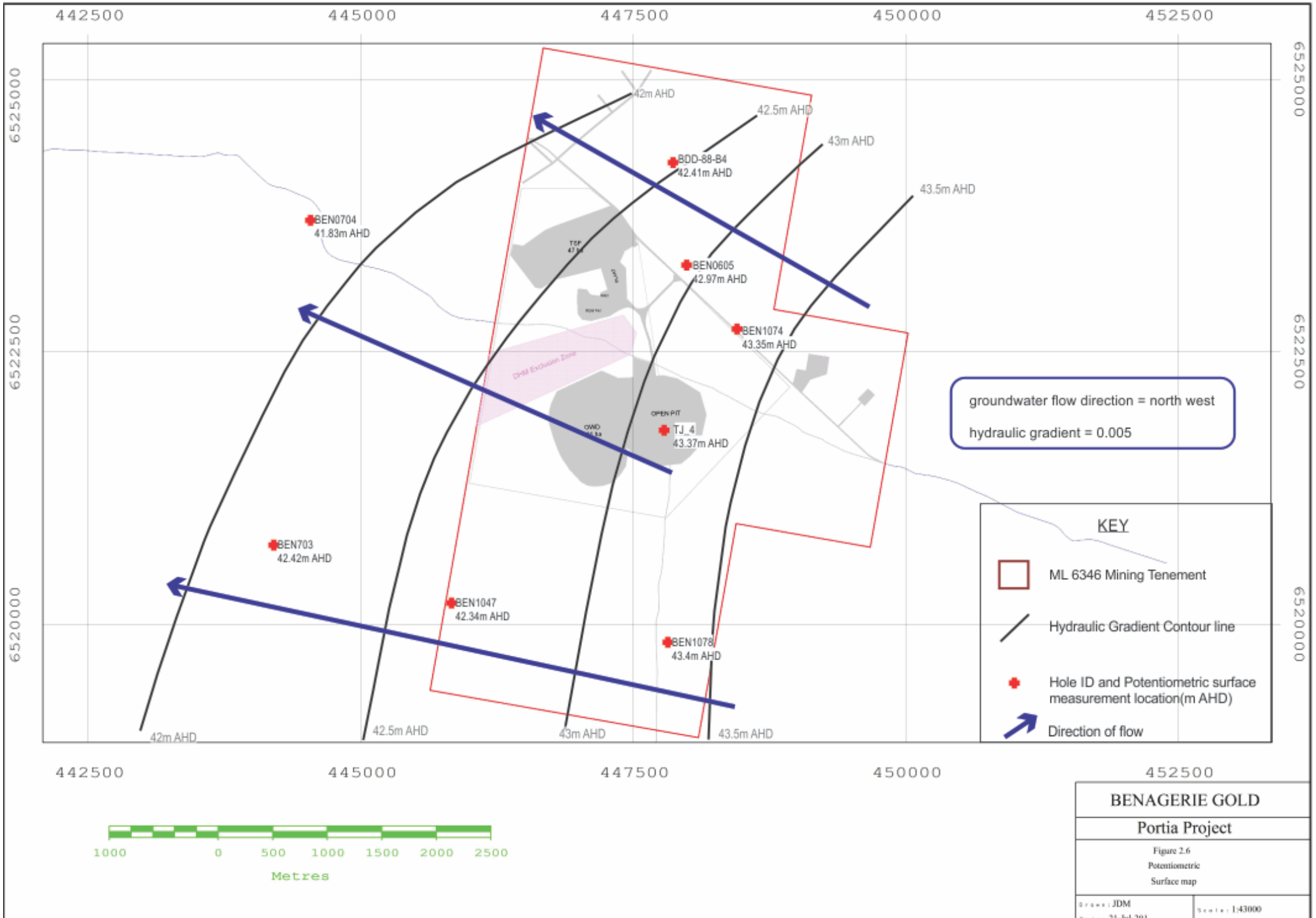

442500
445000
447500
450000
452500
6525000
6522500
6520000
42m AHD
42.5m AHD
43m AHD
43.5m AHD
BDD-88-B4
42.41m AHD
BEN0704
41.83m AHD
BEN0605
42.97m AHD
BEN1074
43.35m AHD
TJ_4
43.37m AHD
BEN703
42.42m AHD
BEN1047
42.34m AHD
BEN1078
43.4m AHD
groundwater flow direction = north west
hydraulic gradient = 0.005
KEY
ML 6346 Mining Tenement
Hydraulic Gradient Contour line
Hole ID and Potentiometric surface measurement location(m AHD)
Direction of flow
1000
0
500
1000
1500
2000
2500
Metres
BENAGERIE GOLD
Portia Project
Figure 2.6
Potentiometric
Surface map
Drawn: JDM
Date: 21-Jul-201
Scale: 1:43000
AGD 66

Table 5 Average Mine Groundwater quality

	UNIT	LOR	AVERAGE VALUE
pH Value	pH Unit	*0.01*	7.84
Electrical Conductivity @ 25°C	µS/cm	*1*	22525
Total Dissolved Solids @180°C	mg/L	*10*	13625
Hydroxide Alkalinity as CaCO3	mg/L	*1*	<1
Carbonate Alkalinity as CaCO3	mg/L	*1*	<1
Bicarbonate Alkalinity as CaCO3	mg/L	*1*	189
Total Alkalinity as CaCO3	mg/L	*1*	191
Sulfate as SO4 - Turbidimetric	mg/L	*1*	1759
Chloride	mg/L	*1*	6866
Calcium	mg/L	*1*	512
Magnesium	mg/L	*1*	307
Sodium	mg/L	*1*	3933
Potassium	mg/L	*1*	25
Arsenic	mg/L	*0.001*	0.406
Barium	mg/L	*0.001*	0.023
Beryllium	mg/L	*0.001*	<.001
Cadmium	mg/L	*0.0001*	<0.0001
Cobalt	mg/L	*0.001*	0.001
Chromium	mg/L	*0.001*	<.001
Copper	mg/L	*0.001*	0.004
Nickel	mg/L	*0.001*	<.001
Lead	mg/L	*0.001*	<.001
Vanadium	mg/L	*0.01*	<.01
Zinc	mg/L	*0.005*	<.006
Iron	mg/L	*0.05*	0.160
Manganese	mg/L	*0.001*	0.529
Mercury	mg/L	*0.0001*	<.0001
Total Anions	meq/L	*0.01*	234
Total Cations	meq/L	*0.01*	223
Ionic Balance	%	*0.01*	3.00

2.11 VEGETATION, WEEDS AND PLANT PATHOGENS

Playfair & Robinson (1997) presented the most recent and detailed review of the vegetation and flora of the region defined as the North Olary Plains (published as Hyde & Playfair 1997 in Playfair & Robinson 1997). The fieldwork for this assessment was undertaken from 1995 to 1997.

In addition, the Pastoral Program of the SA DENR (formerly Pastoral Management Branch) undertakes condition assessments of all pastoral leases in the State. It has information about vegetation condition for each paddock on each pastoral property in the region.

Prior to Playfair & Robinson (1997), this region was one of the most poorly researched in South Australia. No comprehensive assessments of flora had been conducted and there were few historical accounts from explorers.

2.11.1 Vegetation communities in the bioregion

This area lies within the Broken Hill Complex Bioregion (Neagle 2003) and consists mainly of sandy-clay plains with low shrubland vegetation (Playfair and Robinson 1997). The Portia area is located within the North Olary Plains region. Thirty nine vegetation associations (communities), of which twenty nine were discernable by objective analysis, and 448 plant taxa have been recorded in all of the North Olary Plains region (Playfair & Robinson 1997). Of these communities, a number are represented by small, minor or trace occurrences (less than 0.5%). Chenopod shrublands occupy the largest areas in the region, while only the following three major communities were recorded:

- community 24, *Acacia aneura/Enneapogon* spp. low open woodland, 16.48%
- community 32, *Atriplex vesicaria/Maireana astrotricha* low open shrubland, 11.73%
- communities 25/5, Maireana astrotricha low open woodland and Senna/Eremophila/Rhagodia spinescens open shrubland, 7.14%.

2.11.2 Site flora and fauna investigations

Two vegetation surveys covering the Portia gold deposit on Benagerie Station, now part of Mulyungarie Station were conducted under a South Australian Department for Environment and Heritage Permit to Undertake Scientific Research No. G24191 8 held by Dr F.J. Badman. The first survey formed part of an official DEH biological survey, designated “Number 577, Oban – Curnamona Energy”.

The second survey also undertaken by Badman Environmental occurred during the second week of October 2007 and is complementary to the earlier survey in June 2007. Data from the two surveys have been combined and reported on (Appendix A). Although some rainfall had occurred earlier in the year, conditions were dry at the time of the second survey and all ephemeral species had dried off. Conditions were wet at the time of the first survey, with many ephemeral taxa too immature to be identified to species level at that time.

The surveys were carried out using the methodology of the DEH Biological Survey of South Australia although sites from the second survey were not permanently marked. Voucher collections were made of the plant species that were not recorded during recent surveys at Oban, Mutooroo and Kalkaroo for Havilah Resources and allied companies. Voucher collections were lodged with the State Herbarium of South Australia.

Data from 18 sites were analysed using the techniques of classification and ordination and five vegetation groups were identified. These groups are based mainly on domination by different vegetation structures as well as by different species.

A supplementary vegetation survey was conducted by KBR in the period 27 February 2011 to 5 March 2011 during the actioning of a fauna survey (Appendix B). Survey areas were selected within

the site and in areas immediately adjacent to it. Stratification of vegetation, flora and fauna survey sites was non-random and sites were specifically selected to assess the range and quality of communities and habitat types present and to survey a significant portion of the site.

2.11.3 Vegetation communities

Vegetation mapping indicates that the survey area is dominated by low shrublands of *Maireana astrotricha* (Low Bluebush) on the plains, with areas of *Atriplex vesicaria* (Bladder Saltbush) and *Maireana astrotricha* on low dunes. There are some isolated stands of *Casuarina pauper* (Black Oak) low woodlands.

Other less common vegetation types are tall shrublands on sand plains and Eragrostis australasica (Cane-grass) in swampy areas. Grasses were recorded in most groups, but do not appear to be a major factor in the composition of any single group.

Vegetation of the Portia survey area fell within five groups. A brief description of the vegetation groups is summarised below. A map showing the vegetation types around the ML area is presented in Figure 2.7.

Group 1

This is the most common vegetation type in the Portia survey area. It consists of low open or sparse shrublands dominated by *Maireana astrotricha* on sandy-loam soils. *Maireana aphylla* (Cotton-bush) occurs at most sites in this group and *Atriplex vesicaria* was recorded at a majority of sites. *Gunniopsis quadrifida* (Sturt's Pigface) is common at some sites. At the time of the 2007 survey, the understorey was dominated by *Atriplex holocarpa* (Pop Saltbush) and *Sclerolaena ventricosa* (Salt Bindyi).

No other species were dominant in this group and very few tall shrubs and no trees were recorded here. Other species that were often recorded in the understorey include *Austrostipa nitida* (Balcarra Spear-grass), *Dissocarpus biflorus* (Two-horn Saltbush), *Gnephosis arachnoidea* (Spidery Button-flower), *Salsola kali* (Buckbush), *Sclerolaena decurrens* (Green Bindyi), *Sclerolaena intricata* (Tangled Bindyi) and *Tripogon loliiformis* (Five-minute Grass).

Only four introduced species were recorded in this group. The most common of these were *Carrichtera annua* (Ward's Weed) and *Schismus barbatus* (Arabian Grass). Other alien species recorded here are *Brassica tournefortii* (Wild Turnip) and *Sonchus oleraceus* (Common Sow-thistle), neither of which was very common.

Group 2

Group 2 vegetation includes sites that are similar to those in Group 1, but generally support more trees or tall shrubs. This group was found to occur on sandy or sandy-loam soils, with the upperstorey including some or all of *Acacia aneura* (Mulga), *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush), *Hakea leucoptera* (Silver Needlewood) and *Senna artemisioides* ssp. *petiolaris* (Senna). The understorey includes the low shrubs *Gunniopsis quadrifida*, *Maireana astrotricha* and *Rhagodia spinescens* (Spiny Saltbush) and the herbs and forbs *Atriplex holocarpa*, *Atriplex limbata* (Fan Saltbush), *Salsola kali*, *Sclerolaena decurrens* and *Sclerolaena diacantha* (Grey Bindyi). Less common species include *Atriplex velutinella* (Sandhill Saltbush), *Austrostipa nitida*, *Enchylaena tomentosa* (Ruby Saltbush) and *Tripogon loliiformis*.

Schismus barbatus was the most commonly recorded alien species in this group, with *Brassica tournefortii* also recorded here.

Group 3

Although only one site was sampled in this group, it is typical of the numerous cane-grass swamps and clay pans that occur throughout the survey area. These have a clay base and hold water for varying periods following significant rainfall events. The dominant species is the hummock grass *Eragrostis australasica* (Cane-grass). The shrubs *Chenopodium nitrariaceum* (Nitre Goosefoot), *Muehlenbeckia florulenta* (Lignum) and *Rhagodia spinescens* are slightly less common. *Dodonaea viscosa* ssp. *angustissima* also occurs here in the upper storey. The understorey is made up mainly of short-lived species with a few biennials, and includes *Atriplex holocarpa*, *Atriplex spongiosa*, *Bulbine* sp. (Bulbine Lily), *Osteocarpum* sp. (Bonefruit), *Sclerolaena brachyptera* (Short-wing Bindyi), *Sclerolaena ventricosa* and *Zygophyllum iodocarpum* (Violet Twinleaf). *Eragrostis setifolia* (Bristly Love-grass) occurs near the margins of swamps. Some swamps are fringed by a narrow band of *Eucalyptus largiflorens* (River Box).

Three introduced species were recorded in this vegetation group, *Brassica tournefortii*, *Schismus barbatus* and *Carrichtera annua*. The first two of these prefer sandy soils and were recorded only on the sandy margins of the swamps.

Group 4

This group contains areas of *Casuarina pauper* (Black Oak) woodland that occur on clay-loam soils just to the east of the central part of the survey area. *Casuarina pauper* dominates the overstorey, but *Alectryon oleifolius* (Bullock Bush) also occurs here. The understorey commonly includes the low shrubs *Maireana aphylla* and *Maireana pyramidata* (Black Bluebush), with *Gunniopsis quadrifida* and *Atriplex vesicaria* being less common. Other understorey species include *Einadia nutans* (Climbing Saltbush), *Enchylaena tomentosa*, *Eremophila glabra* (Tar Bush), *Rhagodia spinescens*, *Sclerolaena decurrens*, *Sclerolaena obliquicuspis*, *Tetragonia eremaea* (Desert Spinach), *Tripogon loliiformis* and *Zygophyllum iodocarpum*.

No introduced species were recorded at the site that forms the basis for the description of vegetation in this group.

Group 5

The final group contains sites on very low sand dunes and sandplain just to the west of centre of the survey area. Vegetation comprises low open shrubland or tall shrubland with a low shrubland understorey. Tall shrublands include *Dodonaea viscosa* ssp. *angustissima* or *Eremophila sturtii* (Turpentine Bush), while low shrublands include *Atriplex vesicaria*, *Gunniopsis quadrifida*, *Maireana astrotricha* and *Sclerolaena decurrens*. Other groundcover species include *Atriplex limbata*, *Erodium* sp(p). (Heron's Bill), *Sclerolaena diacantha*/*uniflora* and *Tetragonia eremaea*.

No introduced species were recorded within this group.

2.11.4 Threatened flora

A search for information on threatened species was first carried out using the study area's biogeographic boundaries (Neagle 2003). A secondary search was carried out under the area's botanical region boundary (Barker *et al*. 2005). The latter boundary (Eastern Botanical Region) is an artificial one based on straight lines of latitude and longitude. It includes a large area of country that is quite dissimilar to the Portia survey area.

No species that are listed as threatened under either the Commonwealth EPBC Act 1999 or the South Australian National Parks and Wildlife Act 1972 was recorded during either of the Portia surveys.

Barker *et al*. (2005) list three *Endangered* species for the Eastern Botanical Region of South Australia (Table 6). This is the region which contains the Portia survey area. They also list 12 *Vulnerable* and 33 *rare* species from this area (Table 6).

Table 6 Threatened species, Eastern Botanic Region

Threatened Species	50 km radius of Portia Prospect	50-100km radius of Portia Prospect
Endangered		
Atriplex papillata	No	No
Codonocarpus pyramidalis	No	No
Pterostylis lingua	No	No
Vulnerable		
Acacia carneorum	Yes	Yes
Acacia pendula	No	Yes
Cullen parvum	No	No
Dianella poracea	No	Yes
Malacocera gracilis	No	?
Ozothamnus scaber	No	Yes
Ranunculus pumilio var. politis	No	Yes
Santalum spicatum	No	No
Sauropus ramosissimus	No	No
Swainsona fuscoviridis	No	Yes
Swainsona murrayana	No	Yes
Swainsona procumbens	Yes	Yes
Rare		
Acacia barattensis	No	No
Acacia confluens	No	No
Acacia loderi	No	No
Aristida arida	No	No
Atriplex eichleri	No	Yes
Austrodanthonia laevis	No	Yes
Austrodanthonia tenuior	No	No
Austrostipa densiflora	No	No
Austrostipa trichophylla	No	No
Austrostipa tuckeri	No	No
Bothriochloa macra	No	Yes
Brachyscome eriogona	No	No
Calotis lappulacea	No	Yes
Calotis scapigera	No	Yes
Daviesia stricta	No	No
Derwentia derwentiana	No	No
Eragrostis lacunaria	No	Yes
Eucalyptus viridis	No	No
Frankenia cupularis	No	Yes
Geijera parviflora	No	Yes
Gilesia biniflora	No	No
Haeckeria punctulata	No	No
Hakea tephrosperma	No	No
Maireana melanocarpa	No	No
Muehlenbeckia coccoloboides	No	?
Olearia picridifolia	No	No
Ophioglossum polyphyllum	No	Yes
Potamogeton ochreatus	No	No
Rumex dumosus	No	No
Swainsona oligophylla	No	?
Swainsona pyrophila	No	No
Swainsona tephrotricha	No	No

Species Profile and Threats Sheet (SPRAT) have recently been completed on behalf of DEH for half of these species and details of the threatened species are as follows;

Acacia carneorum (Purple-wood Wattle) is known to occur near the Benagerie – Yarramba boundary fence, about 11 km from the centre of the ML area. This species is listed as Vulnerable under both the Commonwealth EPBC Act 1999 and the South Australian National Parks and Wildlife Act 1972. It has

recently been the subject of a detailed study and a Species Profile and Threats (SPRAT) sheet has been completed for it (SADEH 2007). This study found that this species occurs at isolated localities in the general area, with many herbarium records from the vicinity of the Mutooroo Mine area to the south east (Badman 2008) to Kalabity and Curnamona Stations to the west (Badman in prep.). In January 2007 there were 73 herbarium records from the Broken Hill Complex IBRA region in South Australia (SADEH 2007). Recent surveys on behalf of Havilah Resources have located an additional seven populations.

Acacia pendula. This species occurs in the Plumbago area, in deep red sandy loam at base of a low sandstone monolith (SADEH 2008).

Atriplex eichleri. There are records from near Mingary and near the Strathearn Homestead (SADEH 2008). Its habitat appears to be mainly low-lying areas where water concentrates (SADEH 2008).

Bothriochloa macra. There are two nearby herbarium voucher collections; from the roadside near Cockburn, where it was reported to be common, and from near the homestead flats and dam at Kalabity Station, where it was reported to be rare (SADEH 2008).

Calotis lappulacea. The closest herbarium voucher collection to the Portia survey area is from Kalabity Station, where it was reported to be rare (SADEH 2008).

Calotis scapigera. The only nearby herbarium voucher collection is from a flooded creek near Mingary (SADEH 2008).

Dianella porracea. The only nearby records are from granite outcrops on Bulloo Creek Station and from similar habitat half way between Olary and Old Boolcoomata (SADEH 2008).

Eragrostis lacunaria. There are several herbarium voucher collections from rocky hills around Bulloo Creek Station, Old Boolcoomata, the Olary Ranges and Kalabity (SADEH 2008).

Geijera parviflora. The closest herbarium voucher collections are from near Mingary and Boolcoomata (SADEH 2008).

Muehlenbeckia coccoloboides. This is a more northern species and the only record from anywhere near the Portia survey area is from sub-saline swampy flats on Billeroo Station (SADEH 2008), which may be within 100km of the Portia survey area.

Ophioglossum polyphyllum. The closest herbarium voucher collection to the Portia survey area is from Bulloo Creek Station (SADEH 2008).

Ranunculus pumilio var. politis. The only herbarium voucher collection from this general area is from Tombstone Hill on Plumbago Station (SADEH 2008).

Sclerolaena holtiana. Although this species was once considered to be rare in South Australia (Neagle 2003), more recent work has shown that this rating is not warranted and it is no longer listed as such (Barker *et al*. 2005, Lang and Kraehenbuehl 2006).

Swainsona fuscoviridis. There are several herbarium voucher collections from south of the Portia survey area, from Kalkaroo and Boolcoomata Stations and from further west (SADEH 2008).

Swainsona procumbens. There are no records from the Portia survey area, with the closest records being from Kalkaroo and Boolcoomata (SADEH 2008).

During the KBR survey, no species of Commonwealth or State conservation significance was recorded within the site during the surveys. However, in areas adjacent to the site, several large patches of the nationally vulnerable purple-wood were recorded.

2.11.5 Introduced flora (weeds)

Four introduced species were recorded during the surveys. No Proclaimed Species, as listed by APCC (2004), were recorded.

Brassica tournefortii, Carrichtera annua and *Schismus barbatus* are the most common introduced species overall. *Schismus barbatus* was recorded at more sites than any other introduced species.

The reason for the low incidence of alien species during this survey appears to be the lack of gullies and creeks flowing through sites in this area.

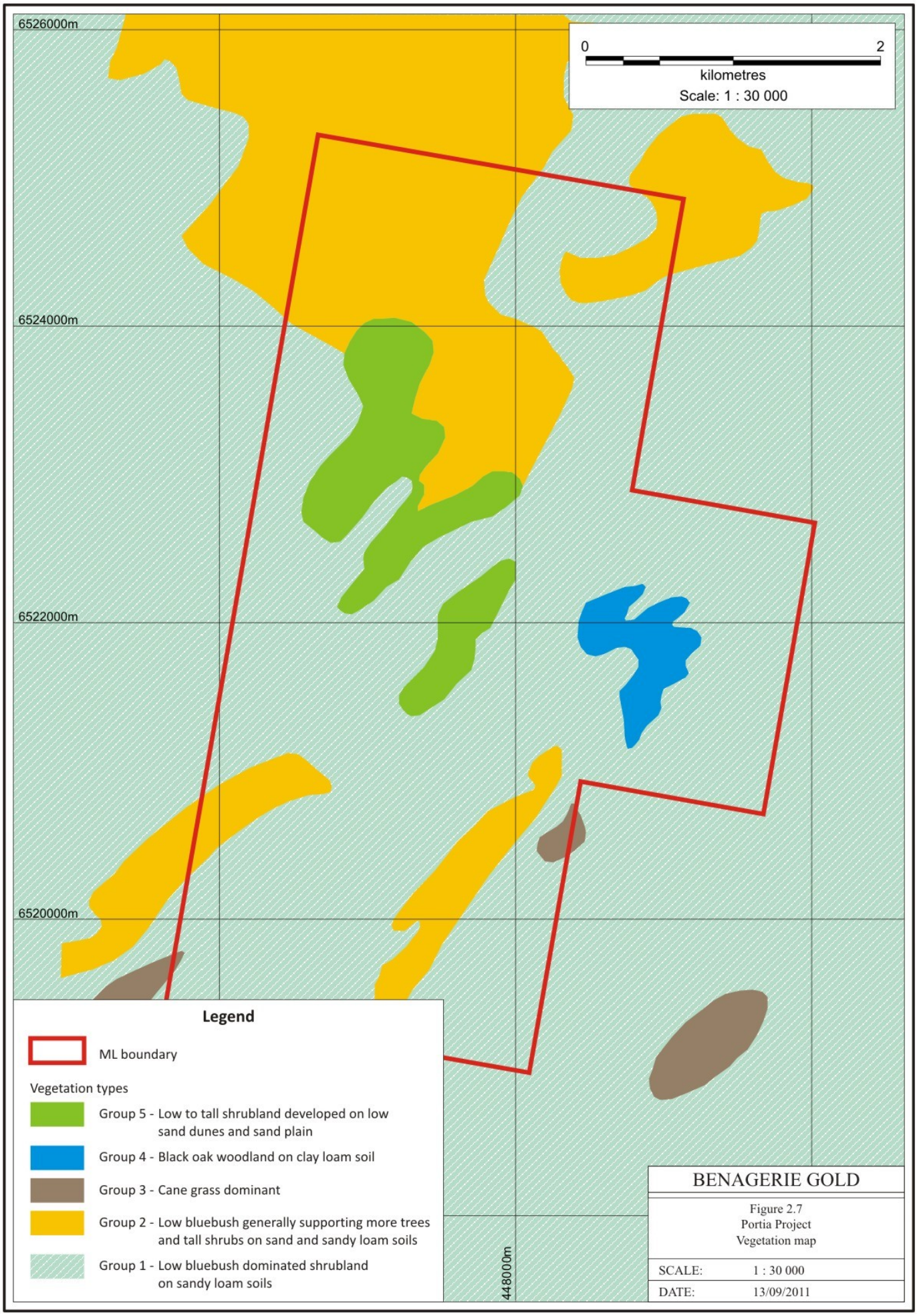
The most likely method of additional introduced species becoming established in the Portia survey area is by seed being brought in on vehicles, plant and equipment.

The introduced species recorded during the second survey represent 4% of the total species list for this survey. No introduced species were recorded in the July 2007 survey. Playfair and Robinson (1997) list 150 introduced taxa for the North Olary Plains, or 33% of their total species list. However, this list includes many taxa that were identified only to generic level, but distinct species in most of these genera were also listed. It is therefore likely that many taxa were counted twice. Barker et al. (2005) list 15% of the flora of the Eastern Botanic Region, which includes Portia and the North Olary Plains, as being introduced. This list is based on vouchered herbarium collections and is the most accurate information available.

Eight additional introduced species were recorded by KBR during the 2011 survey and two of those were recorded outside of the site. The most common introduced species were Arabian grass and Ward's weed, both of which were also recorded by Badman Environmental (2008). Introduced species requiring future control are outlined in Table 7. Three of these plants are declared plants under the NRM Act. They are all of high priority to control and they have the potential to cause significant environmental, economic or social impacts. They are also high priority weeds for mineral tenements. No WoNS were recorded within the site during this survey. However, two of the declared plants were in areas adjacent to the site (Table 7).

Table 7 Declared plants within and adjacent to the site

Family	Scientific name	Common name	Location
Declared plants (NRM Act)			
LABIATAE	**Marrubium vulgare*	Horehound	Occasional in wetter areas
COMPOSITAE (ASTERACEAE)	**Xanthium spinosum*	Bathurst burr	Jack's dam, adjacent to the site
COMPOSITAE (ASTERACEAE)	**Xanthium strumarium sp. agg*	Noogoora burr	Jack's dam, adjacent to the site
High priority weeds			
CRUCIFERAE	**Carrichtera annua*	Ward's weed	General area (i.e., within the site)
COMPOSITAE	**Carthamus lunatus*	saffron thistle	General area
CUCURBITACEAE	**Cucumis myriocarpus*	prickly paddy melon	General area
CRUCIFERAE	**Sisymbrium erysimoides*	smooth mustard	general area


6526000m
6524000m
6522000m
6520000m
448000m
0
2
kilometres
Scale: 1 : 30 000
Legend
ML boundary
Vegetation types
Group 5 - Low to tall shrubland developed on low sand dunes and sand plain
Group 4 - Black oak woodland on clay loam soil
Group 3 - Cane grass dominant
Group 2 - Low bluebush generally supporting more trees and tall shrubs on sand and sandy loam soils
Group 1 - Low bluebush dominated shrubland on sandy loam soils
BENAGERIE GOLD
Figure 2.7
Portia Project
Vegetation map
SCALE: 1 : 30 000
DATE: 13/09/2011

2.12 FAUNA

A fauna desktop study was conducted on the Portia ML area by Badman Environmental (2008) (Appendix A) and includes all information up to February 2008. As part of this study, the Biological Data Base of South Australia (BDBSA) records (SADEH 2008) were searched initially for an area covering a 50 km radius around the Portia ML, but the area of interest was then reduced to a 5 km radius based on coordinates included within the dataset.

It is stated by Badman that fauna habitat varies considerably according to the faunal group involved. Currently the arid zone region (both generally and in this region) is species-poor for most groups and that many of the populations of arid zone mammal and bird species have been and are threatened by anthropogenic influences, especially the impacts of pest plants and animals. A few of the larger species, such as kangaroo (two species), euro and emu, and some of the medium sized bird species, have benefited by the introduction of permanent water points.

In addition, a site fauna survey was carried out by KBR in 2011, which also included additional literature searches for the period 2008 to 2011, including further records from the BDBSA (Appendix B). Information from the Badman Environmental and KBR (2011) reports is summarised below.

2.12.1 Birds

111 bird species have been recorded within a 50 km radius of the ML area (Badman Environmental 2008) with about 90 species being recorded consistently on Mulyungarie PL (Debus et al. 2006). However, the actual species assemblage varies considerably according to habitat, with the largest group not being habitat specific i.e., not having a definite habitat preference. The species recorded here are ubiquitous and use all habitats across the region. Seasonal conditions, primarily rainfall and its season of occurrence, have a major influence on the presence of most avifauna species.

The four most characteristic species assemblages associated with particular habitats were:

Wetland habitat environments. These do not occur in the ML area. Although a canegrass swamp vegetation group has been identified within the ML area, the importance of the canegrass swamps (Vegetation Group 3 of Badman Environmental 2008) as wetland fauna habitat is low. Most of these swamps are shallow and would contain water only after exceptional rainfall events and at such times similar and markedly better wetland habitats are common across northern South Australia. With no deep water wetland habitat available within the ML area it is very unlikely that any of the migratory wading birds will ever be found at Portia. The lack of deep water also excludes a number of waterbird species, especially grebes and cormorants. It is extremely unlikely that any waterbird species will ever be found breeding in the ML area.

Black oak woodland. This community is widespread and is the only woodland that is relatively common in the region. Consequently, it provides an important habitat for a number of species (feeding, roosting and nesting habitat); however, it occurs over a small area just to the east of the ML area.

Eucalyptus woodland. This vegetation group does not occur within the ML area, although a very open community of Black box woodland is located on its eastern edge.

Low and open chenopod shrublands. This community dominates the region and project area. It provides habitat for a range of arid zone 'shrubland specialist' species.

The KBR survey of 2011 indicated that avifauna diversity was moderate with a total of 48 bird species recorded at the site and nearby areas during the study period (Table 8). In general, the majority of the avifauna recorded was in woodland areas (black oak and mulga). However, many birds of prey from the Accipitridae (hawks, eagles and allies) and Falconidae (falcons) were recorded throughout the site and the adjacent areas. Habitat for a range of birds of prey is present at the site and in the surrounding

area in 2011. This was primarily due to the abundance of prey (small birds and mammals) present at the site (and throughout the region) at the time of the survey as a result the above average rainfall conditions and the consequent growth of annual vegetation, especially grasses, over summer.

The majority of avifauna recorded was considered to be common to the region. Two species observed at the site and in adjacent areas, *Elanus scriptus* (letter-winged kite) and *Lophoictinia isura* (square-tailed kite), have a State conservation status of Rare and Endangered respectively and are both listed on the IUCN Red List. These species were observed on more than one occasion and a pair of square-tailed kites was observed daily adjacent to the ML, near Jack's Dam.

Falco hypoleucus (grey falcon) is listed as near threatened in Australia (IUCN Red List) and Rare in South Australia (NPW Act). Grey falcon was observed well south of the site, on the southern section of Yarramba PL adjacent to the Kalkaroo to Yarramba road, but this species may also occur occasionally at the site. It was recorded previously to the north on Mulyungarie PL by Debus et al. (2006).

Three *Aquila audax* (wedge-tailed eagle) nests were in or south of the site boundary and occasional observations were made of wedge-tailed eagles flying over the site. This species is resident, but has a large home range and the site would be part of this home range of the pair.

Emblema pictum (painted finch) was recorded as six to eight birds off the site and along the access track to the south of Jack's dam. This species is typically associated with central Australia and is an unusual, but not an unexpected or novel sighting in this region. Its presence is a geographical range extension presumably as a result of it moving south in response to the exceptionally good seasonal conditions.

Pedionomus torquatus (plains-wanderer) was not recorded at any of the surveyed sites and marginal habitat is present here for it. This species has been recorded in the wider region on Mulyungarie (Debus et al. 2006), including north of the dog fence (R. Singleton, pers. comm., November 2008), Wompinie, Bindarrah, Kalkaroo and Boolcoomatta, with a recent record from Beverley, well to the north-west of the site in 2010. Pastoralists in this region consider that the species is a seasonal visitor only and it may be present anywhere in the district following above average rainfall and plant growth. During drought, it is rarely recorded.

Turnix velox (little button-quail) is a species of interest for the wider region, but it is not of listed conservation significance. This species was observed in the general area of the site and on the access tracks adjacent to the site on a daily basis. Similar to stubble quail, it is an irruptive species occurring in large populations following ideal conditions, such as those occurring in the region from late 2009 onwards.

Table 8 Bird species recorded at the site and adjacent region during the KBR 2011survey

Family	Species	Common Name
PASSERIDAE	**Passer domesticus*	house sparrow
ACANTHIZIDAE	*Acanthiza apicalis*	inland thornbill
ACANTHIZIDAE	*Acanthiza chrysorrhoa*	yellow-rumped thornbill
ACANTHIZIDAE	*Acanthiza uropygialis*	chestnut-rumped thornbill
ANATIDAE	*Anas gracilis*	grey teal
MOTACILLIDAE	*Anthus novaeseelandiae*	Richard's pipit
ACCIPITRIDAE	*Aquila audax*	wedge-tailed eagle
ARTAMIDAE	*Artamus cinereus*	black-faced woodswallow
PSITTACIDAE	*Cacatua sanguinea*	little corella
ACANTHIZIDAE	*Calamanthus campestris*	Calamanthus, rufous fieldwren
SYLVIIDAE	*Cincloramphus cruralis*	brown songlark
EUPETIDAE	*Cinclosoma cinnamomeum*	cinnamon quail-thrush
ACCIPITRIDAE	*Circus approximans*	marsh harrier, swamp harrier
ACCIPITRIDAE	*Circus assimilis*	spotted harrier
ACCIPITRIDAE	*Circus sp.*	harrier (unidentified species)
CORVIDAE	*Corvus coronoides*	Australian raven
CORVIDAE	*Corvus orru*	Torresian crow
PHASIANIDAE	*Coturnix pectoralis*	stubble quail
ARTAMIDAE	*Cracticus tibicen*	Australian magpie
CASUARIIDAE	*Dromaius novaehollandiae*	emu
ACCIPITRIDAE	*Elanus scriptus*	letter-winged kite
ESTRILDIDAE	*Emblema pictus*	painted finch
CACATUIDAE	*Eolophus roseicapillus*	galah
MELIPHAGIDAE	*Epthianura aurifrons*	orange chat
FALCONIDAE	*Falco berigora*	brown falcon
FALCONIDAE	*Falco cenchroides*	nankeen (Australian) kestrel
FALCONIDAE	*Falco berigora*	brown falcon
RALLIDAE	*Fulica atra*	Eurasian coot
COLUMBIDAE	*Geopelia cuneata*	diamond dove
COLUMBIDAE	*Geopelia placida*	peaceful dove
COLUMBIDAE	*Geophaps lophotes*	crested pigeon
DICRURIDAE	*Grallina cyanoleuca*	magpie-lark
ACCIPITRIDAE	*Hieraaetus morphnoides*	little eagle
HIRUNDINIDAE	*Hirundo neoxena*	welcome swallow
MELIPHAGIDAE	*Lichenostomus virescens*	singing honeyeater
ACCIPITRIDAE	*Lophoictinia isura*	square-tailed kite
MALURIDAE	*Malurus leucopterus*	white-winged fairy-wren
MALURIDAE	*Malurus sp.*	fairy-wren (probably variegated)
PSITTACIDAE	*Melopsittacus undulates*	budgerigar
ACCIPITRIDAE	*Milvus migrans*	black kite
PSITTACIDAE	*Northiella haematogaster*	blue bonnet
PSITTACIFORMES	*Nymphicus hollandicus*	cockatiel
POMATOSTOMIDAE	*Pomatostomus ruficeps*	chestnut-crowned babbler
POMATOSTOMIDAE	*Pomatostomus superciliosus*	white-browed babbler
PSITTACIDAE	*Psephotus varius*	mulga parrot
EUPETIDAE	*Psophodes cristatus*	chirruping wedgebill
DICRURIDAE	*Rhipidura leucophrys*	willie wagtail
ESTRILDIDAE	*Taeniopygia guttata*	zebra finch
TURNICIDAE	*Turnix velox*	little button-quail
CHARADRIIDAE	*Vanellus tricolor*	banded lapwing

* *indicates introduced species.*

2.12.2 Mammals

Nine species were recorded in the literature within a 50 km radius surrounding the ML area in Badman Environmental (2008). The larger mammals (kangaroo species), and introduced and pest species dominate records and 4 of the 9 species recorded were introduced.

There is, apparently, a low frequency and diversity of small terrestrial mammals recorded for the wider region which reduces even further within a 5 km search of the ML area with only 3 species being recorded, 1 of which was introduced (namely European rabbit which was recorded as visual sighting in 2007).

The KBR fauna survey in March 2011 was undertaken after exceptional winter and summer rainfall i.e., under ideal conditions for the occurrence of small mammals. It used a variety of methods and techniques including Elliott traps, pitfall traps and direct observation, plus opportunistic searches and night observations**.**

Mammal captures and observations from the KBR survey within the site are presented in Table 9 and discussed below.

Table 9 Mammal observations and captures during the KBR 2011 survey

Family	Species	Common Name
BOVIDAE	**Bos Taurus*	cattle
FELIDAE	**Felis catus*	feral cat
MURIDAE	**Mus musculus*	house mouse
LEPORIDAE	**Oryctolagus cuniculus*	European rabbit
BOVIDAE	**Ovis aries*	sheep
CANIDAE	**Vulpes*	European red fox
MURIDAE	*Leggadina forresti*	Forrest's mouse, desert short-tailed mouse
MACROPODIDAE	*Macropus fuliginosus*	western grey kangaroo
MACROPODIDAE	*Macropus rufus*	red kangaroo
MURIDAE	*Notomys fuscus*	dusky hopping-mouse
MURIDAE	*Pseudomys bolami*	Bolam's mouse
MURIDAE	*Pseudomys hermannsburgensis*	sandy inland mouse
MURIDAE	*Pseudomys sp.*	native mouse (unconfirmed identity)
DASYURIDAE	*Sminthopsis macroura*	stripe-faced dunnart

* *indicates introduced species.*

The diversity of mammal species observed within the site by KBR was moderate; however, many species were recorded on less than three occasions. The majority of the commonly observed and caught mammal species was the introduced species, house mouse, which was present in plague numbers. Red kangaroos were observed on numerous occasions in the general area and were not specific to any site or habitat type. Western grey kangaroos were also observed but they were not as abundant as red kangaroos. Domestic sheep and cattle are still present within areas adjacent to the site. Introduced species such as European red fox and feral cat are known to occur in the wider region. Although none of these species was actually observed, evidence of both was recorded during the survey in the form of scats and footprints. Dingo and dingo-dog hybrid are also present in the region, and, more recently feral pig have been observed. Havilah personnel have seen goats on the ML

Six small native mammal species were trapped during the survey. Bolam's mouse and dusky hopping-mouse were captured on one occasion each. Stripe-faced dunnart was caught on five

occasions over three sites. Forrest's mouse was the most commonly recorded small native mammal species and was captured a total of 18 times at six sites.

Subsequent to the survey, small numbers of dusky hopping-mice were regularly observed at night throughout the site and region over March and April 2011 by Havilah employees. Sightings of many hundreds of individuals were recorded over late May and early June 2011 by Havilah employees and by pastoralists in the region surrounding Portia. These anecdotal reports are reliable first hand observations as both the Yarramba pastoralist and a Havilah employee collected dead individuals of the species.

During June, August and September 2011, regional investigations on the distribution of dusky hopping-mice were undertaken by KBR separate to the assessment at Portia. These observations confirm that there has been a massive irruption of the species in the wider region extending from Beverley to Quinyambie PL and currently extending to incorporate sections of almost all of the PLs south to the Barrier Highway and south west to Plumbago. This is also supported by observations of personnel from the SAAL NRM Board (2011). Based on observation of age class distribution, the species is breeding throughout this range and now occupies a variety of habitats considered to be atypical for the species, such as low sandy rises and drift sand dominated by chenopod shrubland. It is unknown if the species will continue to survive in the wider region and in the areas of less suitable habitat in future.

2.12.3 Reptiles and amphibians

Thirty reptile and 1 amphibian species have been recorded for the wider region. Most species recorded during past surveys are typical of those predicted to occur. Similar to the data for mammals, very few sites in the region had large numbers of reptiles and fewer had high species diversity. Only six reptile and one amphibian species had been identified to occur within a 5 km radius of the ML area in Badman Environmental (2008).

The KBR survey (2011) indicates that reptile diversity is low given the range of habitat types present at the site and the surrounding areas. Eleven species were recorded over all trap sites; the most common being Ctenotus schomburgkii (sandplain Ctenotus). Table 10 shows the reptile species recorded during the survey.

Only two dragon species were observed, a hatchling Pogona vitticeps (central bearded dragon) and a juvenile Ctenophorus nuchalis (central netted dragon), but it is highly likely that other species also occur at the site. Additional species potentially occurring here include species of Ctenophorus pictus (painted dragon) and two species of Tympanocryptis (lineata and tetraporophora, five-lined earless dragon and Eyrean earless dragon respectively). Suitable habitat for these species occurs at the site.

Three gecko species were caught, namely Nephrurus levis (knob-tailed gecko), Lucasium damaeum (beaded gecko) and Diplodactylus tessellatus (tessellated gecko), all of which are common in the region. A number of other common gecko species is likely to occur at the site including Gehyra variegata (tree dtella), Heteronotia binoei (Bynoe's gecko), D. furcosus (ranges stone gecko) and L. byrnei (pink-blotched gecko).

Varanus gouldii (Gould's goanna) tracks and scats were present in many sections and all habitat types at the site and one individual was caught in a patch of black oak.

Table 10 Reptile observations or captures within the site and surrounding areas

Family	Species	Common Name
AGAMIDAE	*Ctenophorus nuchalis*	central netted dragon
SCINCIDAE	*Ctenotus orientalis*	spotted Ctenotus
SCINCIDAE	*Ctenotus regius*	royal Ctenotus
SCINCIDAE	*Ctenotus schomburgkii*	sandplain Ctenotus
GEKKONIDAE	*Diplodactylus tessellatus*	tessellated gecko
SCINCIDAE	*Eremiascincus fasciolatus*	narrow-banded sand-swimmer
SCINCIDAE	*Lerista labialis*	eastern two-toed slider
GEKKONIDAE	*Lucasium damaeum*	beaded gecko
GEKKONIDAE	*Nephrurus levis*	knob-tailed gecko
SQUAMATA	*Pogona vitticeps*	central bearded dragon
VARANIDAE	*Varanus gouldii*	Gould's goanna

No amphibian species was recorded at the site during the KBR survey.

2.12.4 Conservation significance of regional fauna

Badman Environmental (2008) recorded only bird species of potential conservation significance in the region. Many of the bird species present in this region are nomadic to vagrant and the occurrence of these species at any time is dependent on the amount of food present i.e., the condition of the vegetation, which in turn is dependent on seasonal conditions, especially rainfall, and some other environmental pressures. The following comment is also presented in Badman: "None of the resident species of birds expected to be present on the ML area is threatened".

Five species are listed under the National Parks and Wildlife Act 1972 (SA), or in the case of one species, are proposed for listing under this act (Badman Environmental 2008) have been recorded within a 50 km radius of the ML area, namely, Australasian Shoveler, Grey Falcon, Crested Bellbird, Plains wanderer, and Freckled Duck. Each is discussed below. None of these species have been recorded in a 5 km radius of the ML area.

Australasian Shoveler

There are very few records of this aquatic species from this part of South Australia because of lack of suitable habitat, and the single record of SADEH (2008), listed in Table 4 of that report may be the only one from this area (Barrett et al. 2003). There are no breeding records from this part of South Australia (Barrett et al. 2003). This species is much more common to the east and south in New South Wales and Victoria.

The coordinates given by SADEH (2008) do not correspond exactly with any wetland, but are close to Cartspring Dam on Mulyungarie Station, about 18 km to the south east of Portia. This is the likely location of the sighting. The date of the record is 3 September 1996 and the reliability is said to be less than 5 metres (SADEH 2008), which would indicate a GPS derived coordinate. The database does not indicate the number of birds, or whether they were on water or flying overhead. Read and Badman (1999) found that all records of this species in the Lake Eyre South region were from bore drain swamps, a habitat that does not occur in the Portia area. The lack of dams in the Portia ML would also suggest that this species is very unlikely to occur here.

Grey Falcon

This is Australia's rarest falcon (Hollands 1984) and is of high conservation significance. The single record of this woodland species listed in SADEH (2008) is from about 42 km north-east of Portia, near Oban tank on Mulyungarie Station according to coordinates given in that database. This record

is based on a South Australian Museum record of "sign – slough/skin" on 27 May 1975. Debus et al. (2006) have more recent records of the species on Mulyungarie, north of the homestead. Barrett et al. (2003) do not list nearby breeding records from South Australia and only a very low reporting rate for this State. Breeding was reported for South Australia by Blakers et al. (1984), with most breeding records from Strzelecki Creek (Cupper and Cupper 1980).

The likelihood of this species being recorded in the Portia area is very low and is diminished by the relative scarcity of genuine woodland habitat in this area. Notwithstanding this, the species was recorded in March 2011 between Yarramba and Kalkaroo (well south of Portia) with another record of the species on Bimbowrie Conservation Park in 2011.

Crested Bellbird

This species is currently not listed as Rare in South Australia, but SADEH (2008) has recommended that this species should be upgraded to this category. SADEH (2008) list eight records from within 50 km of Portia, but none from within 5 km. Barrett et al. (2003) show that this is a common and widespread breeding species across most of the southern two-thirds of Australia, so the reason for the recommendation to upgrade its status is not clear. Blakers et al. (1984) reported that its abundance had declined in far north Queensland and east of the Great Dividing Range, but it is still common in southern Australia, including most parts of its range in SA. Barrett et al. (2003) show few records and no breeding from the Portia area, probably because of a lack of suitable woodland and tall shrubland habitat. This species is still common in suitable habitat in northern and western parts of the State (Badman, 2008) and it is not included in the revised list of threatened species in the State (SADEH 2008). The species was recorded around Jack's Dam.

Plains-wanderer

Up to 2008, this nationally vulnerable species had been recorded twice within 50 km of Portia (SADEH 2008). These records are from 14 km south-east and 42 km south of Portia, with both sightings made in May 2006. No sightings have been recorded within a 5 km radius of the ML area. More recent sightings have been made of the species, as documented in KBR (2011), but most are well south of Portia.

This species generally relies on extensive areas with a varied community of perennial and annual grasses and other herbs, sometimes within very open woodland (Blakers et al. 1984), a habitat that does not occur around Portia. The species key area is within the Riverina. It is regarded as a rare vagrant in northern South Australia (Read and Badman 1999).

Freckled Duck

This species is very unlikely to be found in the Portia area because of a lack of suitable habitat. Barrett et al. (2003) show very few records from this part of South Australia. The two records from the BDBSA (SADEH 2008) are from just to the south-west of Mulyungarie Homestead, about 24 km east of Portia, and from near the Yaramba Homestead, about 27 km south-east of Portia. The habitat in both cases, are large station dams with flood-out areas. Away from places with large areas of this type of habitat, this species occurs only as a vagrant (Read and Badman 1999).

KBR (2011) indicates that 3 listed fauna species were recorded at or adjacent to the site and include dusky hopping-mouse (listed under the EPBC Act and NPW Act), letter-winged kite (NPW Act) and grey falcon (NPW Act). The report also provided additional information about plains-wanderer. Each species is discussed below in relation to more recent data in the literature and field observations in March 2011.

Dusky hopping-mouse

This species is listed as Vulnerable (EPBC Act, IUCN Red List) in Australia and Vulnerable in South Australia (NPW Act). One adult male dusky hopping-mouse was captured in an Elliott trap

at PO5 (March 2011) and although suitable habitat did not occur at PO5, it is likely this individual was travelling between sites when captured. Habitat for this species was present in a limited area within the site, namely PO4, which was an intact dune, and possibly PO8 which was degraded sand habitat. The low sand dune area around site PO4 will be fenced off in order to avoid any possible disturbance of the habitat by the mining activities at Portia (see DSM exclusion zone on Figure 3.7).

Dusky hopping-mouse constructs characteristic 'pop holes', which act as vertical escape routes for their underground tunnel system. Pop holes were observed at PO4, and spot trapping of this area for an additional two nights failed to result in further captures of this species. Pastoralists on surrounding PLs, including Yarramba, have observed and collected dead specimens of this species in recent months (G. Treloar pers. comm., March 2011), and several instances were documented of many hundred occurring along access tracks and within and adjacent to the Yarramba homestead area (A. Partridge, Havilah Resources, pers. comm., May and June 2011). Finally, the species is now known to be present in large numbers over a massive area of the region and wider region extending from north of Quinyambie to the Barrier Highway and west from Beverley nearly to Broken Hill (KBR observations in 2011 and SAAL NRM Board (2011)).

Letter-winged kite

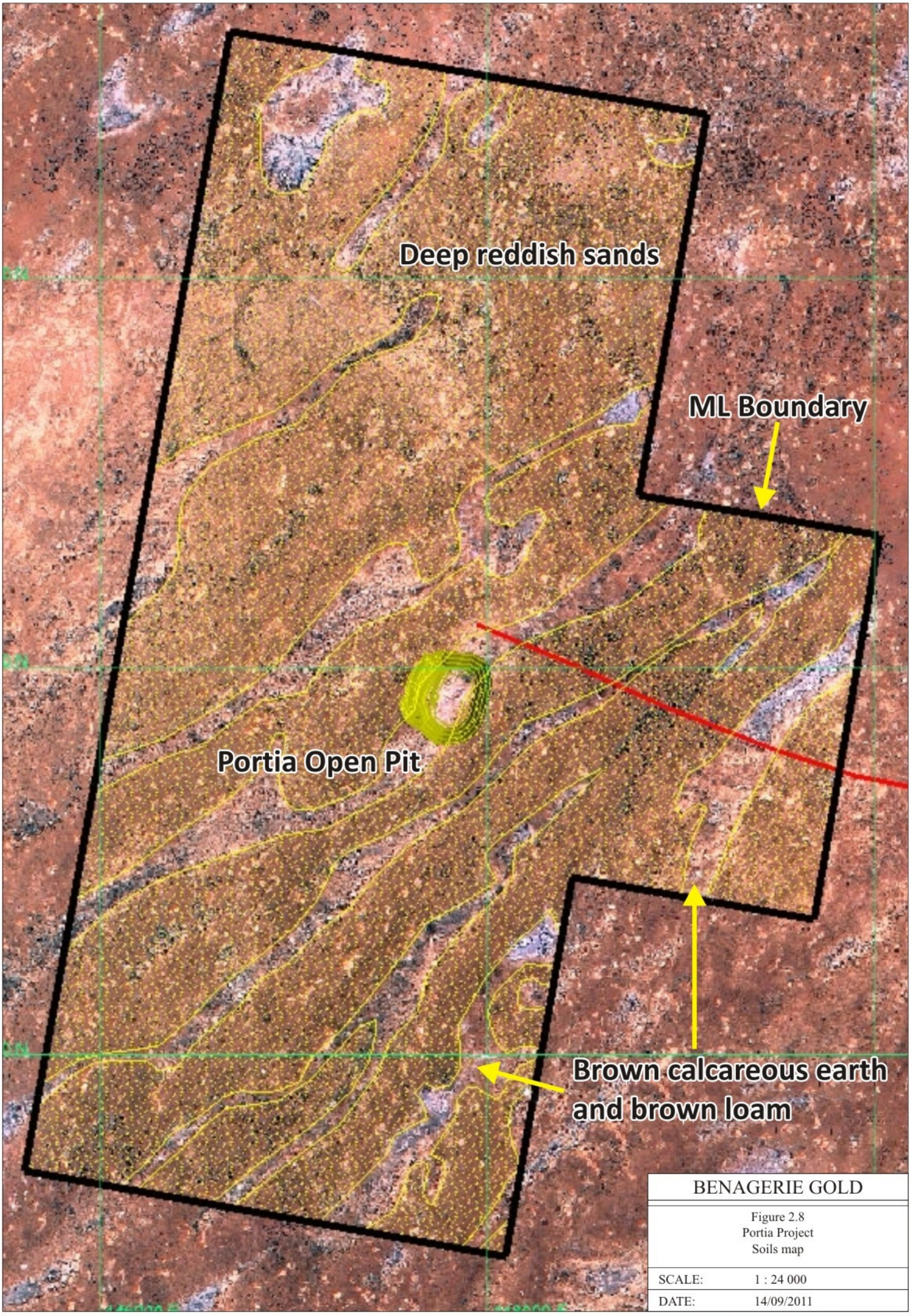
Letter-winged kite was observed adjacent to the site and is listed as near threatened in Australia (IUCN Red List) and Rare in South Australia (NPW Act). Letter-winged kite is considered to be a vagrant species, both here and elsewhere, and populations fluctuate drastically depending on its main prey population sizes (native and introduced rat species); making this species sensitive to other threats whilst rat numbers are low. Following high rainfall and local rodent-rat population increases, letter-winged kite numbers also increase markedly and they are known to become locally abundant (Olsen 1995). However, population sizes of this species are almost impossible to assess because of its extreme fluctuations (Olsen 1995).

Above average rainfall would influence the presence and abundance of letter-winged kite in the region as small mammal populations, therefore potential prey, have increased following the rainfall events. If above average rainfall continues, then letter-winged kite numbers could increase, with the possibility of it becoming locally common in the region for a brief time (until prey numbers decrease and the kite moves to another region).

2.13 TOPSOIL AND SUBSOIL

The Portia site is located in the north east corner of the Eastern Pastoral Province which forms part of a broad scale resource survey area covering the whole of South Australia (Laut, 1977). The province has been divided into three environmental regions and subdivided into 24 environmental associations. The site is situated within the Benagerie Association of the Southern Frome Basin Region. Soil types and other parameters are described on a schematic profile basis.

The most widespread soil type is found on the principal landform of the area (flat plain with maximum slope 1%) as a brown calcareous earth. Low undulating dunes, the sub-dominant landform type, are characterised by deep reddish sands and some brown calcareous earths. Both are well drained and contain carbonate nodules in the B horizon and below. Occasional pans (small depressions) occur and are distinguished by poorly drained soils: where Gilgai micro-relief is present, the soil is a uniform brown loam, self-mulching with cracking clays, and where a surface crust occurs, the soil is a crusty red duplex type with a strongly structured B horizon. All soils in the Benagerie Association described above have an alkaline reaction trend. Both the deep reddish sands and the brown calcareous earth are susceptible to wind erosion, but this only occurs when the ground cover is removed by overgrazing or other physical disturbance. If unchecked, the deep reddish sands will form drifts and migrate. A soils map is presented as Figure 2.8.



BENAGERIE GOLD	
Figure 2.8 Portia Project Soils map	
SCALE:	1 : 24 000
DATE:	14/09/2011

2.14 HISTORY AND HERITAGE

2.14.1 Aboriginal Heritage

The Portia project area is subject to a registered native title application made by the Adnyamathanha people (SC99/1). A Native Title Agreement pursuant to Part 9B of the Mining Act was entered into PIRSA's register on 10 October 2008.

An investigation into the presence of archaeological relics in the area undertaken by the Aboriginal Heritage Unit of the South Australian Department for the Environment found only scant evidence of aboriginal activity at the proposed mine site and the airstrip site. Stone artefacts are exceedingly rare. Occasional camp-oven sites occur in the area and care is taken to protect these from accidental access. None are known close to Portia.

A detailed field survey was undertaken with representatives of the Adnyamathanha people together with an anthropologist and two representatives of Benagerie Gold on 20-21 May 2008. The entire project area was surveyed plus a possible future EML area for road sheeting material. Sites which were identified as having some preservation significance during this Survey have been recorded and avoided during the planning phase for the project.

Pastoralists and other long term residents in the region have stated to their knowledge there are no known living descendants of the aboriginal community which once frequented the area.

An anthropological report commissioned by Geoscience Australia and PIRSA in 2005, prior to a deep seismic crustal survey, details the aboriginal history and notes that the original descendants of the early indigenous people moved to an area north of Broken Hill from a camp on Boolcoomata in 1943. In this report, it is observed that the current Native Title Claimants, the Adnymathanha Group from the Flinders Ranges, have assumed a caretaker role for the area in recent years and are not the original inhabitants of the site.

2.14.2 Non Aboriginal history and Heritage

The area has been subject to pastoralism since about 1859, although the Government Surveyor, Captain Charles Frome, led a party to the region in 1843. Captain Frome travelled as far as Mt Serle and sighted the lake, which was later to bear his name, although at the time he believed it to be Lake Torrens.

At this period of European settlement in South Australia it was believed that Lakes Frome, Torrens and Eyre formed an unbroken, horseshoe shaped inland lake system around the raised Flinders Ranges.

By 1850 small parcels of land had been leased in the pastoral country of South Australia and taken up around surface and other reliable waters. One such small lease of 10 square miles was taken up in 1854 at 'Ethiadina', in country that subsequently became Plumbago Station. Ethiadina is near a semi-permanent spring. Shepherds moved small flocks of sheep out to pasture and returned them at night to stone and bough yards. They used well-watered areas regularly until drought struck the region in the 1860's.

The area has been used almost continuously for sheep and cattle grazing. Wire fencing was introduced in about 1860. Extensive use was made of storage drains by an early pastoralist, Edwin Crozer. He deepened water courses that flowed to Lake Frome, to form long dams.

Travellers in the area used horse and carriage services from Burra before the railway to Silverton and Broken Hill was constructed in 1884. A fortnightly mail service was also established, which serviced Post Offices at Bimbowrie, Outalpa and old Boolcoomatta. Eating-houses were built along

the track from Burra to the northeast. The ruins of some of these eating-houses survive at Karolta and Outalpa.

The townships of Mannahill, Olary and Mingary sprang up to service the railway and station properties in the area. The township of Mingary no longer exists, but its location is marked by a railway siding.

2.15 PROXIMITY TO CONSERVATION AREAS

The nearest conservation area is Boolcoomatta Station which was purchased in April 2006 by the Australian Government in partnership with the Nature Foundation of South Australia. Boolcoomatta Homestead lies 60 km to the south of Portia.

The nearest Ramsar site is at Lake Pinaroo situated 250 km to the north-east of Portia within the Sturt Conservation Park, NSW.

2.16 PRE-EXISTING SITE CONTAMINATION AND PREVIOUS DISTURBANCE

The site does not currently have any contamination issues. Some previous disturbance has occurred through historical exploration and pastoral activities. Exploration drill hole locations are shown in Figure 2.9.

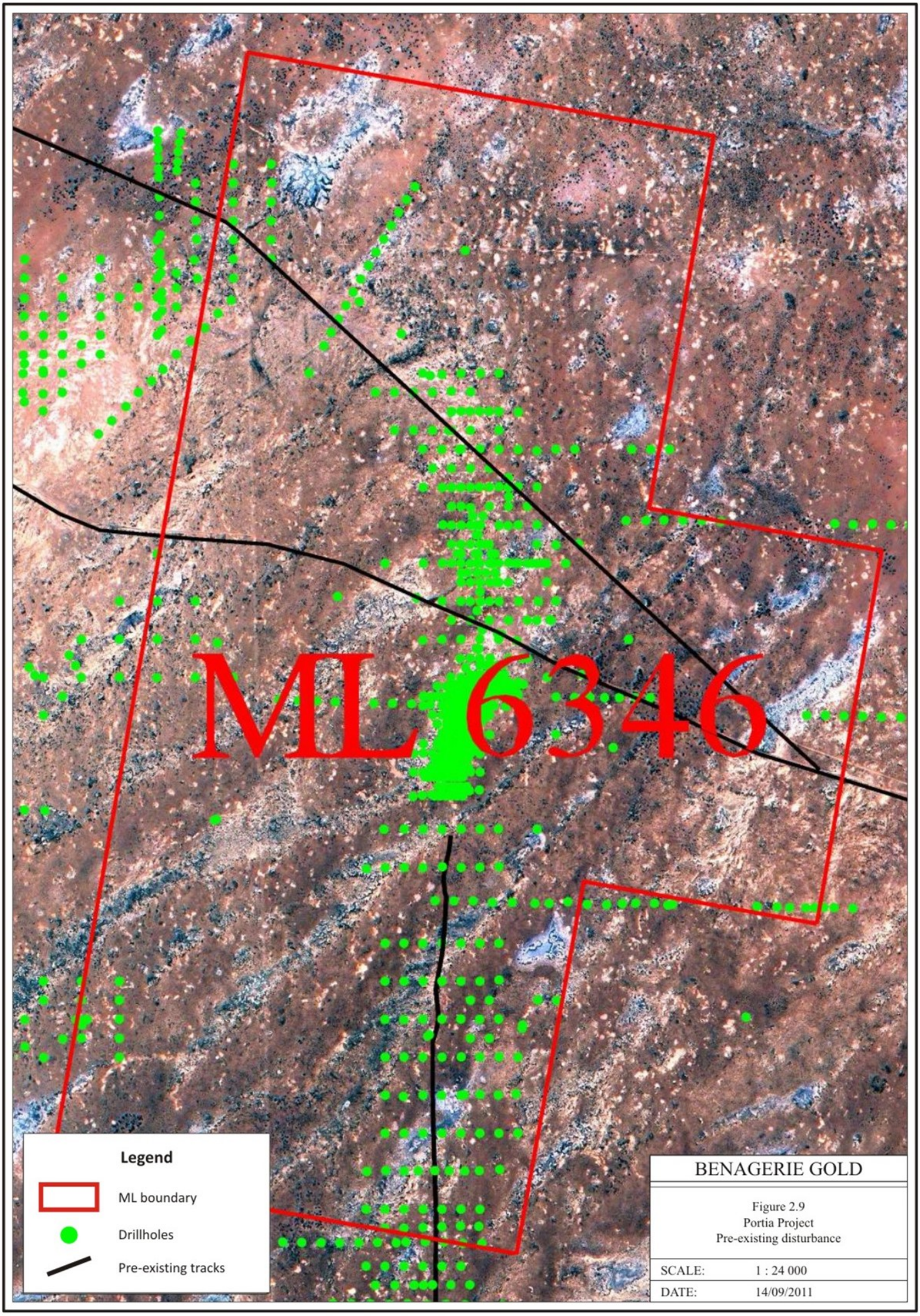
The land has been grazed for the past 150 years, and the area is considered to be in moderate rather than good condition and shows signs of past erosion. Previous exploration activities have resulted in one mineral well and a number of exploration drill sites. Drillholes have been capped and largely rehabilitated.

2.17 EPBC ACT IMPLICATIONS

An Environmental Protection and Biodiversity Conservation Act (EPBC) database search and "self-assessment" has been undertaken which indicates there are no matters of national environmental significance relating to the project area. The site does not contain any threatened ecological communities or populations of threatened plant species.

Based on earlier data, no fauna species listed under the EPBC Act have been reported from the Portia lease area (or within a 5 km radius area) and are unlikely to occur within the ML area (Badman Environmental 2008). One bird species, *Pedionomus torquatus* (plains-wanderer) has been recorded twice from the 50 km radius area (SADEH 2008). These records are both from Kalkaroo Station well to the south of Portia and more recent records of the species are all remote from the ML.

No flora species that are listed as threatened under either the Commonwealth EPBC Act or the South Australian National Parks and Wildlife Act were recorded during surveys of the ML area.


ML 6346
Legend
ML boundary
Drillholes
Pre-existing tracks
BENAGERIE GOLD
Figure 2.9
Portia Project
Pre-existing disturbance
SCALE: 1 : 24 000
DATE: 14/09/2011

3 Description of the operation

3.1 GENERAL DESCRIPTION AND SUMMARY

3.1.1 General

The Curnamona Province has for the past thirty five years been subject to modern exploration during which time it is estimated that between $60-$100 million has been expended in the region by several major mining companies and some small exploration companies in the search for both base metals and uranium.

By and large, the work has met with limited success; some discoveries have been made, but none have been developed. Prior to the recent acceleration in exploration activity, all the major companies effectively abandoned the area and Havilah Resources NL was able to acquire a large contiguous exploration block which included several undeveloped discoveries, including Portia.

The Portia Deposit was originally discovered by Pasminco in their search for zinc deposits. The Benagerie area was joint ventured with Werrie Gold, who acquired the area after uranium exploration work by Marathon Petroleum in 1980/81 intersected some copper mineralisation in an area that is now known as the North Portia copper-gold orebody.

The Pasminco-Werrie Joint Venture obtained some spectacular drilling results for gold but had considerable difficulty in repeating them in subsequent drillholes. They used conventional assay methods that did not accurately take into account the sampling problems caused by the coarse, nuggety nature of the mineralisation. This inconsistency led to a lack of confidence in resource estimations and consequently the Portia project was not developed. They did, however, estimate a resource of between 60,000 and 140,000 ounces of gold at around 5 grams per tonne in a layer at the base of the Tertiary cover sequence. The significant thickness of clay overburden prevented simple bulk testing of the ore.

By detailed gravity mapping and strategic drilling, the joint venturers were able to trace the prospective Tertiary gold horizon and stratigraphic zone of interest around the Benagerie Dome for many kilometres. This resulted in discovery of several other promising gold occurrences along strike from Portia (e.g., at Shylock and Lorenzo), but proper evaluation was invariably plagued by inconsistent and unrepeatable gold assay results.

When Havilah acquired the area from Pasminco (then in administration), it adopted a different approach, recognising that the coarse nugget gold could not be properly sampled by conventional techniques. To this end, a small gravity wash plant was constructed and every one metre of good quality drill sample was selectively washed and the gold collected, to obtain a more representative result on the basis of a larger sample size. By washing the entire sample from the selected drillholes, sub-sampling and homogeneity problems were minimised and the physical gold was available for study and inspection (Figure 3.1).

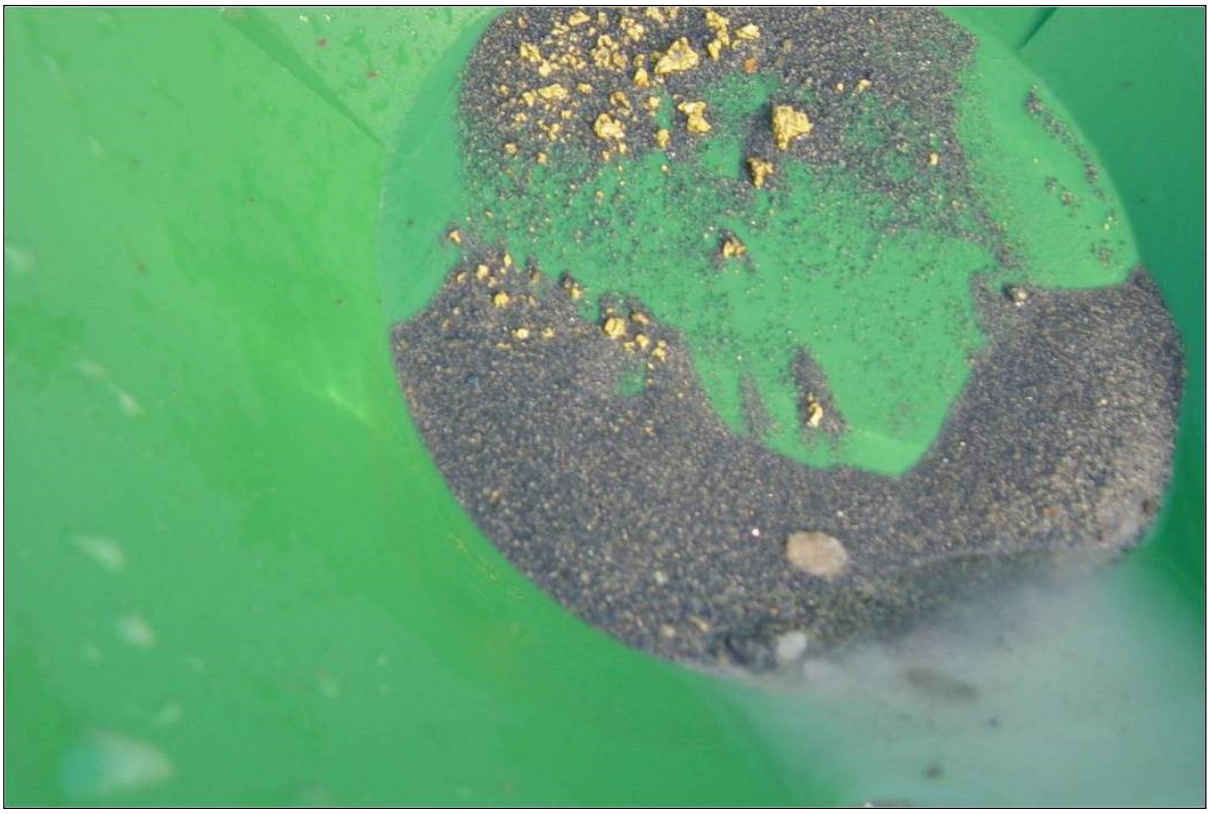


Figure 3.1 Photo showing free gold

In parallel, a concerted effort has been made to re-assemble all the exploration data and integrate the data to a common framework using the VULCAN 3D mining software package.

This work has led to a better understanding of the controls on mineralisation and several successful drilling programs have been undertaken using exploration models developed in VULCAN.

Whilst the Proterozoic basement rocks are recognized as having excellent economic potential, the great problem with this part of the Curnamona Craton is the significant thickness of soft clay cover that blankets the prospective rocks.

This cover makes exploration difficult as no surface sampling can be undertaken and no detailed geometric or structural information can be gleaned from outcrops. However, if it was not for the depth of cover, ore deposits which Havilah Resources are evaluating would have been mined long ago.

Havilah Resources exploration was initially guided by detailed aeromagnetic mapping. This was complemented by detailed gravity mapping and extensive low-level magnetic surveys, carried out by Havilah Resources to enhance the information collected by PIRSA (now DSD) and Geoscience Australia in past regional surveys.

This work was followed up by carefully selected, close spaced drilling to build up the knowledge of the stratigraphy and structure of the prospective basement rocks.

It appears that the gold has formed largely at the contact of the footwall albitite unit and a graphitic (carbonaceous) pelite. The base of the Tertiary age gold rich layer appears to be richest at the subcrop trace of the mineralised bedrock albitite – pelite contact which dips at about 40 degrees to the east. As this formation was progressively weathered and deflated in Tertiary times a rich detrital gold layer accumulated at the bedrock palaeosurface with little or no fluvial transport of the gold. The

whole area was subsequently inundated in a large palaeo-Lake Frome Basin, thereby covering and preserving the detrital gold layer with a thick pile of clay-rich lacustrine sediments.

In early 2007, Havilah made a significant breakthrough after several drilling programs by washing deeper samples of the weathered bedrock and finding that they contained rich gold mineralization in addition to the base of Tertiary layer. Mineragraphic examination and later electron microscopy revealed that the deeper gold was chemically the same as the base of Tertiary gold (apart from some minor supergene enrichment in the Tertiary gold). It remains nuggetty at depth and is apparently related to the contact zone mentioned above. A sound working model for the mineralisation has now been established for Portia after much drilling and persistent research by Havilah.

PQ diamond drilling was successfully carried out in April 2007 and good core recovery was achieved both through the entire Tertiary cover sequence and the mineralised sequence. Careful assaying on large samples of the core was carried out and results obtained support the earlier wash results. Significantly, the diamond drill core assay results remove the possibility that the deeper gold was related to down hole contamination.

As stated above, the Portia Deposit is located in north eastern South Australia, about 105 km north west of Cockburn. ML 6346 eastings and northings are shown on Figure 2.2. The Portia operation is planned to be an open pit, approximately 80 m deep, with excavation of the Tertiary age clays to expose the underlying gold bearing clayey and silty layer occurring on top of weathered basement rocks.

The main infrastructure components of the Portia Gold Project will include:

- an open cut pit through the Namba Formation and Eyre Clays to the top of the saprolitic basement material,
- an overburden waste dump (OWD),
- a pit dewatering dam (PDD)
- a raw water dam (RWD),
- a tailings storage facility (TSF),
- a nominal 149,000m^3 capacity ROM pad,
- a gravity separation gold recovery plant,
- pit dewatering wells and pipework (doubling as a water supply system),
- a mine water disposal re-injection well field and pipework,
- a small landfill facility for putrescible and non-recyclable rubbish,
- offices and workshop buildings,
- a nominal 52 person camp, and
- internal haulage roads and internal and external access roads.

The projects infrastructure components are shown in Figure 3.7.

3.1.2 Project Alternatives

Resource development projects are restricted in the manner of their development in the following ways:

- Physically, by the location of the orebody and the climatic, topographic and geotechnical constraints imposed by the surrounding landscape.
- Environmentally, by the environmental sensitivities of the project setting.
- Socially, by the expectations and concerns of affected communities.
- Economically, by the need to extract and process the ore profitably.

In particular, a fundamental constraint of all mineral resource developments is that they can only occur where a commercial deposit is found. The alternative to the development of the Portia Gold Project is no development.

The direct consequences of not proceeding with the project can be summarised as follows:

- The social and economic benefits described in Section 4.1 and 4.2 e.g., wages, royalties and taxes, would be lost at all levels, i.e., local, regional, South Australian and national.
- In particular, about 50 full-time jobs created directly at the Portia mine during operations, and additional indirect jobs created elsewhere would not be available. Normally there is at least a five times multiplier effect for each direct mine job created.
- The land, water and air impacts (and associated physical, biological and social impacts) associated with the development of a well-managed open pit mine located in an isolated setting would not occur.

Alternatives considered in project planning included:

- Open pit mining
- Borehole mining
- Underground mining

Borehole (downhole extraction) mining involves drilling into the ore zone and flushing the gold ore out by underground sluicing. After detailed evaluation and investigation of production rates the method was considered less favourable than conventional open pit methods. In view of the soft nature of the material, underground mining was also considered inappropriate.

With regard to alternative metallurgical processes, extensive wash plant processing using a simple trommel and Knelson concentrator, followed by clean-up of concentrate on Gemini Table (i.e., a gravity circuit) was found to produce a gold concentrate suitable for direct smelting to Dore bars.

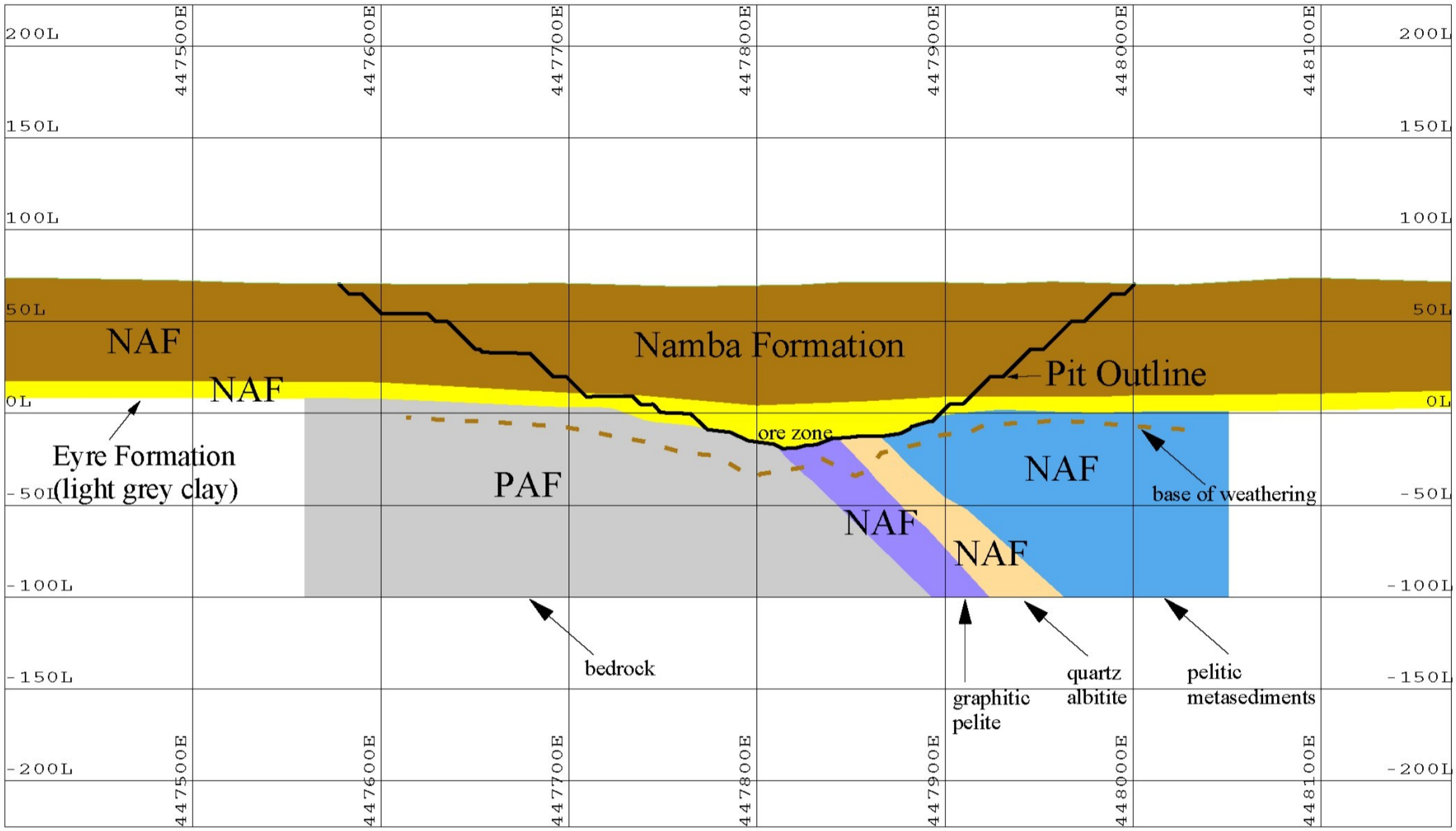
The approach avoids the use of cyanide in recovering gold as most of the gold occurs as discrete medium to coarse grains. The environmental advantages of a simple gravity circuit are significant.

3.2 RESERVES, PRODUCTS AND MARKET

3.2.1 Geological Environment

A typical geological cross-section of the Tertiary stratigraphy and the underlying Proterozoic rock formations are shown in Figure 3.2 The gold is predominantly confined to the base of the Tertiary age sequence in a silty layer typically 1-3 metres thick and 120-150 metres wide, informally referred to as the Light Grey Clay (LGC). It is located at the contact zone between the Tertiary Eyre Formation and the underlying variably weathered basement rocks. This contact zone is believed to have formed a chemical focal zone for the precipitation of the gold and the *in situ* growth of small nuggets in open fractures and voids. Later weathering along this contact probably enabled the supergene overgrowth enrichment of the gold to occur. Electron microprobe studies confirm the primary nature of the nuggets. They are not alluvial in origin, nor secondary in nature, as previously assumed.

Other heavy metals, including uranium, are very low in abundance, probably due to the long term weathering and leaching which these rocks have sustained. The footwall horizon at Portia is interpreted to be equivalent to the copper horizon at North Portia but is only weakly mineralised in copper in the Portia area. Waste material is comprised almost entirely of clays from the Namba and Eyre Formations, and the open pit design allows for approximately 7 million cubic metres of waste to be removed to expose the LGC at the base of the Tertiary sequence.



BENAGERIE GOLD	
Figure 3.2 Portia Project Geological cross-section	
SCALE:	1 : 3000
DATE:	01/03/2012

3.2.2 Reserves and Resources

Havilah has published an Inferred Resource of 720,000 tonnes @ 2.9 g/t for 67,000 ounces of gold using a high grade cut of 60 g/t for the base of Tertiary (LGC) gold (Table 11). The resource estimate is based on 895 assayed samples from 205 Havilah drillholes. It is supported by the earlier Pasminco drilling results, but because of acknowledged sampling and assaying problems, the Pasminco assays were not included in the present resource estimate.

Table 11 Inferred Resource

High grade cut g/t	**uncut**	**60**	**30**
Grade g/t	3.1	2.9	2.6
Total oz	72,000	67,000	60,000
Total tonnes	**720,000**		

The optimised open pit design (Figure 3.3) captures 355,000 tonnes of the Inferred Resource containing 53,200 oz of gold.

Currently there is an unquantified amount of gold in the underlying bedrock. The economic viability of this bedrock gold will be defined by further drilling, and pit floor sampling, from the base of the open pit once the LGC gold bearing layer is mined.

With regard to known or potential resources, prospects have been identified from previous drilling programs adjacent to the Portia Deposit. These deposits are located within ML 6346 and include North Portia located (700 m to the north of Portia), for which an indicated plus inferred JORC resource of 11.3 million tonnes of 0.89% Cu, 0.64 g/t Au and 500 ppm Mo has been estimated. Additionally, the Lorenzo prospect, located approximately 1 km due south of Portia has several ore grade intersections; however, it is yet to be drilled to JORC status. Both areas have high potential for future development; further evaluation of these deposits is planned. This will include drilling, resource definition, metallurgical studies and water testing. Drilling methods will most likely include aircore, reverse circulation, diamond and rotary mud, depending on the purpose of the drilling.

Access to drill sites on ML 6346 will be along existing tracks, then by driving across country. It is unlikely that construction of any graded tracks will be necessary, as the ground is relatively flat with open, sparse vegetation. Areas of thicker vegetation will be avoided.

Field crews normally consist of one geologist and one field assistant, along with a drilling crew of two or three people. Vehicles will consist of the drill rig plus compressor truck and three 4WD utilities. All field crew will be accommodated at the mine camp.

Any mineral exploration on ML 6346 will be conducted in accordance with PIRSA's information sheets "Statement of Environmental Objectives & Guidelines for Mineral Exploration Activities in SA" (Form M33-June 2004). Rehabilitation will be in accordance with lease conditions and will occur progressively during the period of lease tenure. Where groundwater is encountered, significant flows will be recorded and water samples and relevant information will be supplied to DSD. All holes will be abandoned in line with PIRSA "General Specifications for the Construction and Abandonment of Mineral Exploration Drillholes" (PIRSA Information Sheet M21). Drill sites will be sited to cause the least impact to vegetation. A small area at each site may be cleared, by hand, for laying out samples.

For percussion drilling, one sump (4 m x 2 m x 2 m deep) may be dug at each drill site to contain any expelled groundwater. Topsoil will be stockpiled separately for later use in site rehabilitation. All samples will be collected as 1m samples in large plastic bags and laid out in rows. For any diamond drilling or water well drilling, two sumps of similar size (4 m x 2 m x 2 m deep) will be dug to retain drill cuttings and decant clean water for recirculation.

Partial rehabilitation will be completed as soon as practicable, with the sumps backfilled and topsoil re spread. The holes will be temporarily capped with PVC caps. The 1m bagged samples will be stored at each site until the assays have been received and it has been decided that the samples are no longer required. These samples will then most likely be emptied into pits on each drill line which will be back filled and rehabilitated in line with requirements. The empty plastic bags will be removed from site. At each site, the PVC casing will be cut off below ground level and the hole plugged as per the requirements. The rehabilitation of each site will then be finalised by raking or lightly scarifying.

3.2.3 Production rates, products and market

Of the 720,000 tonnes of inferred resource, 355,000 tonnes of LGC ore occur within the planned open pit envelope. This is termed the in pit resource and is to be mined.

The mine plan calls for removal of approximately 7 million cubic metres of overburden to access the base of Tertiary (LGC) gold ore. It is expected that this will be completed within twelve months, using the mining equipment planned.

Mining and processing of the estimated 355,000 tonnes of LGC ore is planned to take a further six months. Once the LGC layer is exposed, gold production will commence and be continuous thereafter at a planned rate of around 9,000 ounces per month until completion of the mining operation. The product is free gold; this will be recovered in a simple gravity plant, without the use of cyanide or other chemicals. For security reasons the gold will be smelted on site into gold bars for shipment to the Perth mint for refining and sale.

Based on the mine plan it is expected that around 51,000 ounces of gold will be mined and recovered from the LGC within the eighteen month period from commencement of mining.

3.3 MINING PLAN

3.3.1 Types of Mining to be carried out

Mining at Portia is to be by open cut methods. Processing will involve gravity separation only. Hence, chemical beneficiation will not be carried out.

Ongoing exploration has been described in Section 3.2.2 above.

Geotechnical analysis and pit design

A geotechnical investigation for the open pit was completed by Dr Anthony Meyers of Rocktest Consulting in order to ascertain appropriate pit wall slope design parameters. This investigation drew not only on data and information collected from the Portia site, but also on very comprehensive testing and measurements carried out as part of the Kalkaroo feasibility study in identical overburden and bedrock material. In the investigation, a series of limit equilibrium and rigid block models were prepared and implemented to ascertain the likely behaviour of the material once excavated. Atterberg Limit and multi-stage triaxial compression tests were carried out by Australian Testing Pty Ltd on selected samples to provide material characteristics and strength data for modelling. Wedge and planar failure analyses as well as circular type instability analyses were conducted to

assess the risk and likelihood of a structural failure within batters for drained and undrained conditions within the pit walls. Based on the predictions from the analyses (refer Appendix C) the pit walls were divided into east and west geotechnical domains. The recommended parameters for the walls in these two domains, incorporated into the pit design, are such that under normal operating conditions these parameters achieve a mean safety factor of, or exceeding 1.2 and a probability of failure of less than 20% to ensure that the hazard associated with pit wall instability remains acceptable. Details are as follows:

- East wall:
  - Final: 35° maximum overall slope angle incorporating 15m bench heights with 45° maximum batter angles and 7m minimum berm widths.
- West wall:
  - Initial: 23° maximum overall slope angle incorporating 15m bench heights with 45° maximum batter angles and 25m minimum berm widths.
  - Final: 32° maximum overall slope angle incorporating 15m bench heights with 7m minimum berm widths and 45° maximum batter angles.

A number of recommendations are made in the report, including:

- Implementation of a rigorous program of pit wall monitoring to highlight the performance of the walls. The results obtained from these activities will be used to confirm the suitability of the design and, if necessary, modifications will be made accordingly to ensure that the hazards remain manageable.
- Installation of a series of pumped vertical depressurization wells within the walls and a pumped sump in the pit floor, to ensure that the clays at the toes of the walls and the saprolites upon which the walls are founded remain unsaturated.
- Ongoing collection of material and hydrogeologic data during mining.
- Further material testing and stability, if the characteristics of the materials differ significantly from those expected.

Mining method

The pit will be developed from the 70 m RL (ground level) to nominally -20 m RL, a total depth of 90 m.

Mining is expected to be completed within eighteen months.

A sketch of the open pit is shown in Figure 3.3. It should be noted that this figure is an isometric view and cannot be scaled. It is a schematic only. Pit Plans and Sections are also provided in Section 7, Figure 7.3 through to Figure 7.7.

BENAGERIE GOLD

Figure 3.3
Portia Project
Open pit schematic viewed from the south

SCALE: n/a

DATE: 13/09/2011

Mine dewatering

Australian Groundwater Technologies (AGT) were commissioned to complete definitive pit dewatering investigations for the Portia pit. These hydrogeological reports completed by AGT can be found in Appendix E and Appendix P. The technical addendum provided in Appendix P, provides results and findings from a recent extraction and reinjection trial conducted to provide additional hydraulic and hydrochemical data to support this Program for Environmental Protection and Rehabilitation (PEPR) and to support an application for a drainage and discharge permit for mine production. The latest results from the injection trial were used to update the groundwater model for the project and refine the site water balance. The key findings from the investigations are summarised below.

The initial mine pit dewatering scenario selected by Havilah Resources involves 12 dewatering bores installed in two stages (nine initial bores followed by three more after 160 days of pit mining) and pit-floor sumping active from 300 days of pit mining. Simulated pumping operations lasted 1030 days, with the entire simulation time being 1000 years to investigate the recovery of the groundwater system on closure. The intention shall be to dispose of excess mine water abstracted from the pit dewatering wells (deemed excess to site requirements) through re-injection into the Shylock palaeochannel well field located within the Mining Lease (see Section 3.7.5 and Section 3.10 for further details). The results from the recent re-injection trial (refer to Appendix P) show that the Shylock palaeochannel has the capacity to receive excess mine water at the modelled rates over the life of mine.

Dewatering scenario modelling results indicated that the modelled dewatering bore and pit-floor sump configuration would keep groundwater levels below that of the pit elevation throughout the life of the mine. This will ensure the pit floor and walls remain dry ahead of the mining schedule. This draw-down will assist in maintaining stability of the pit walls and keep working conditions safe within the pit at all times.

The dewatering schedule was revised and optimised to reflect the use of an onsite re-injection disposal well field in response to the injection trial findings detailed in Appendix P. The re-injection disposal well field is described more fully in Section 3.7.5. To summarise however, final pit dewatering rates were re-modelled and the following pit dewatering schedule has been developed and assumed for the project.

- Stage 1: Beginning at time T = 0 days to T = 340 days, representing Pre-mining and initial mine dewatering. Dewatering at a rate of 1,500 m^3/day from 9 initial dewatering wells;
- Stage 2: From T = 340 days to T = 480 days representing completion of Prestrip mining, total dewatering at a rate of 1,860 m^3/day from 12 wells;
- From T = 480 days to T = 540 days (representing completion of mining), total dewatering at a rate of 2,810 m^3/day from a combination of 12 wells and in pit sumps;
- From T = 540 days to T = 820 days, (representing completion of Ore Processing) total dewatering at a rate of 2,525 m^3/day from a combination of 12 wells and in pit sumps;
- From T = 820 days to T = 925 days, total dewatering at a rate of 2,225 m^3/day from a combination of 12 wells and in pit sumps (closure activities and technical evaluation);
- From T = 925 days to completion, total dewatering at a rate of 1,930 m^3/day from a combination of 12 wells and in pit sumps;

Average dewatering rates are predicted to be 1,653 m^3/d (19.1 L/s) during prestrip and advanced dewatering and an average rate of 2,369 m^3/d during the period of ore mining until completion of processing (27.4 L/s).

Benagerie's approach shall be to install Stage 1 bores with the view to monitor the effectiveness of pit dewatering over the first four months of operation. This will provide the opportunity to verify or if necessary re-calibrate the groundwater model with the long term operational/monitoring data obtained during Stage 1 development of the pit dewatering plan and establish whether additional bores are required as part of Stage 2. It also allows the flexibility to revise the configuration of the Stage 2 bore field to further optimise dewatering and provides contingency for internal bores on the western side of the pit.

All pit dewatering wells will be cased using 177mm ID Class 12 PVC casing to a depth of 102 metres. The screened interval shall extend from 70m below ground level to 102m below ground level and will consist of a combination of 4 way slotted casing and 6mm clean graded gravel. The gravel pack will extend from 102m to 68m. A 2m bentonite seal will be placed above this gravel pack and the wells will be pressure cemented (via tremie line) to the surface. The pit dewatering well locations are shown in Figure 3.4.

To assess the regional drawdown impacts of mine dewatering and re-injection, numerical groundwater flow modelling was carried out using the 'MODFLOW' modelling program. The revised findings are detailed within Appendix P and summarised as follows.

Three model observation points (model targets W1, W2 and W3) were placed in the numerical model layer representing the water bearing bedrock (weathered basement - layer 3) to assess for regional groundwater impacts from mine site activities. These model targets were positioned in transect away from the proposed open-pit in the direction of the nearest groundwater receptors (eg Honeymoon Mine). A fourth model target was located in the Shylock Palaeochannel region of the numerical model to predict groundwater response to reinjection, and a fifth target was located in the Yarramba Palaeochannel region to the south east (See Figure 3.5).

Although all model targets are in the same numerical model layer, the properties assigned to the model were very different between the Shylock Palaeochannel and open-pit region of the model domain. In this way the Palaeochannel and the water-bearing bedrock beneath the proposed mine-pit site are both represented in the same numerical model layer (layer 3). The different numerical model layers represented the major geological units considered as part of the investigation: Namba Formation (Layer 1), Eyre Formation (Layer 2) and weathered basement rock, (Layer 3) and the model covered an area of 10 km x 10 km.

Modelled groundwater drawdown was greatest at the end of the mining and processing (~1000 days) and at locations nearest to the open pit. Modelling results indicate that drawdown impacts will be largely confined to the mining lease boundary as shown in Figure 3.5, with drawdown in the target layer (layer 3) generally restricted to less than 5 metres. The exception is a portion in the south-central lease area where the 5 m drawdown contour was predicted to extend approximately 500 metres beyond the lease boundary (Figure 3.5). Predicted drawdown in the Yarramba palaeochannel was less than 0.2 m for the entire model simulation indicating a low risk to this groundwater resource.

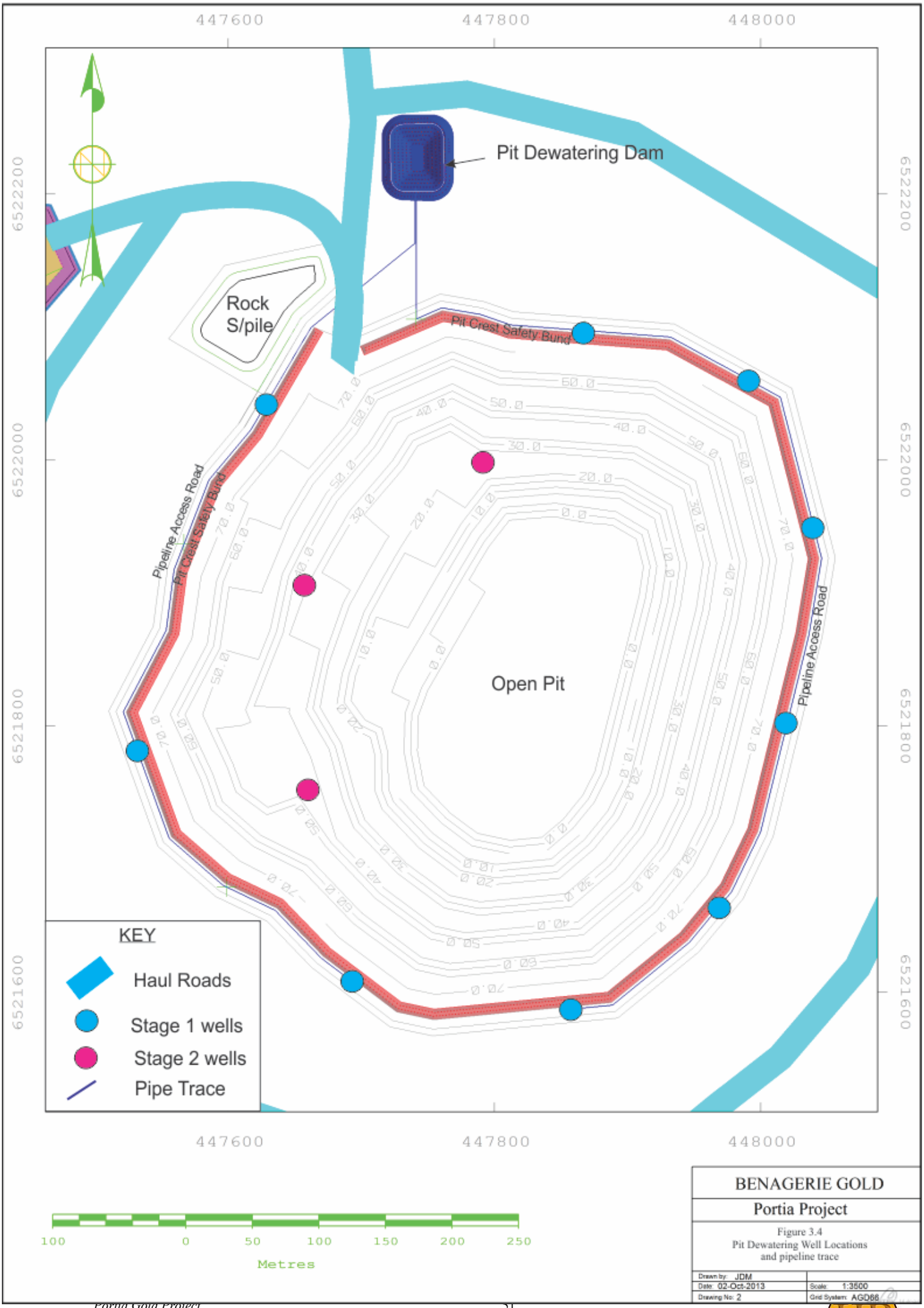
The nearest known groundwater use sites (Honeymoon mine and Zacs Bore) are situated outside of the modelled area, being in excess of 25 kms south east of ML6346. As indicated by the contours in Figure 3.5, the cone of depression remains a significant distance from the model boundaries. Hence, drawdown at Honeymoon and Zacs Bore due to dewatering at Portia is modelled to be zero.

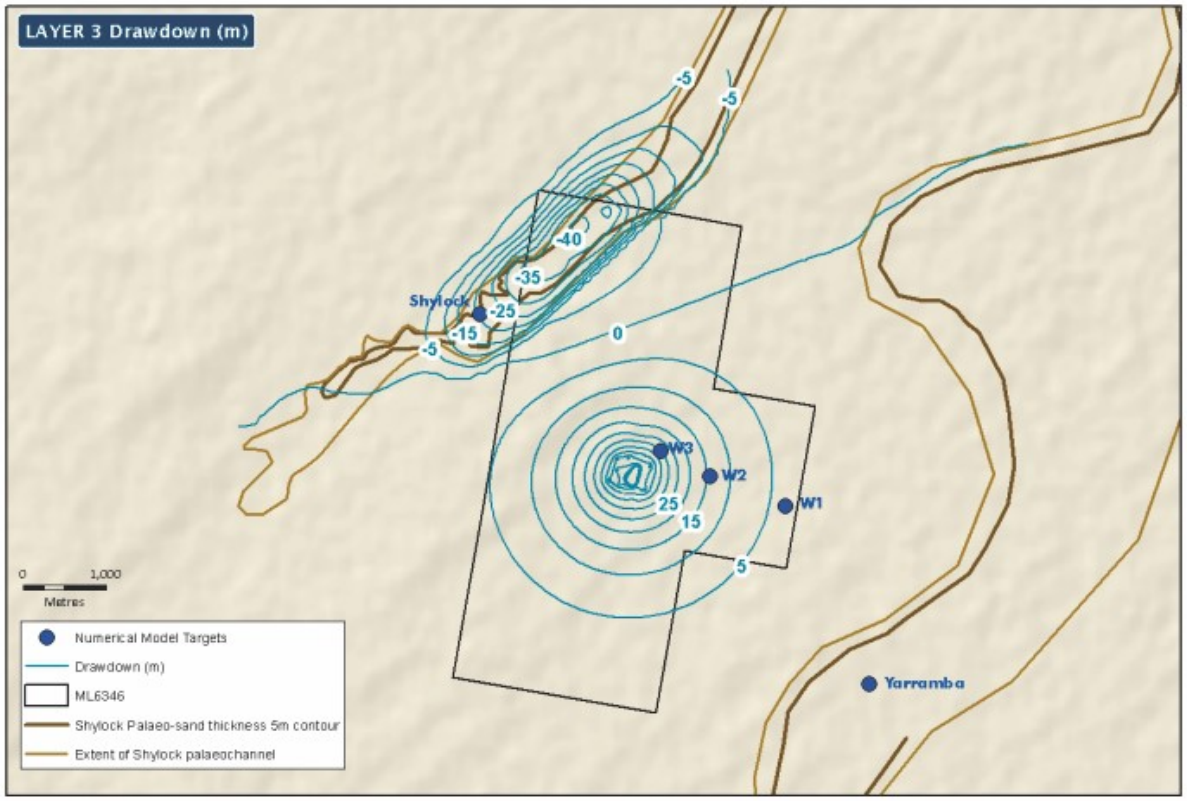
The predicted groundwater levels at the end of modelled dewatering were incorporated into a stand-alone numerical model to investigate the time taken for groundwater level recovery due

to regional inflows. Evaporation from the mine pit was modelled as an average 3.6 mm/day (using an average pan factor of 0.7) and the numerical model ran for 1000 years following the end of mining.

Predicted groundwater level recovery is presented in Figure 3.6 and illustrates that groundwater level at the pit never reaches full recovery with in-pit water levels stabilising at approximately 23 m AHD. Given pre-mining water levels of 41 m AHD, the Portia pit will remain a groundwater sink in the long term.

Although not modelled, in-pit salinity will increase due to evaporative effects. Given ambient salinities (basement aquifer) are ~14,000 mg/L, an additional increase will not change the environmental value of the groundwater resource, currently classed as industrial, (AGT,2014).


447600
447800
448000
6522200
6522000
6521800
6521600
Pit Dewatering Dam
Rock
S/pile
Pit Crest Safety Bund
Pipeline Access Road
Pit Crest Safety Bund
Pipeline Access Road
Open Pit
KEY
Haul Roads
Stage 1 wells
Stage 2 wells
Pipe Trace
100
0
50
100
150
200
250
Metres
BENAGERIE GOLD
Portia Project
Figure 3.4
Pit Dewatering Well Locations
and pipeline trace
Drawn by: JDM
Date: 02-Oct-2013
Drawing No: 2
Scale: 1:3500
Grid System: AGD66



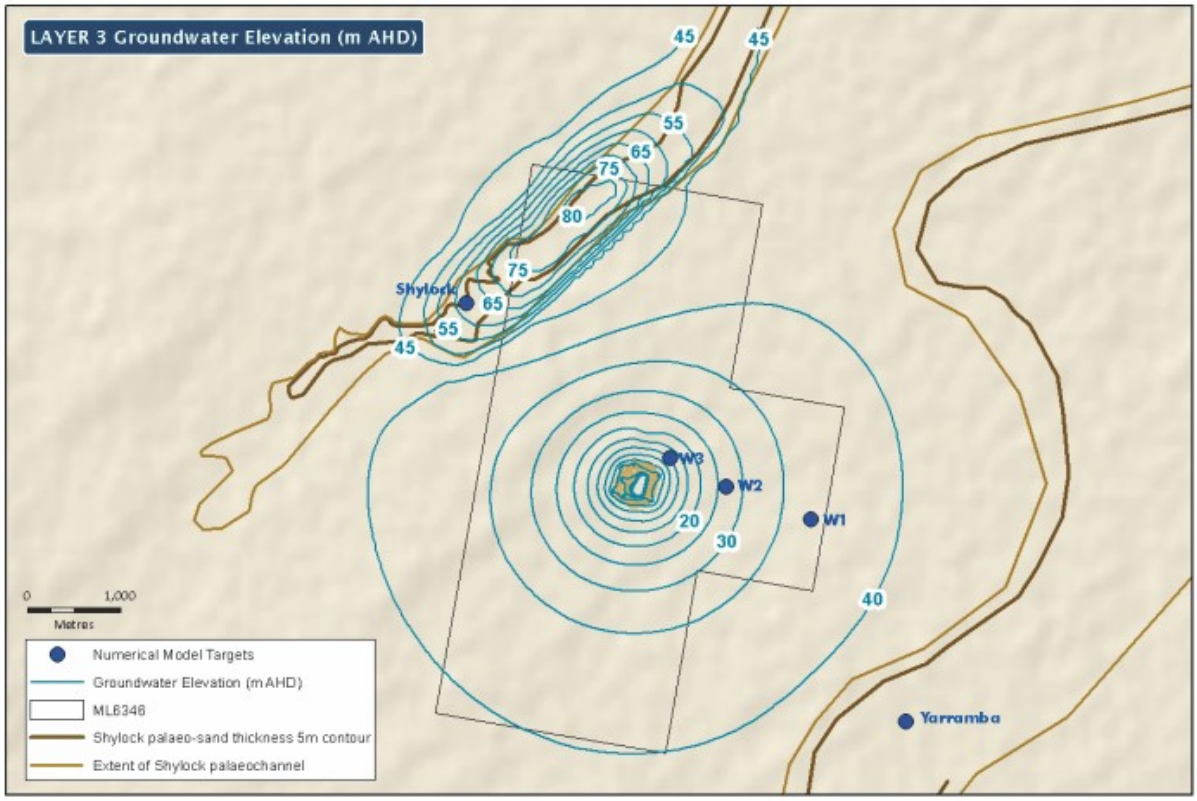


Figure 3.5| Predicted regional groundwater response to dewatering - end of mining (1030 days)

July, 2014 | P:\HAD_Hawlah Resources\Project\1319\GIS\Mxd\1319-HAD Figure 19 Predicted Regional Impact 1030 days.mxd

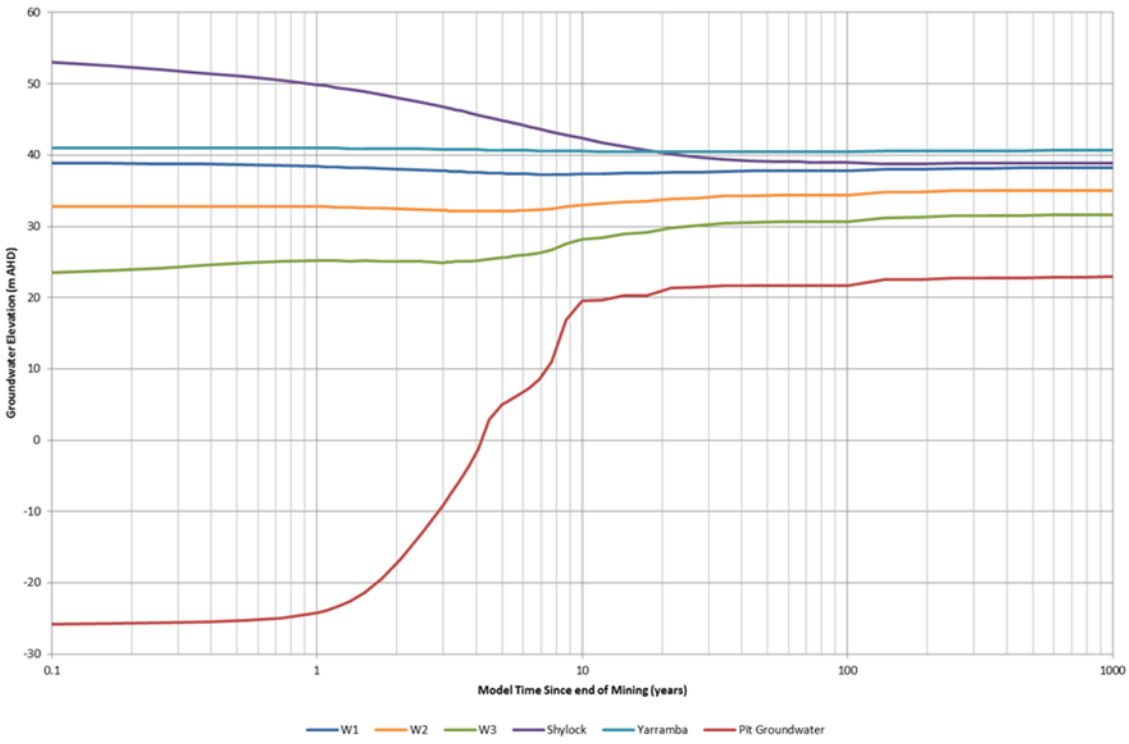


Figure 3.6 Predicted Groundwater Recovery Post Mining (Assumed starting head ~ 41 m AHD).

Materials handling

Initially, Quaternary clay overburden material that will be mined from the first bench of the open pit shall be used in site construction activities. More specifically, these activities include the Constructional earthworks associated with the Tailings Storage Facility (TSF) cell embankments, the ROM Pad, site haul roads, hardstand areas and flood protection measures (bunds and windrows).

On completion of Site constructional earthworks activities, additional Quaternary clay overburden material that will be mined from the first bench of the open pit shall be systematically stockpiled as follows:

Abandonment Bund

Construction of the pit abandonment bund to design (see Section 3.11.1) can only occur at the completion of mining when access to the pit is no longer required and when all haul roads and pipelines are no longer needed. To facilitate the building of the abandonment bund however, sufficient Quaternary clay material to be mined from the first bench of the open pit that will be used to form the clay core of the bund shall be hauled from the pit to the surface, truck dumped and stockpiled for later use within the pit abandonment bund footprint. This material shall be end dumped and formed at the materials natural angle of repose and to a height of approximately 3.0m. Prior to the construction of the bund on closure, this material shall be stored with small perimeter bunds to minimise erosion and loss of material from surface water run-off and to prevent heavy rainfall from discharging sediment laden water away from the stored material prior to final bund construction. The storage of this material within the proposed bund footprint, will facilitate efficient completion of this bund in accordance with the closure schedule.

TSF Capping Stockpiles

Once the TSF Cell embankments are constructed to design, surcharge stockpiles shall be built, consisting of Quaternary clay material obtained from the first bench to be mined from the open pit. This material shall be hauled to the TSF from the pit by truck and stockpiled on the eastern side of each of the TSF cells for later use as rehabilitation capping material of the dried out TSF cells on closure. The proposed capping stockpile locations can been seen in Figure 3.10 and Figure 3.12.

These stockpiles, being up to 6m in height, shall be formed with 1V:5H slope angles along with small bunds to minimise erosion and loss of material from surface water run-off and to prevent heavy rainfall from discharging sediment laden water away from the stored material.

Once all site constructional earthworks requiring the use of the Quaternary clay materials have been completed, the overburden within the pit is planned to be excavated in 15 m benches. Two nominal 180-200 tonne excavators will load 80-100 tonne payload capacity trucks which will haul this material on 3.5 m flitch intervals from the pit. This will occur for all mining activities.

Overburden waste material will be removed from the pit and transported by truck to an overburden waste dump (OWD). This waste material will be truck dumped, spread and trimmed progressively during overburden waste mining to build the OWD to design batter angles and design top slopes. This will ensure that on completion of all mining activities, the OWD landform will be formed to the intended final rehabilitation shape, in preparation for rehabilitation activities associated with the OWD to commence.

Once the overburden has been removed, extraction of the ore will commence. The ore is planned to be removed in quick succession to mitigate commercial risk to the project and will be transported and stockpiled on the ROM pad prior to processing. Figure 3.7 shows the general Site layout for the internal road system, dumps and the ROM pad.

3.3.2 Sequence of mining and rehabilitation operations

As the deposit is small and the pit is not aerially extensive, activities will focus on topsoil removal and overburden stripping to expose a flat pit floor which will then be mined in a single operational phase.

The planned commencement date of operations is immediately on approval of the PEPR and the obtaining of all required licenses. Subject to receipt of approvals and financing, this date is nominally 1st October 2014.

Work stages and production schedules are defined as 1) Establishment of Supporting Site Infrastructure, 2) overburden removal and ore mining, and 3) ore processing. The following data apply:

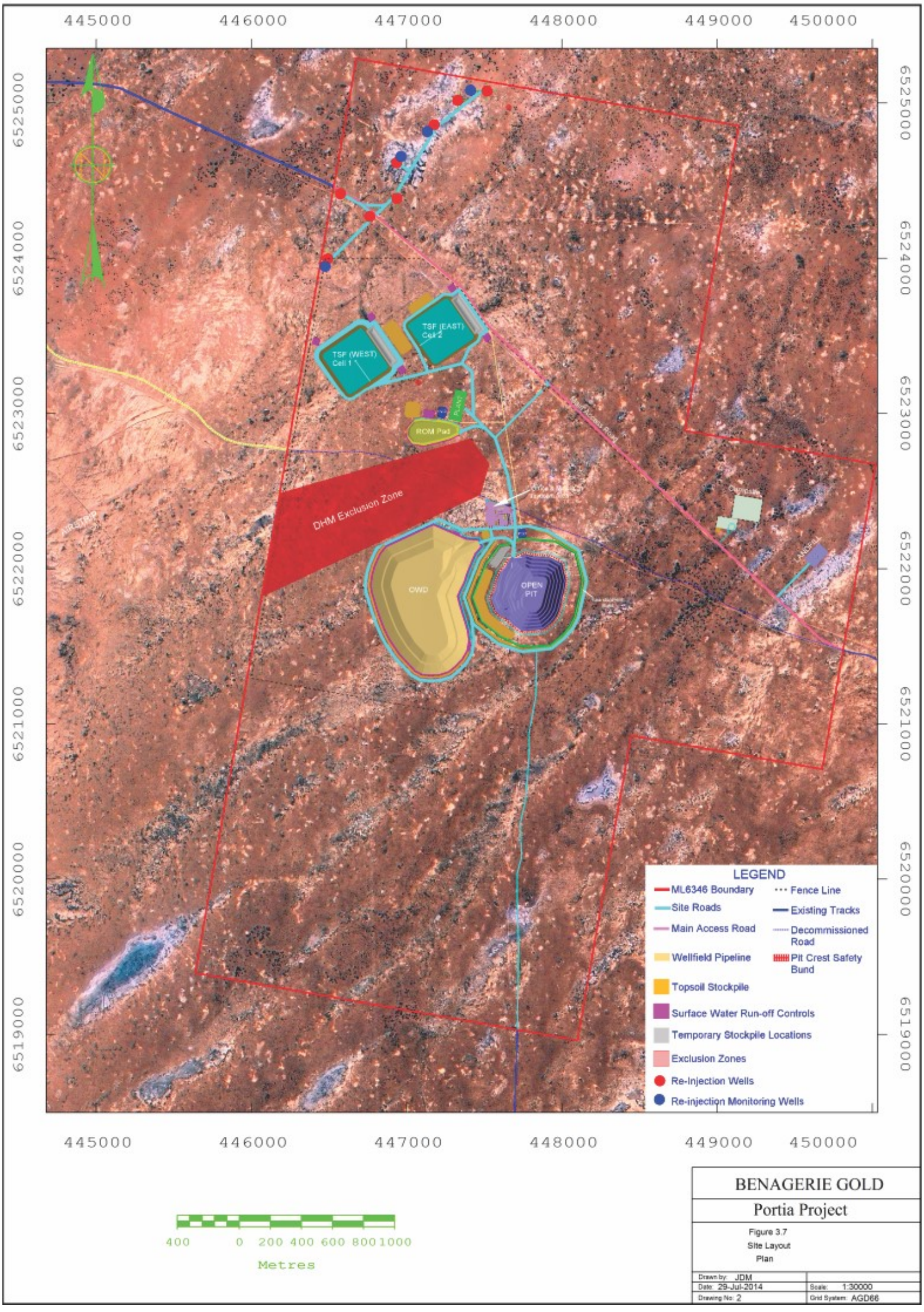
1) Establishment of Supporting Site Infrastructure: Duration 12 months consisting of site construction activities including:
   - Camp Installation and Landfill construction,
   - Topsoil removal and storage,
   - Building of Site Roads, haul roads and hardstand areas and installation of office facilities;
   - Installation of the Pit Dewatering Dam and Raw Water Dam,
   - Installation and commissioning of the pit dewatering and re-injection well field, associated pipelines and infrastructure,
   - Construction of the TSF to design,
   - Stockpiling of the quaternary clay material within the planned abandonment bund footprint for construction of the pit abandonment bund on closure,

- Stockpiling of Surcharge capping material adjacent to the eastern embankments of the TSF cells,
- ROM Pad construction,
- Stockpiling of quaternary clay material within the Abandonment Bund footprint,
- Establishment of sediment bunds and drainage structures.

2) Planned overburden and ore mining schedule
   - Production rate: estimated 7 million cubic metres per annum
   - Duration: 12 months

3) Planned ore processing schedule
   - Production rate: 60,000 tonnes per month.
     – Duration: 6 months
   - Total gold produced: 355,000 tonnes @ 4.66 g/t = 51,000 oz (at 95% recovery)

Rehabilitation is described in detail in the closure section. Due to the small scale of the operation, progressive rehabilitation measures will be limited to the rehabilitation of access and ancillary tracks not used during operations (operational period). There will be 2 stages of rehabilitation post ore recovery from the pit. The first will include placing a cover layer on the tailings dams, the covering and rehabilitation of the overburden waste dump (OWD), the infilling and levelling of the raw water dam and the pit dewatering dam, completion of the abandonment bund and the construction of stock grade fencing around the pit abandonment bund. The second stage will include the removal of the camp, office, and workshop facilities, followed by topsoil placement and revegetation. In these activities, quaternary overburden will be used where required to infill structures, the faces of the OWD and TSF will be battered and sculpted, topsoil that has been stockpiled will be spread over disturbed areas, and locally sourced seedstock will be spread to supplement that remaining in the topsoil to facilitate revegetation.



BENAGERIE GOLD

Portia Project

Figure 3.7
Site Layout
Plan

Drawn by: JDM	
Date: 29-Jul-2014	Scale: 1:30000
Drawing No: 2	Grid System: AGD66

3.4 MINING OPERATIONS

3.4.1 Modes and hours of operation

A 24 hour continuous working roster will be used for all mining operations. Direct operations personnel will work on a three shift roster system.

3.4.2 Workforce

Approximately 50 personnel will be directly employed at Portia with a maximum of 37 people on site at any given time. The operation will also have additional technical support provided by specialists in key fields of environmental management, mining engineering, geotechnical engineering and ore processing. A summary of personnel required during mining operations is presented as Table 12.

Table 12 Personnel summary

DEPARTMENTS	SHIFT	SHIFT	SHIFT	TOTAL
	1	2	3	
BENAGERIE MINING AREA				
Project Manager	1			
Mine Surveyor	1			
Mine Geologist	1			
Environmental Manager	1			
TOTAL EMPLOYED	*4*			*4*
BENAGERIE PROCESSING AREA				
Foreman/Gold room operator	1			
Plant Leading Hand	1	1	1	
Plant Operator	1	1	1	
TOTAL EMPLOYED	*3*	*2*	*2*	*7*
MINING CONTRACTOR AREA				
Site Manager	1			
Site Clerk	1			
Safety/Training/Environment Co-ordinator	1			
Supervisor/Leading Hand	1	1	1	
Excavator Operator	1	1	1	
Truck Operator	4	4	4	
Water truck operator	1	1	1	
All-rounder (Grader/dozer)	1	1	1	
Workshop Foreman	1			
Fitter	1		1	
Serviceman	1	1	1	
TOTAL EMPLOYED	*14*	*9*	*10*	*33*
CATERING & ACCOMMODATION				
Cook, Cleaners and Administration	3	2	2	
TOTAL EMPLOYED	*3*	*2*	*2*	*7*
SITE TOTAL	***24***	***13***	***14***	***51***

3.4.3 Use of explosives

The ore and waste material is of a very low strength and will not require the use of explosives.

3.4.4 Underground ventilation systems and raise bores

The Portia Deposit will be mined by open cut methods. Underground ventilation systems and raise bores will not be required.

3.4.5 Underground fill

The Portia Deposit will be mined by open cut methods. Underground fill will not be required.

3.4.6 Type of equipment

A standard equipment fleet typically used in similar metalliferous mining operations is expected to be used in the excavation of pit (Table 13). Table 14 shows the anticipated light vehicle fleet.

A heavy equipment laydown area will be prepared near the process plant.

Diesel fuel for vehicles will be dispensed from a bowser in a bunded storage area.

A vehicle workshop and parking area will be prepared near the heavy equipment laydown area.

Processing equipment is to include a large washing trommel, a Gecko in-line circular jig, a Knelson concentrator (a special centrifuge), large shaking tables and a final cleaning table. A small gas fired smelter will also be on site, but housed at the site office.

Table 13 Mining fleet

Type	**Size/model**	**Capacity** (tonnes)	**Number**	**Notes**
Excavator	PC1800	20t	2	Overburden Stripping
Excavator	PC1200	13t	1	Ore mining
Haul/Dump truck	777	90	4	Overburden removal
Haul/Dump truck	AD40	40	4	Ore Removal/Construction works
Bulldozer	D10	60	1	Stockpile shaping/maintenance
Grader	16H		1	Road maintenance
FEL	966	5	1	Ore feeding
Roller		13	1	Compaction (e.g., bunds)
Water cart	Cat 773	50	1	Dust suppression/fire fighting
Service Truck		14	1	Fuel/lube and maintenance

Table 14 Light vehicle fleet

Person/function	Type	Number
Contract manager	4WD	1
Supervisor/Leading hand	4WD	1
Fitters	4WD	2
Project Manager	4WD	1
Survey/Geology	4WD	1
Plant Foreman/Operators	4WD	1
Ambulance	4WD	1
Total light vehicles		8

3.4.7 Stockpiles

Stockpiles will be limited to those for temporary topsoil storage, permanent waste rock storage, as well as temporary construction and capping stockpiles and ore holding prior to processing.

Ore stockpiles will be developed on the run of mine (ROM) pad. The ROM pad has been designed to accommodate a volume of 149,000 cubic metres of ore stacked to a maximum height of 6.0 metres at the materials' natural angle of repose. It will be sheeted with approximately 300 mm of compacted clay and sand which will be cross graded to control storm water runoff, erosion and provide a suitable working surface during use. On the northern side, a sump and trenches will capture run-off water from rainfall. Periodically, this sump will be pumped out to the Processing Raw Water Dam for re-use in the ore processing circuit.

The Clay Overburden material and any other waste rock mined from the pit will be dispatched to the Overburden Waste Dump (OWD).

Gravel supplied to the project will be temporarily stockpiled in a gravel stockpile location adjacent to the Open Pit prior to re-use. The temporary gravel stockpile will be built to a maximum height of 6.0 m and can hold up to 27,000 cubic metres of material.

A TSF capping stockpile shall be placed on the eastern side of the TSF cells for later use in rehabilitation activities associated with the TSF.

All stockpiles, including topsoil stockpiles, shall be constructed with small perimeter bunds to minimise erosion and loss of material from surface water run-off and to prevent heavy rainfall from discharging sediment laden water away from the stockpile.

Topsoil stockpiles will be built to a maximum height of 2.0 m and shall be placed at locations to enable efficient re-use and handling during final rehabilitation activities.

Topsoil stockpiles will be monitored at 3 monthly intervals to assess soil stability, vegetation establishment and the presence and removal of weeds. Weeds will be eradicated as they germinate and prior to using the topsoil in site rehabilitation.

Topsoil stockpiles will be formed adjacent to cleared areas including the OWD, the ROM pad, the open pit, the TSF, the plant area and adjacent to the office and mining laydown area.

All permanent, temporary and ore stockpile locations for the work site can be seen in Figure 3.7.

3.5 CRUSHING, PROCESSING AND PRODUCT TRANSPORT

3.5.1 Crushing plant

Overburden from the pit will consist of clays and silts of the Namba Formation, whilst ore zone materials will include clays, silts and minor sands associated with the Eyre Formation. None of these materials will require crushing for materials handling for production or disposal.

Crushed rock for use in the construction of hardstand areas and road sheeting will be brought in to the site. Hence, there will be no crushing of rock for ancillary site use.

3.5.2 Processing plant

The ore will be processed using gravity separation based on the large difference in specific gravity of gold versus the host materials (19.1 versus 2.7). This is a very simple, benign process and well suited to the materials present at Portia, as it is low energy, cost-efficient and simple to operate.

The process plant location is shown on Figure 3.7. A flowsheet of the separation plant is shown in Figure 3.8. No cyanide or chemicals will be used in this process. A small gas-fired furnace will be operated to convert the gold won from the gravity circuit to impure dore bars containing, on average, at least 90% gold with minor impurities including silver and copper.

The primary treatment is a large washing trommel designed to disaggregate the clayey weathered rock into a slurry. The slurry from the trommel will be passed across a Gecko in-line circular jig. The underflow will contain the gold and this will pass through a Knelson concentrator (a special centrifuge) to further concentrate the gold. The material trapped by the Knelson concentrator will then pass over large shaking tables to provide a separation of the gold concentrate. A final cleaning table will further concentrate the gold and this will be weighed and smelted. Centrifuges will be used to recycle much of the processing water, reducing the volume of water discharged to the TSF.

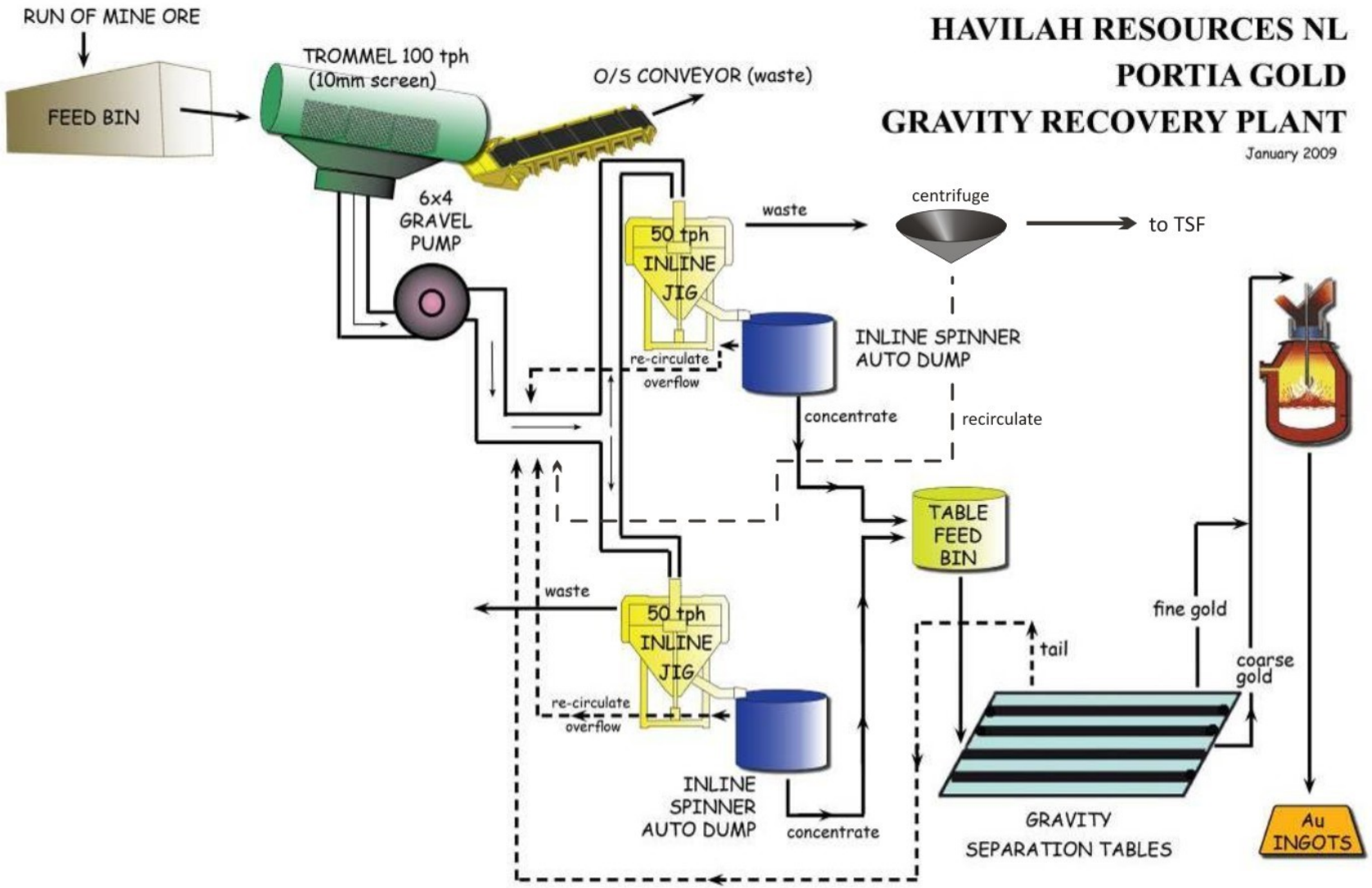
The waste discharge streams from the trommel and the jigs will have further trapping devices to minimise gold loss before this slurry flows into the adjacent Tailings Storage Facility (TSF).

Waste material and water from the gravity washing process will be discharged into the TSF.

All plant (trommel, jigs, concentrators, shaking tables) will be skid or trailer mounted, thereby precluding the need to construct significant concrete footings.

Process water will be sourced from the dewatering wells constructed around the periphery of the open pit and from in pit-sumps. Pit dewatering activities are expected to provide an average of around 27 L/s of water which will be maintained throughout the life of the mine. The plant will use approximately 725 kL/day of makeup raw water sourced directly from the Pit dewatering wells (~8 L/s) with the additional water coming from the tailings decant return and some from the ore moisture.

Dust sources will include vehicle movements such as haul trucks and loaders. No dust will be generated by the ore once it leaves the trommel as it is in the form of a slurry. There are no ignition sources apart from diesel fuel in engines powering the machinery. Noise will be generated by all machinery at the processing site.



HAVILAH RESOURCES NL

PORTIA GOLD

GRAVITY RECOVERY PLANT

January 2009

BENAGERIE GOLD

Figure 3.8
Portia Project
Processing flowsheet

SCALE:	n/a
DATE:	13/09/2011

3.5.3 Hours of operation

A 24 hour continuous working roster will be used for all processing operations.

Direct operations personnel will work on a three shift roster system.

3.5.4 Type of Mobile Equipment

Mobile equipment includes the items listed in Table 13 and Table 14. The processing infrastructure described in Section 3.5.2, i.e., trommel, circular jigs, Knelson concentrator, vibrating tables and gold room, although removable, are considered to be fixed plant.

3.6 WASTES

3.6.1 Overburden and waste rock

Overburden and waste rock will be deposited in an overburden waste dump (OWD) which will be constructed adjacent to the pit (refer to Figure 3.7). It is designed to hold the anticipated 7 million cubic metres of mined overburden and will cover an area of approximately 61 ha (including ancillary features such as roads and water collection structures). Prior to construction, topsoil and vegetation will be removed and stockpiled adjacent to removal areas (see Figure 3.7) for use in future revegetation and rehabilitation. The dump will comprise of 2 benches, nominally 15 m high with 16^{o} batter angles separated by a 10m wide catch berm. This will provide an average 14.8^{o} overall slope angle to the OWD. The dump shall reach a maximum height of 35m (104 m RL). Stability analyses by Rocktest Consulting (Appendix D) indicate that these specifications will result in an acceptably low likelihood of instability. Within the foundation of the dump will be a system of drains designed to assist water within the clays in the dump to dissipate. Rigorous construction procedures and a specification will be followed to ensure that the dumped clays achieve high strengths and low permeabilities. Doing so will involve truck dumping the clays, spreading them thinly, moisture conditioning if necessary and compacting with a roller or dozer. Monitoring and management procedures will aim to ensure the risks associated with the dump remain acceptable. Toe drains and collection / retention structures will also be constructed to channel and retain runoff from the OWD during periods of heavy rainfall. The final top surface of the OWD shall be designed to hold water after rain events in order to assist in revegetation. OWD cross sections for operations and closure are presented in Section 7, Figure 7.11 through to Figure 7.17 inclusive.

Ore and Waste Rock Characterisation

Representative samples of the different ore types and the overburden waste material within the Portia Deposit were selected and submitted for analysis to enable appropriate classification of the selected waste and ore rock types by acid rock drainage (ARD) criteria.

ARD studies were undertaken using the following geochemical static tests by the ALS Laboratory Group.

Acid Base Account (ABA)

The ABA evaluates the balance between acid generation processes (via oxidation of sulphide minerals) and acid neutralising processes and it involves determining the maximum potential acidity (derived from % total sulphur) and the inherent acid neutralising capacity (ANC).

Two measures of the ABA are calculated, the Net Acid Producing Potential (NAPP) and the ANC/MPA Ratio (MPA is maximum potential acidity).

NAPP testing is used as a screening test to qualitatively determine the acid generating potential based upon acid base accounting. Generally, very close to zero or negative NAPP values for samples indicate that the sample may have sufficient ANC to prevent acid generation. Conversely, positive NAPP results indicate the material may be acid generating.

The ANC/MPA ratio provides an indication of the relative margin of safety for neutralising acid generation within material and generally ranges between 1.0 and 3.

Net Acid Generation (NAG) Test

NAG testing estimates acid generation through a direct measure of the amount of acid generated. A pH after reaction (NAG pH) of less than 4.5 indicates that the sample is net acid generating.

ARD Sample classification

Geochemical classification criteria adopted based upon NAPP and NAG test data are shown in Table 15 below.

Table 15 Acid forming classification criteria

Primary geochemical material type	Final NAG pH	Static NAG Value kg H_2SO_4/t	NAPP kg H_2SO_4/t
Potentially Acid Forming (PAF)	< 4.5	> 5	Positive
Potentially Acid Forming - Low Capacity (PAF-LC)	≤ 4.5	≤ 5	Positive
Non Acid Forming (NAF)	≥ 4.5	≤ 0.1	< 0.5
Acid Consuming Material (ACM)	≥ 4.5	< 0.1	< -100
Uncertain (UC-NAF)	≥ 4.5	< 0.1	Positive
Uncertain (UC-PAF)	< 4.5	> 0.1	Negative

ARD Study Findings

Laboratory results were compared with the classification criteria set out in Table 15. The acid forming potential results are shown in Table 16.

The results indicate that the overburden waste material is likely to be non-acid forming (NAF). One sample (PT_1) from the central portion of the overburden sequence has been classified with an uncertain-non acid forming (UC-NAF) status due to the positive NAPP measurement. Based upon a typical geochemical plot shown in Figure 3.9, this material is likely to be NAF, because of the low NAG measurement and pH value significantly greater than 4.5.

Assay results for the high grade ore found within the light grey clay Tertiary age sediments of the Eyre Clays indicate this material is likely to be NAF.

Assay results for the graphitic metasediments in the bedrock indicate this material is likely to be NAF.

Assay results for the footwall albitite units in the bedrock indicate that it is likely to be PAF and would require management strategies to minimise potential acidification impacts. However, at this stage it is not planned to mine any of this material.

Table 16 Summary of acid forming potential results

Sample_ID	Geological Description	Material Classificati	NAG kg	ANC kg H_2SO_4/	MPA/ANC Ratio	NAPP kg	pH	Category
PT_1	Namba Fm	Overburden	<0.1	17.1	0.08	185	10.5	Uncertain (NAF)
PT_2	Namba Fm	Overburden	<0.1	6.9	2	-3.6	6.8	NAF
PT_3	Namba Fm	Overburden	<0.1	3.9	1.1	<0.5	6.5	NAF
PT_4	Namba Fm	Overburden	<0.1	6.1	1.5	-2.1	6.2	NAF
PT_818	Eyre Fm	Ore	<0.1	3.9	1.4	-1.1	5.8	NAF
PT_822	Eyre Fm	Ore	<0.1	1.2	1.0	<0.5	5.7	NAF
PT_843	Graphitic pelite	Ore	<0.1	<0.5	0.03	15.9	6.0	Uncertain (NAF)
PT_863	Graphitic pelite	Ore	<0.1	1.9	1.24	<0.5	6.1	NAF
PT_872	Footwall albitite	Footwall waste	39.9	0.8	0.01	55.8	2.5	PAF
PT_888	Footwall albitite	Footwall waste	113	<0.5	<0	170	2.1	PAF

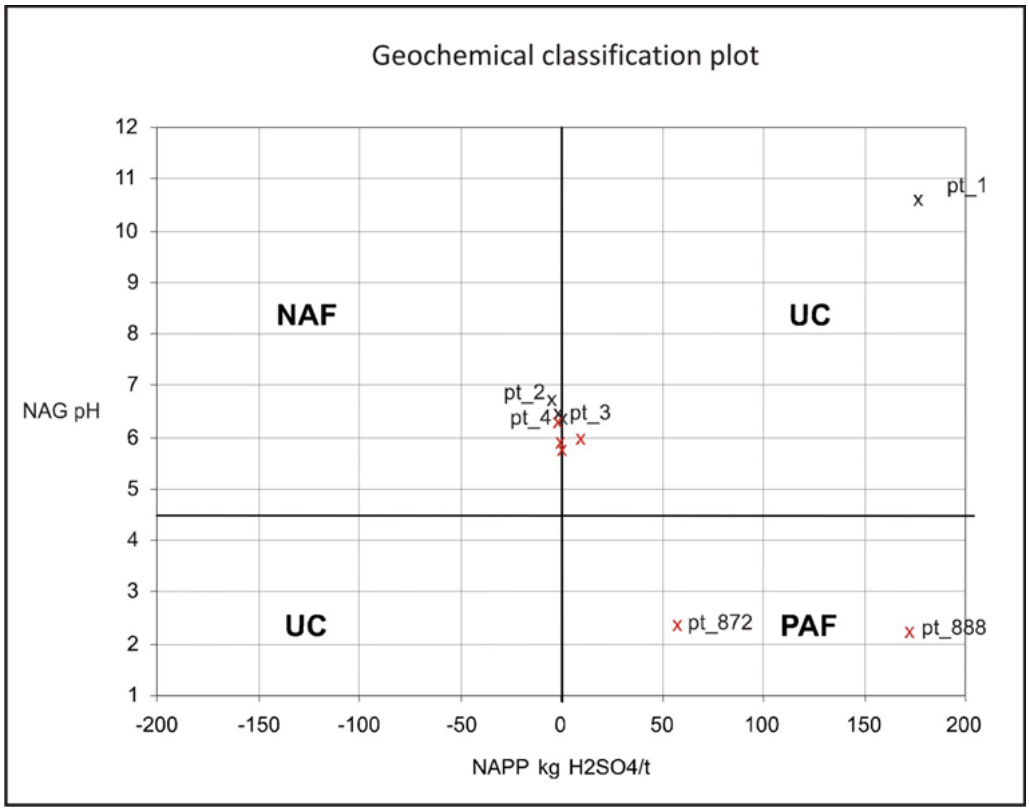


Figure 3.9 Geochemical classification plot

Overburden and Waste Material Management Strategies

Preliminary assessments indicate that impacts associated with ARD will not arise from the excavation of the overburden and ore zone clay sequence and that no PAF waste material will be encountered during excavation. Only NAF and Uncertain (UCNAF) material that is suitable for general construction use and general fill, including for rehabilitation works will be mined. Geochemical characterisation of the overburden and waste material will occur during mining by the monthly sampling and analysis of representative in-situ overburden and waste material.

3.6.2 Tailings

Waste material generated from the gravity separation wet plant will be discharged into the tailings storage facility (TSF). Golder Associates were engaged to complete the design of the TSF for the Portia Project. The detailed Golder TSF design report can be found in Appendix O and is broadly summarised as follows.

The TSF comprises of two cells, Cell 1 (TSF Cell West) and Cell 2 (TSF Cell East), located to the north of the pit and waste dump, as shown on the general site layout in Figure 3.7. The locations of the two cells were selected based on the site topography and with the objectives of having a large enough footprint to allow the tailings to dry and consolidate to a defined closure timeframe, to reduce the volume of material required to construct the perimeter embankments and to keep the maximum height of the embankments below 4 m. The tailings cells are both approximately 320 m by 320 m in plan area. The total cell tailings surface area is approximately 20 ha.

Tailings will be transported to the TSF cells from the plant, which is around 500 m to the southeast, via a pipeline, at approximately 50% w/w solids concentration. Both of the cells will be fully operational during processing with deposition of tailings transferring between each cell approximately every 16 days to allow drying of the tailings to occur.

The TSF embankments will be constructed to final expected height prior to deposition of tailings. There are no planned raises to the embankments. Each TSF cell has been designed such that it can contain the 1:100 year AEP 72 hour storm event, and they do not include a spillway. The project is expected to generate approximately 400 000 t of tailings over a period of six months, with an assumed stored density, based upon consolidation testwork, of 1.4 t/m^3. Each cell is designed to store approximately 143 000 m^3 of dry tailings, providing a total capacity of 286 000 m^3. The TSF will occupy a footprint area (including the limit of clearing and grubbing) of approximately 36 ha.

The following design and management measures have been implemented with the intent of having a ‘very low’ consequence category TSF and the design intent for placement of cover soils within two years of cessation of tailings deposition.

- Tailings will be placed in thin layers within the cells to allow time for drying and consolidation. This will allow for a trafficable tailings beach with a few months of cessation of deposition.
- Cover materials will be stockpiled near the cells during construction so that placement of cover soils can occur soon after tailings deposition ceases.
- Tailings deposition will be managed to control the pond at the central decant in each cell. Keeping water away from the embankments will limit seepage. (refer to the seepage report contained within Appendix O) and lower the risk of geotechnical instability.
- The embankments are low height and have flat downstream slopes to have a low risk of geotechnical instability. The embankment design incorporates an engineered upstream zone to form a low permeability barrier to manage the risk of lateral seepage.
- Tailings will be deposited in each cell to maintain an operational freeboard of 0.3 m. Maintaining this freeboard will reduce the risk of overtopping in the case of a storm event and obviate the need for a spillway.

- The location of the TSF is such that it complies with the requirements of Section 18 of the Environment Protection (Water Quality) Policy 2003.
- The TSF design does not comprise an engineered liner (e.g. engineered clay or synthetic materials) as the TSF will not store pollutants listed in Schedule 5 of the Environment Protection (Water Quality) Policy 2003.

Construction

Site Preparation

Topsoil will be stripped to 150mm to the extent of clearing and grubbing, as shown in Figure 3.7. The topsoil will be stockpiled no higher than 2m.

Each of the TSF cells is situated on relatively flat ground. As such, there is no requirement to construct surface water diversion channels or bunds to prevent erosion to the TSF downstream embankments. In the event that surface water channels are identified that cause erosion to the downstream embankment, repairs will be carried out by site personnel.

Runoff sumps and bunds have been included within the design footprint by Benagerie Gold as contingency to capture storm water run-off generated by the downstream embankments of the TSF. Any erosion to the TSF downstream embankments shall be repaired by site personnel.

Benagerie Gold plan to stockpile capping material for use in TSF closure on the downstream face of the eastern embankment of each cell during construction and as the pit is excavated. The intent of placing the material on the embankment is to only move the overburden material required for closure once. These closure stockpile areas are shown in plan in Figure 3.10 and in cross section on Figure 3.12. The footprint of the embankments will be prepared by ripping and moisture conditioning to compact the soil to a depth of 150 mm below the stripped level. This will create a connection between the foundation and the above ground embankment.

Embankment Construction

The embankments have been designed with upstream slopes of 1V:2H and downstream slopes of 1V:10H with a 6 m width from the upstream crest to the downstream crest. The crest has a 1% cross fall toward the centre of the cell to manage surface water. The flat downstream slope was selected to facilitate rehabilitation after operations are complete. The extent of the embankments for each cell is shown on Figure 3.10. Cell 1 requires approximately 50, 000 m^3 of fill materials and Cell 2 requires approximately 27 200 m^3 of fill materials. The maximum embankment height from the natural ground surface is 3.3m for both cells.

The embankment is divided into two sections; an upstream section and the downstream section. The typical geometry of these two sections is shown in the details on Figure 3.11 and Figure 3.12. The upstream section will be constructed with select engineered fill, comprised of Quaternary mine waste material with a minimum of 30% fines, and will be moisture conditioned and compacted in layers with a padfoot roller. This engineered upstream zone will form a low permeability barrier and an engineered control to manage the risk of lateral seepage.

The downstream section will comprise of general embankment fill, likely to be general Quaternary mine waste material with some clay content. The materials will be placed, moisture conditioned, traffic-compacted and keyed in by stepping in layers of the upstream and downstream sections of the embankment together, as shown on Figure 3.11 and Figure 3.12.

Clay earth fill to be placed in Select Filling applications shall have a moisture content during and after compaction within the range of -2% to +2% of optimum moisture content and shall be compacted within the range of 95% -2% to +2% of its modified maximum dry density (MMDD) using approved compaction equipment and methodology.

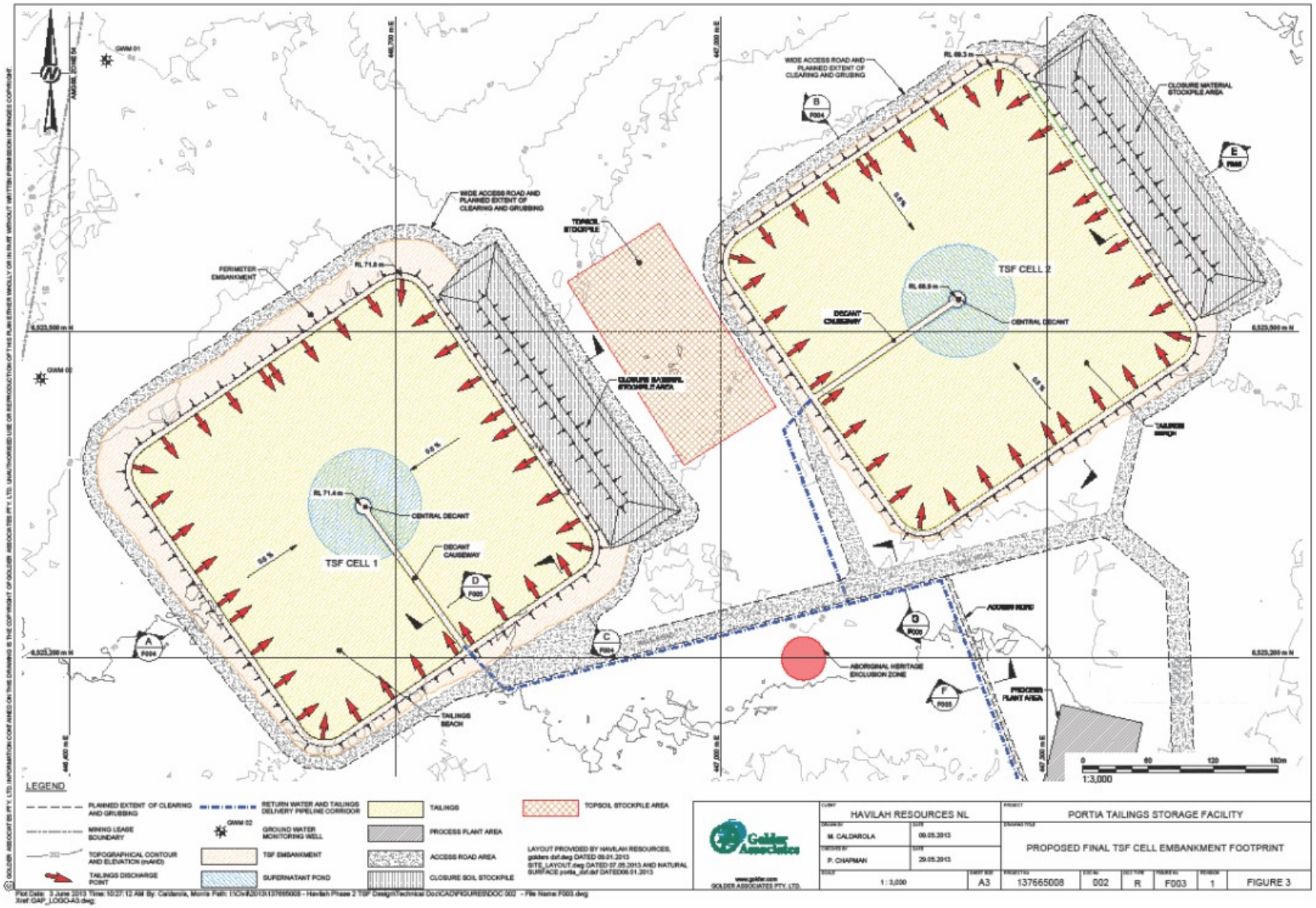


Figure 3.10 Proposed TSF Embankment Footprint

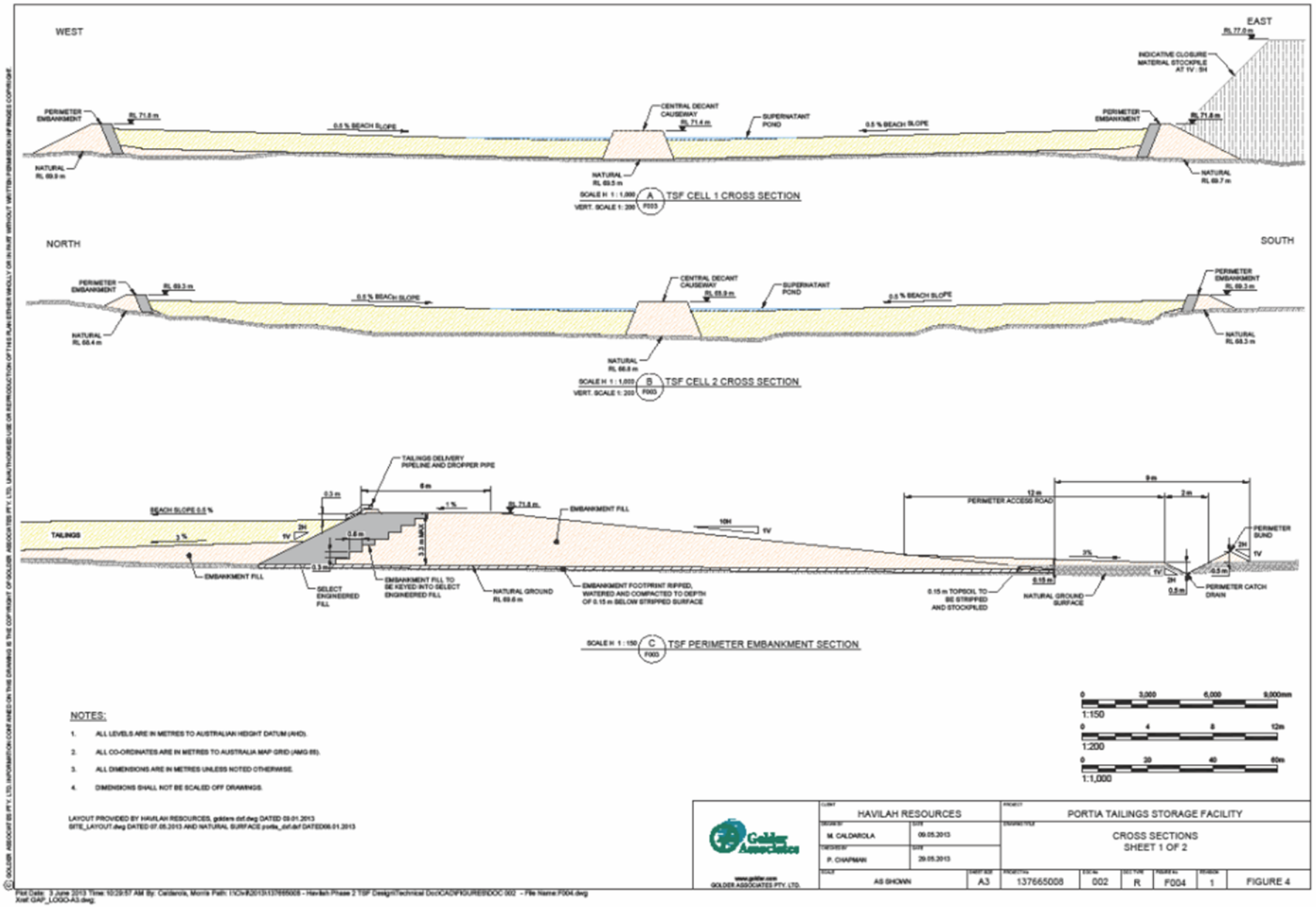


Figure 3.11 Embankment Geometry cross sections

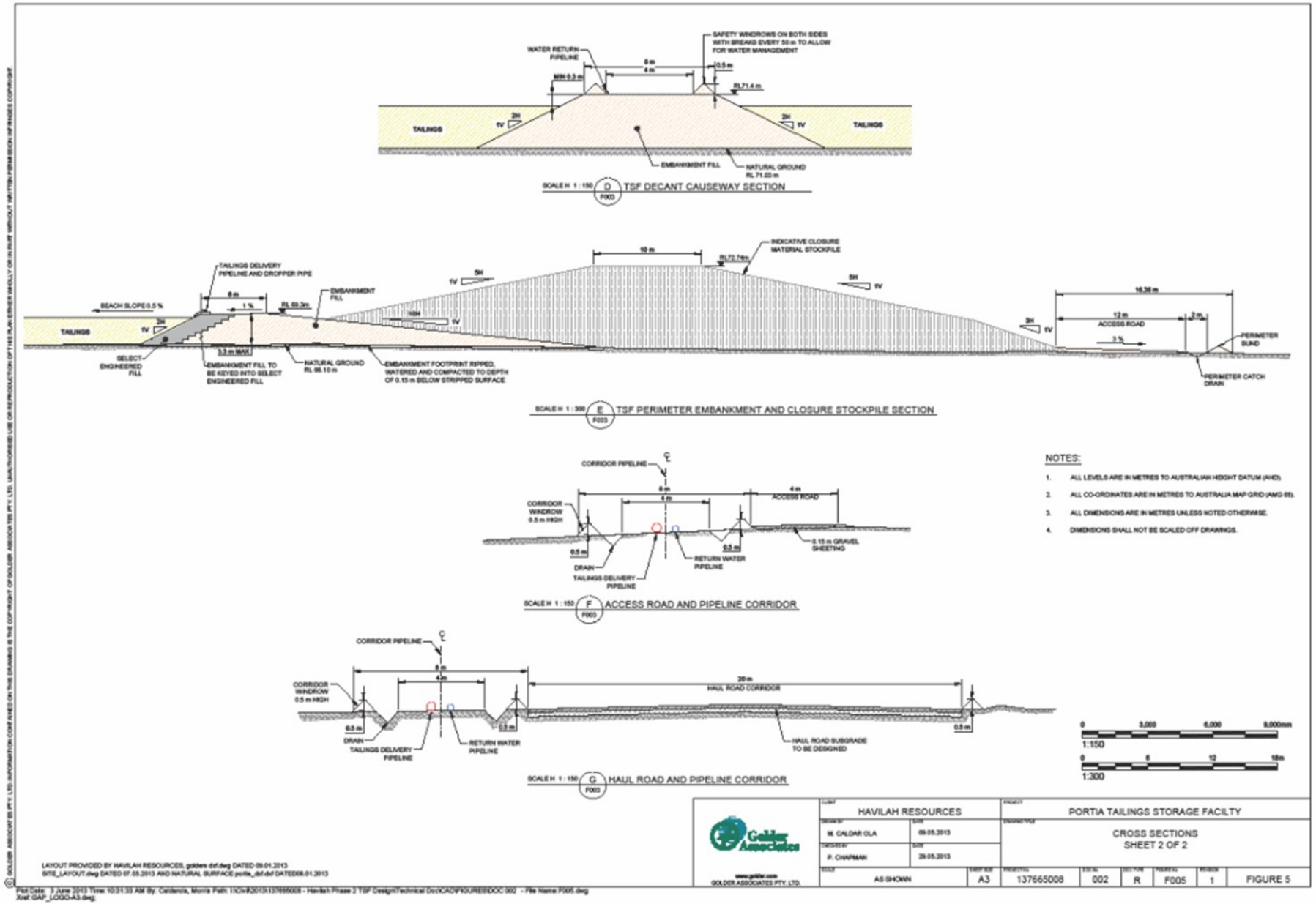


Figure 3.12 Embankment Geometry cross sections

TSF Operation

Tailings Deposition

Tailings deposition will be rotated around the perimeter of each cell, in accordance with the *"Havilah - Portia TSF Operations and Surveillance Manual"*, refer to Appendix N. This will control the pond location around the central decant. Tailings deposition will also be rotated regularly to place the tailings in thin layers and allow time for drying and consolidation.

Tailings will be discharged from spigots placed around the perimeter embankment, spaced approximately 32 m apart. Indicative spigot locations are shown in Figure 3.13. The exact number and location of the spigots will need to be refined during the course of operations, as required to maintain the position of the decant pond around the central decant and maximise the storage capacity of the TSF. The spigot discharge will incorporate a sacrificial slotted dropper pipe to limit embankment erosion.

Deposition of tailings will occur in zoned sections, equal to approximately one half of each side embankment of the cell. This is shown in the blue ring on the schematic in Figure 3.13. At the maximum deposition rate, tailings deposition would occur in a zone for approximately two days before moving to the next zone. Deposition is planned to continue around one cell until one full rotation has been completed after approximately 16 days. At this time, deposition will be diverted to the other cell to allow the tailings in the initial cell to dry and consolidate.

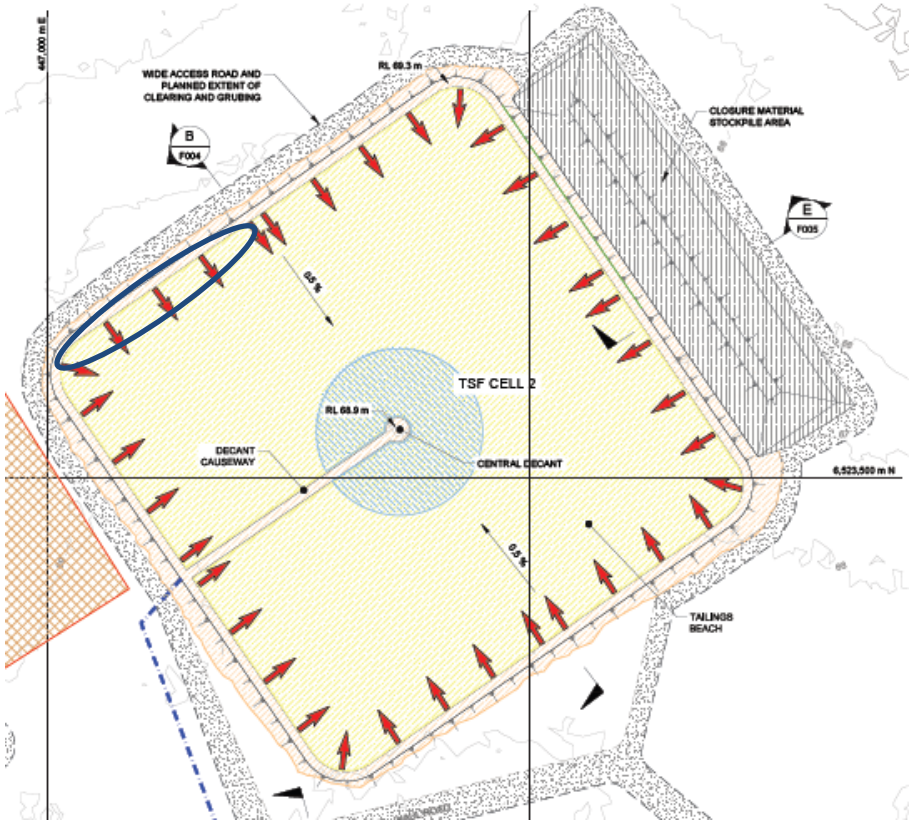


Figure 3.13 Schematic of tailings deposition

The rate of rise for the cells generally decreases over time as the elevation of the tailings increases, the rate of rise remains marginally above 3 m/year which is acceptable as there are no planned embankment raises.

Water Recovery

Supernatant water released from the tailings slurry will be recovered from the TSF cells via a skid mounted diesel pump with a flexible suction inlet and floating foot valve. Return water from the TSF will be pumped back to the process plant for reuse. A return water pipeline will be required to convey the return water from the TSF, along the decant causeway and back to the process water pond. The details of the water return infrastructure are shown in Figure 3.14.

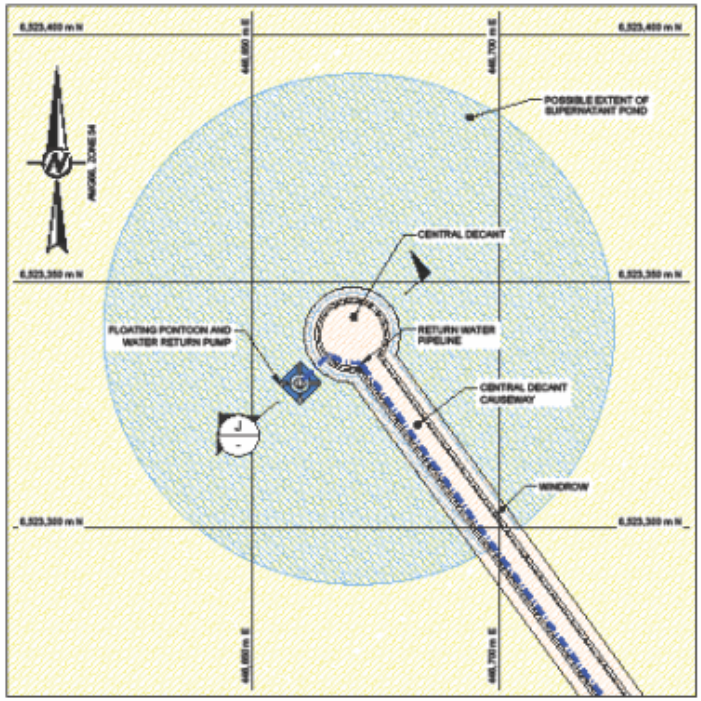
All tailings pipelines will be bunded.

Under normal operations the water pond should never be allowed to build up on the storage such that the pond extends beyond 10% of the tailings beach area (~10,000m^2) and preferably remains approximately 1,000 m^2 in size, which equates to about a pond extent of 35m out from the decant edge. Temporary water build up from extreme storm events will be removed as quickly as possible.

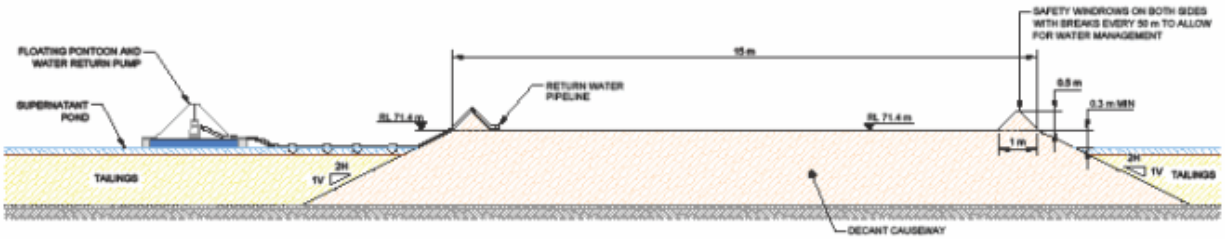
The size of any water pond which develops is governed by the following controlling factors:

- the efficiency of the decant pumps and pipework;
- evaporation from the surface of the pond;
- input of tailings water (percent solids and production rate);
- rainfall;
- difference in permeability between the tailings and the underlying soil types

The Portia tailing's material has the benefit of being made up of low permeability clays (10^{-9} m/sec) which make seepage flows very low. Therefore, the decant flows are higher than other facilities with up to 50% of the water being returned to the process.



TSF CELL 1 DECANT PLAN
SCALE 1:1,000



SCALE H 1:150 J TSF CELL 1 DECANT SECTION

LEGEND

- TAILINGS
- EMBANKMENT FILL
- SUPERNATANT POND
- RETURN WATER PIPELINE

NOTES:

1. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD).
2. ALL CO-ORDINATES ARE IN METRES TO AUSTRALIA MAP GRID (AMG 66).
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.

0 3,000 6,000 9,000mm
1:150
0 20 40 60m
1:1,000

Figure 3.14 TSF decant water return infrastructure

LAYOUT PROVIDED BY HAVILAH RESOURCES, golders dxf.dwg DATED 09.01.2013
SITE_LAYOUT.dwg DATED 07.05.2013 AND NATURAL SURFACE portia_dxf.dxf DATED08.01.2013

Golder Associates	HAVILAH RESOURCES NL		PORTIA TAILINGS STORAGE FACILTY						
	M. CALDAROLA	09.05.2013	CENTRAL DECANT PLAN AND SECTION						
	P. CHAPMAN	29.05.2013							
	AS SHOWN	A3	137665008	002	R	F008	1	FIGURE 8	

www.golder.com
GOLDER ASSOCIATES PTY. LTD.

Plot Date: 3 June 2013 Time: 10:35:50 AM By: Caldarola, Monte Path: I:\Civil\2013\137665008 - Havilah Phase 2 TSF Design\Technical Doc\CAD\FIGURES\DOC 002 - File Name: F008.dwg
Xref: GAP_LOGO-A3.dwg;

Supporting Analyses

Consequence Category Assessment

The consequence category for each of the TSFs has been assessed in the context of the ANCOLD guidelines (ANCOLD, 2012). This process forms part of a risk-based approach to assessing the various design and operational requirements for TSFs, including design of flood storage allowances. The information used for assessing the consequence category has been compiled in a matrix and is presented in Appendix O.

Golder judge that the Portia TSF will be assigned a "Very Low" Category based on a Population at Risk (PAR) of less than 1 and a minor Severity Level impact by virtue of the low embankment height and likely minimal impact to the surrounding environment.

Stability Assessment

The TSF constitutes two cells with ultimate embankment heights no more than 4 m. The potential failure mechanisms for the TSF include:

- Static geotechnical failure of the embankments or foundations
- Erosion and subsequent failure of the embankments or foundations
- Liquefaction failure of the foundation soils
- Long-term (post-closure) erosion or deformation resulting in a sudden or sustained release.

The slope angles for the embankments of the TSF have been designed with the objective of satisfying both the long-term and short-term stability criteria.

The downstream embankment slope of 1V:10H is considered by Golder to have acceptable stability under static loading and failure of the upstream embankment is unlikely to cause loss of containment. Liquefaction of the tailings is considered to be unlikely, and a suitable factor of safety is likely even in the event that the tailings liquefy.

The post-closure profile of the TSF will include a store and release style cover on the tailings surface, which will be a dished profile. This profile along with this type of cover will likely prevent the build up of long term moisture in the structure. Post-closure instability or geotechnical failure is considered less likely than during operation and overall a very low risk.

Seepage Assessment

The results of the seepage modelling are in Appendix O. A model was built that included the TSF cell geometry, interpreted subsurface conditions based on the geotechnical and hydrogeological field investigations and the properties of the tailings determined from laboratory testwork. The lateral seepage model assumed that a 1 m deep pond occurs against the TSF embankment for a period of 14 days with no tailings material coverage in place. It is noted that this is an unlikely service condition as the design intent is to manage the TSF operating pond around the central decant which is over 100 m from the perimeter embankment.

The key outcomes of the seepage modelling are summarised below.

- Low flux rates through the base of the TSF cells based on the tailings deposition approach, the low permeability of the tailings and nature of the sub surface materials.
- No impact is predicted to occur to the groundwater piezometric surface.
- Indicates that lateral seepage does not extend more than 10 m beyond the toe of the embankment and does not daylight onto the ground surface.
- Post closure, the model results indicate that seepage rates underneath the TSF would steadily decrease over time as pore water contained in the TSF slowly drains from the tailings, and

eventually reach equilibrium with natural rainfall recharge. After 110 years, the model indicates that the seepage rates would be 0.7 m^3/day, which is similar to natural rainfall recharge through the TSF (0.6 m^3/day).

Freeboard Assessment

No spillway is required as the TSF is defined as a non-release dam in that it can contain more than 3 consecutive 1:100 AEP 72 hour rainfall events which for the project location is 156mm. Therefore the ANCOLD free board criterion will be readily met.

Operational freeboard

For the purpose of calculating the water balance, the operational decant pond is assumed to be 10% of the tailings beach area.

With regard to TSF total freeboard during operation, the capacity of each cell tailings dam at the end of operation up to the total free board line (or crest) is 55,000 m^3. A 1:100 AEP storm of 156 mm would add 16,000m3 given the catchment area, still leaving 0.4m freeboard which is sufficient for a low risk dam.

Closure freeboard

After each cell of the TSF has been capped and decommissioned, the volume of rainfall required to spill over the upstream crest is approximately 57 000 m^3. This volume considers the design closure profile and the increase in storage as a result of settlement due to consolidation. This volume is equivalent to approximately 3.5 consecutive 1:100 AEP 72 hour storm events. This volume does not consider the additional storage that will be provided by the infiltration of rainfall into the store and release cover, although this volume is dependent on many geotechnical and climatic factors and would therefore be variable.

A schematic illustrating these freeboards is shown in Figure 3.15.

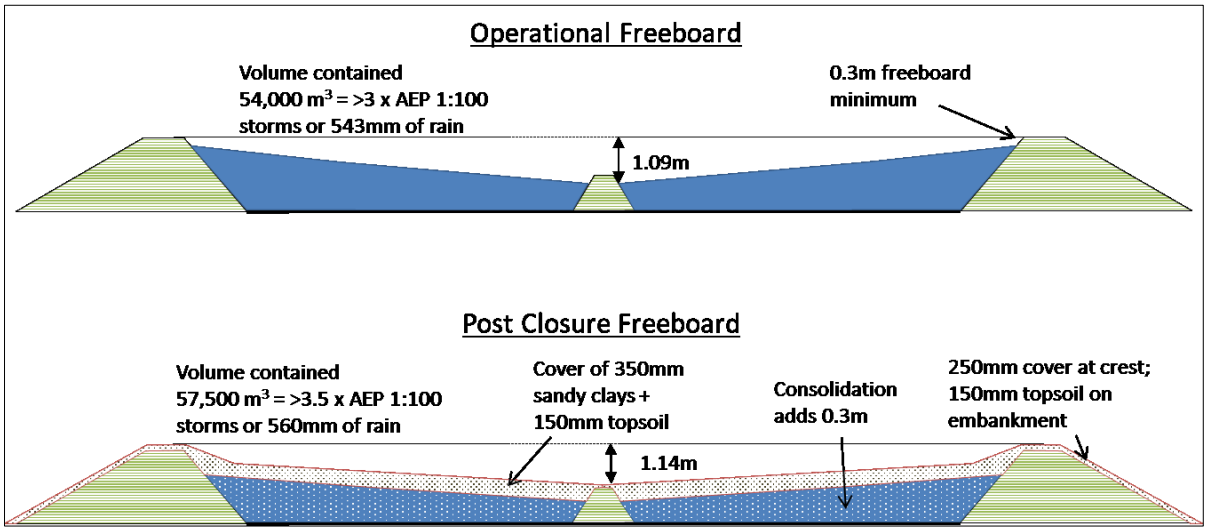


Figure 3.15 Schematic of freeboard calculations

Geochemical Characterisation of the Tailings material

Geochemical characterisation work for the ore material to be mined indicates that no PAF ore is planned to be mined. Multi-element geochemical analysis for the Portia ore suggest that non-hazardous levels of heavy metals occur within the ore zone (Table 17). These measurements are representative of the quantities of heavy metals likely to be found within the tailings material. The current average element concentrations for these elements are below the health based investigation levels (HILs) for parks, recreational open space and playing fields as described under *Schedule B(1) of the National Environmental Protection Council (NEPC) Guideline on Investigation Levels for Soil and Groundwater.*

Table 17 Geochemistry of the Eyre Clays for each element

Descriptives	PROSPECT	Mean (ppm)	5% Trimmed Mean (ppm)	Median (ppm)	Detection Limits[(1)] (ppm)
As	Portia	151.0	137.0	125.0	200
Ag	Portia	0.5	0.5	0.5	
U	Portia	16.3	15.2	14.0	80
Sb	Portia	1.6	1.6	1.6	
Mo	Portia	21.7	18.3	17.0	
Co	Portia	13.1		17.2	200
Cd	Portia	0.2	0.1	0.1	100
Bi	Portia	1.1		0.8	
Cu	Portia	190.0	122.1	105.0	2000
Fe	Portia	19517.0	18173.0	15750.0	
K	Portia	9051.0	8405.0	7100.0	
Mg	Portia	1252.0	1168.0	1000.0	
Mn	Portia	29.8	26.5	25.0	3000
Na	Portia	2184.0	2147.0	2100.0	
Ni	Portia	51.3	50.2	50.0	600
P	Portia	437.5	407.7	319.0	2000
Pb	Portia	54.2	52.3	52.0	600
Se	Portia	3.0	2.9	2.4	
V	Portia	172.6	168.6	162.0	
Zn	Portia	73.0	70.6	65.0	14000
Hg	Portia	3.4		1.4	30

1. *health based investigation levels (HILs) for parks, recreational open space and playing fields as described under Schedule B(1) of the National Environmental Protection Council (NEPC) Guideline on Investigation Levels for Soil and Groundwater.*

3.6.3 Processing Wastes

Processing wastes will be limited to the tailings stream, as the only other discharges are the recovered water that is to be returned to the raw water dam and the recovered gold. No process chemicals or reagents will be used on the site, but a small amount of antiscalent POSM352T shall be used in the reverse osmosis plant and will be discharged into the TSF. The antiscalent is a phosphonate which will be applied to the incoming raw water at a dosage rate of 10.34 mg/L (approximately 0.52 litres per day). Toxicological assessments of this antiscalent were provided by the product manufacturer and are summarised below.

At the intended dosage rates of POSM35T, the antiscalent

- is not classified as harmful to aquatic invertebrates;

- is not classified as harmful to fish;
- is not harmful to birds;
- is not harmful to mammals;

Furthermore, the antiscalent will be converted to orthophosphate and Carbon dioxide through either bio-degradation or photo degradation and therefore poses no long term environmental risk.

Water usage for the site is described in section 3.10.

3.6.4 Industrial and domestic wastes

Solid waste materials (e.g., batteries, 200 L drums, scrap metal) will be collected for recycling. Recyclable waste will be periodically removed from site by an EPA licensed contractor and disposed of in an approved waste disposal facility.

Empty drums will be stored sealed and in a bunded area. Returnable drums will be sent to the vendor, and damaged drums will be sent to a licensed scrap metal dealer.

Used tyres will be removed from site.

All putrescible and non-recyclable waste material generated during operations will be disposed of in a small approved EPA licensed landfill on site. Refer to Section 3.6.5 for further details concerning the Landfill design and operation.

Hydrocarbons and Oily Wastes will be managed by the following means:

- implementation of appropriate storage and handling procedures in accordance with AS1940 – The storage and handling of flammable and combustible liquids,
- segregation of hydrocarbon materials and waste products from storm water runoff and other water,
- the actioning of hydrocarbon spill response procedures and
- environmentally acceptable disposal of captured hydrocarbons.

Hydrocarbons will be managed to minimise the potential risk of spills and the area of contamination should a spill occur. Management practices will be based upon the *EPA Guidelines for Bunding and Spill Management, 2007* and will include:

- use of self bunded pallets for all 200 L drum storage areas,
- drums in use being placed on spill capturing platforms,
- effective maintenance of all valves and piping systems, and
- implementation of regular inspection and monitoring programs pertaining to the storage and handling of flammable and combustible liquids and facilities on site.

Accidental spillages of hydrocarbon materials will be managed by the placement of absorbent material and/or excavation and removal of contaminated soil. Any soil contaminated by hydrocarbons will be disposed of at an EPA approved facility (e.g., Broken Hill). The site manager shall ensure spills and leaks of contaminants are recorded in the contaminant spill register and those greater than 20 L are reported to DSD's Principal Mining Regulator by the site manager within 24 hours of occurrence, Records shall be kept to show that spills (if any) have been remediated to an appropriate EPA standard within 48 hours of the spill, or longer time as agreed with DSD's Principal Mining Regulator.

Waste oil and other hydrocarbon wastes collected will be removed from the site for recycling/disposal by a licensed waste contractor.

A small RO plant will be located within the plant area and will supply the operation and infrastructure with necessary fresh water requirements. It is anticipated to produce a brine reject water at a rate of

approximately 0.6 L/s. This reject water will be discharged to the Raw Water Dam and disposal into the TSF cells.

Sewage generated at the mine site ablutions and wash facilities will be disposed of by small "envirocycle" waste treatment systems. The capacity of these waste treatment systems will match the requirements for the mine and processing ablutions.

An "Enviroflow" waste water treatment unit will be installed at the camp which will service washing, shower and toilets. This waste water treatment system is designed to discharge treated water at a Class B quality. A small amount of this water will be used for campsite landscaping amenity whilst the remaining water will be diverted to the evaporation irrigation area where it will be evaporated off. The waste water treatment plant (WWTP) will not discharge treated sewage of a quantity exceeding a peak loading capacity of more than 1000 persons per day to land that is not in a water protection area. As such, no EPA approvals for the waste water treatment plant are required under the Environmental Protection Act 1993. The WWTP shall be located 100 metres away from the nearest campsite building locations.

The construction and operation of the sewage system will be in accordance with SA Health requirements. The establishment of all plumbing requirements needed to service the site will be completed by licensed South Australian Plumbers.

3.6.5 Landfill

S&G Environmental Consulting (S&G) were commissioned to develop a Landfill Environment Management Plan (LEMP) for the Portia Gold Project in accordance with the requirements of the EPA Guidelines *Environmental Management of Landfill Facilities (Municipal Solid Waste and Commercial and Industrial General Waste)* (EPA 2007). This LEMP for the Project can be found in Appendix K and is summarised below.

Putrescible and non-recyclable wastes will be disposed of to an on-site landfill facility. It is anticipated that the majority of these wastes will originate from the accommodation camp.

Australian Bureau of Statistics data (ABS 2010) indicates that the average Australian person produces around 2,080 kg of waste per year, with approximately 52% of that diverted from landfill into recycling and/or reuse programs. For the purpose of estimating the waste volumes for the Project landfill design, it has been assumed that the camp operates continually at its capacity (being 52 personnel) for the whole of the estimate mine life (being 18 months). Given this, the likely total volume of waste that would be directed to the on-site landfill is around 100 tonnes, or around 200 m^3 using the standard EPA waste consolidation factor.

Correspondence between Havilah Resources and the EPA (Havilah 2012) have concluded that a landfill classification of SB- is appropriate for the proposed facility, designating a small landfill with a total landfill capacity of less than 26,000 t and with low potential to generate leachate based on climatic conditions and low potential for water flow into the waste.

The landfill volume is sufficient for the disposal of the estimated 200 m^3 of putrescible and non-recyclable wastes plus regular soil capping whilst also allowing at least 600 mm of subsoil and 100 mm of topsoil to be placed over the landfill for closure and rehabilitation purposes.

The landfill will be situated approximately 500 m south of the accommodation camp as shown in Figure 3.7.

Landfill design and construction

The landfill will consist of an excavation of approximately 20 m x 20 m to a depth of around 2.5m, with the floor consisting of compacted (to a minimum dry density ratio of 95% relative to standard

compaction as per Australian Standard AS 1289 5.1.1.) Quaternary sand clay layer of at least 150 mm depth (with a permeability of around 1 x 10^{-8} m/s). The floor will be graded to a sump, allowing the collection and evaporation of leachate and stormwater run-off (see Figure 3.16 and Figure 3.17).

The landfill shall have wall slopes of 1V:3H and be a maximum depth of 2.5 m, giving a low risk to slope stability of the landfill during operation as well as ensuring the final waste filling height shall be a minimum of 500mm below ground level.

Leachate management

The landfill leachate collection system is designed to protect groundwater from the impacts of leachate. This is achieved by constructing a compacted clay landfill liner that prevents the vertical seepage of leachate and grading the subgrade to allow the collection and removal of leachate as it is generated. The subgrade for the landfill will have a smooth surface of compacted clay, with at least a 2% grade to a leachate collection sump (also constructed from compacted clay). This compacted clay base will form the surface for the drainage of leachate and waste placement. Upon completion of compaction activities, the surface will be proof-rolled in order to assess the presence of any areas that may require subgrade improvement, such as areas of differential settlement or voids which may adversely affect the leachate drainage system.

The leachate and stormwater collection sump will be sized conservatively to allow for stormwater generated from rainfall collected within the facility to be stored and either removed to the TSF or left in-situ for removal via evaporation, depending on the volume of collected.

Stormwater management

The landfill is situated to minimise stormwater run-off into the facility and would be constructed with a perimeter stormwater cut-off drain to direct stormwater around the landfill cell, keeping it separate from landfill leachate and minimising the volume of leachate requiring management within the landfill itself. The landfill excavation has volume sufficient for the temporary storage of a 1-in-100 year AEP rainfall event without overtopping of the facility.

Erosion of landfill infrastructure will be minimised by limiting the amount of vegetation disturbance within the landfill compound, rehabilitating inactive areas as soon as practicable, installing sediment controls such as diversion drains and bunds around the excavated capping material stockpiles and the implementation of temporary erosion control measures such as mulch on rehabilitated surfaces prior to the establishment of vegetation.

Landfill gas management

The US EPA LandGEM model was used to estimate the likely evolution of methane from the landfill for the 10 years post-closure. The model default factors were modified in accordance with the Australian National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Municipal Solid Waste Landfills (Version 2, NPI 2010). The results of this analysis are summarised in Table 18.

The generation of around 1 m^3 per day of methane is considered not to represent an explosion or asphyxiation risk to human health and safety based on the short facility life and the lack of nearby receivers post-closure, and further management and/or mitigation of the gas via gas capture and treatment would likely be cost prohibitive.

Table 18 Landfill methane generation by year following closure

Year	Methane generation (m^3/year)
1	424
2	400
3	377

Year	Methane generation (m^3/year)
4	356
5	336
6	317
7	299
8	282
9	266
10	51

Dust, odour and noise management

Dust may be generated during construction and operation of the landfill, generally from areas of land disturbance, vehicle traffic and stockpiles. Process water derived from mine dewatering would be used for dust suppression as necessary.

The noise from activities associated with the landfill would be limited to vehicles unloading waste and waste capping and compaction activities. These are unlikely to generate a disturbance beyond that associated with the surface mining activities and are not considered to require specific management measures.

The regular capping of the putrescible wastes within the landfill, together with the small volume of landfill gas expected to be generated and the remote location of the facility are likely to adequately mitigate any potential for significant odour emissions.

Pest and litter management

A 1.8 m high wire mesh fence would be constructed around the perimeter of the landfill facility with lockable gates allowing vehicle access. The gates would nominally be closed at all times the landfill is inactive, thus preventing fauna access to the landfill. Additionally, baiting may be undertaken from time-to-time as necessary to eradicate pests from the facility.

The fence would have a secondary function, limiting the spread of litter from the facility, although the primary control mechanism for the management of litter would be the regular capping and compaction of the waste mass.

Closure and rehabilitation (capping and final landform)

All landfill surface infrastructure, including fences, gates and unused stockpiles would be removed. An engineered cap of at least 600 mm of Quaternary clays would be placed above a 300mm thick interim fill cover that is deposited on top of the compacted waste materials. The engineered cap shall be blended into the surrounding land. This layer would be compacted and would provide a layer designed to shed any rainfall / surface water, minimising infiltration and avoiding the build-up of leachate within the facility. This would be topped with at least 100 mm of topsoil to allow for revegetation using endemic native species (shrubs) with a rooting depth sufficiently shallow to avoid roots penetrating the cap, negatively influencing its ability to mitigate rainfall infiltration (see Figure 3.17).

The landfill cap would be proud of the natural land surface and be mildly sloped to promote the run-off of surface water. Initially, temporary sediment control measures such as mulch or hale bales may be used to mitigate the potential for erosion prior to the establishment of vegetation. With time, it is expected that the landfill mass will compact with the decomposition and compression of the putrescible waste, ultimately leaving a vegetated landfill cap that approximates the local topography and is suitable for the resumption of pastoral activities.

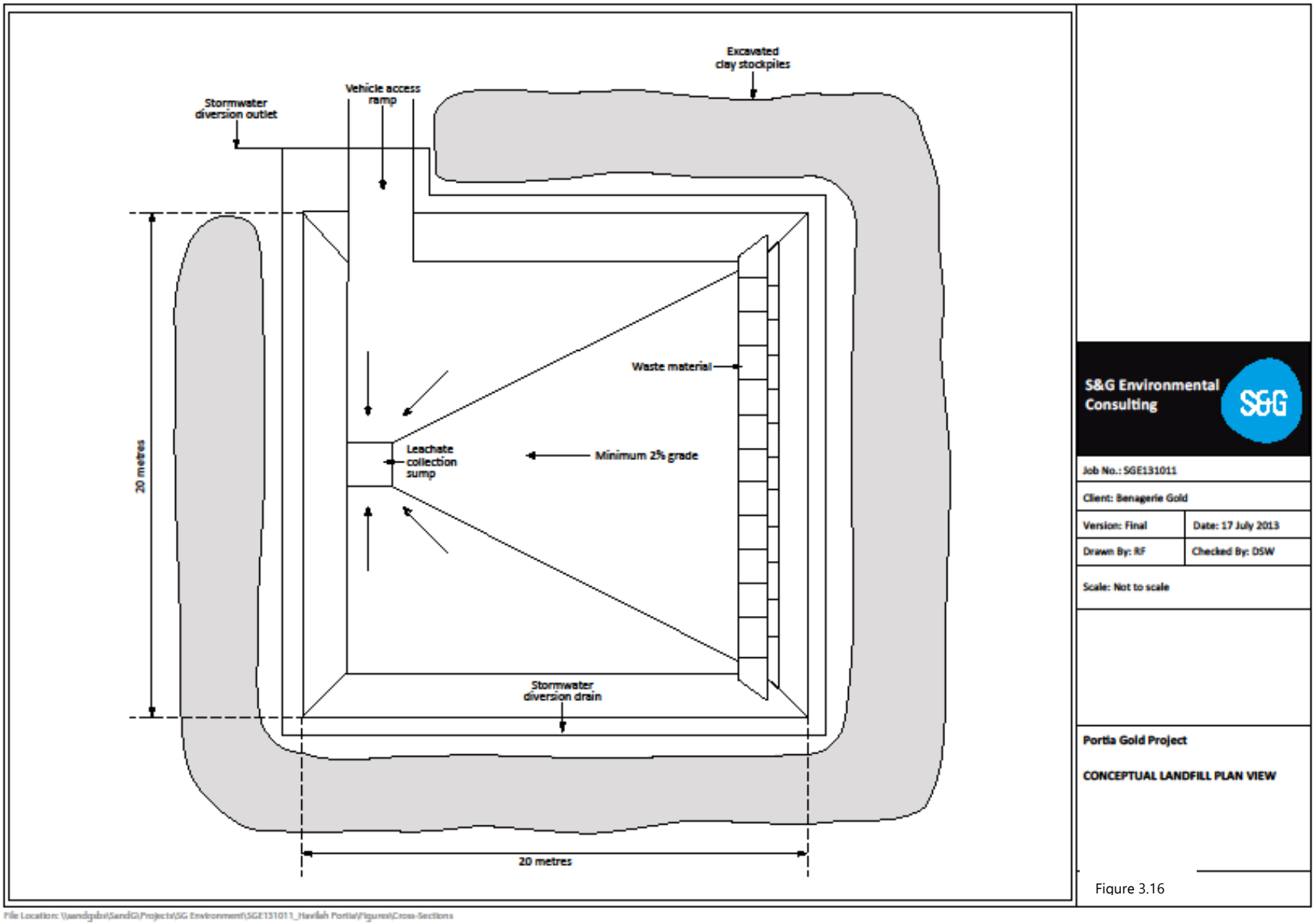
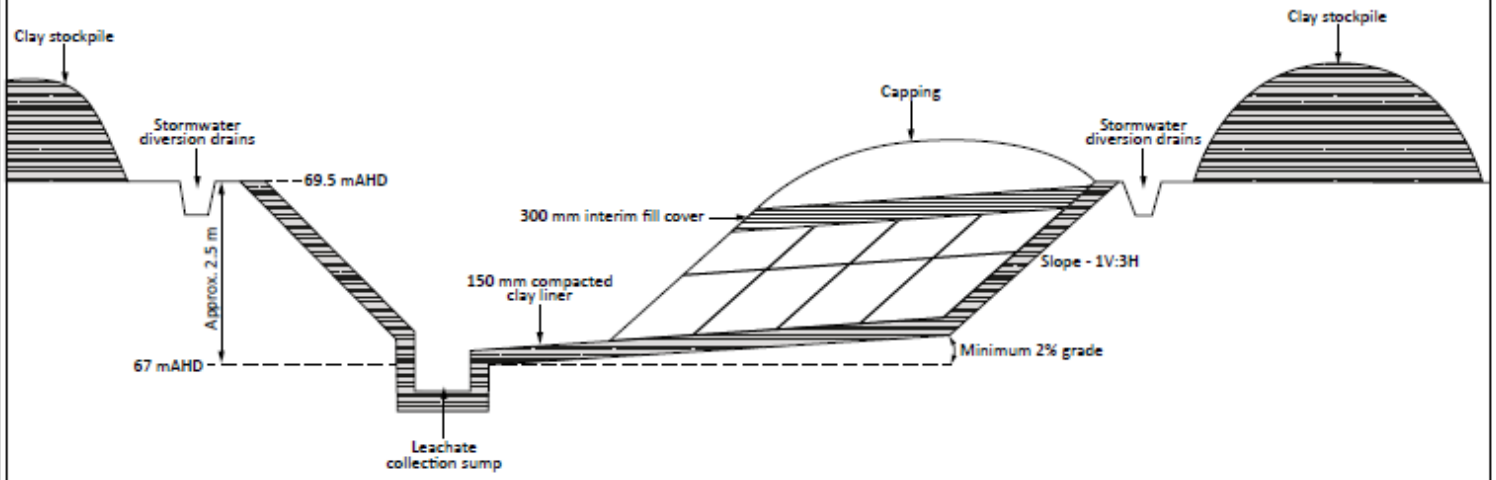


Figure 3.16 Plan view of the Landfill design (not to scale)



Note: Clay liner would be compacted to 95% MMDD at +/-2% OMC in accordance with AS1289 5.1.1

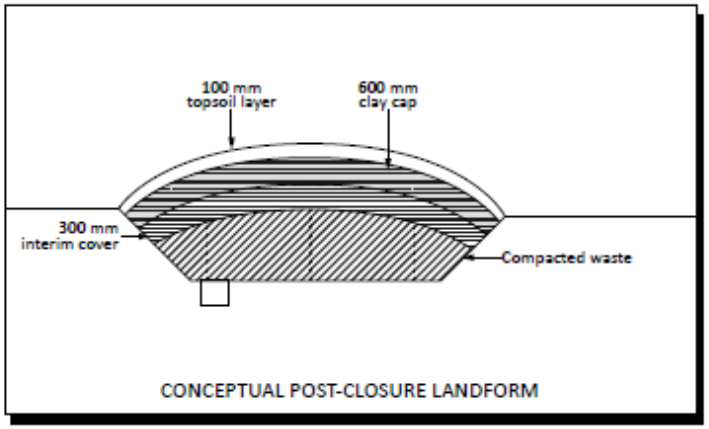


Figure 3.17 Conceptual Landfill Crossection (not to scale)

S&G Environmental Consulting

Job No.: SGE131011	
Client: Benagerie Gold	
Version: Final	Date: 13 Dec 2013
Drawn By: RF	Checked By: DSW
Scale: Not to scale	

Portia Gold Project

CONCEPTUAL LANDFILL CROSS-SECTION

Figure 3.17

3.6.6 Silt control and Surface Run off

Dirty Water Stream Management

A minor amount of "Dirty water" will be generated on the site. Dirty water streams consist of

- The brine reject from the Reverse Osmosis Plant;
- ore processing water;
- Leachate from the Landfill collection sump
- Run-off from in-pit sumps and collection sumps associated with the, the ROM Pad, Overburden Waste Dump and Office and Mining laydown area.

All dirty water streams shall report to the Raw Water Dam for disposal and evaporation into the Tailings Storage Facility Cells. To this end, if significant water accumulates, this water will be pumped to the raw water dam for use in processing. Runoff generated within the pit will be pumped to the raw water dam, with surplus water being pumped to the TSF.

Run-off and sediment control structures

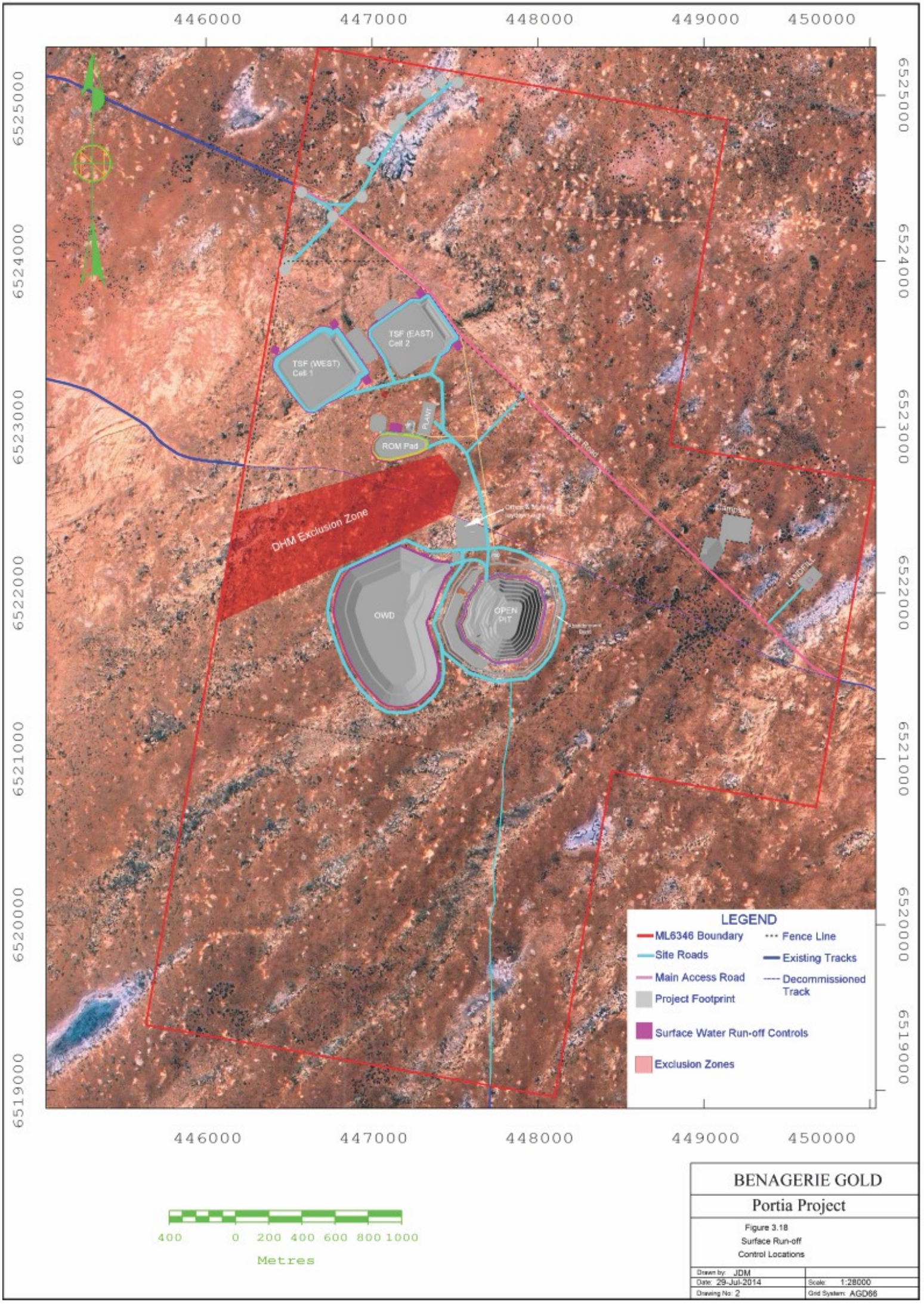
Much of the rain falling on the OWD is expected to infiltrate and be retained within the concave surface profile of that structure. The contained volume on the top of the OWD is greater than five consecutive AEP 100 year 72 hour rain events and so no run-off will occur. During intense rainfall events, some surface runoff may be generated from the outer sides of the OWD which could lead to erosion of the outer surface of the OWD. To reduce the potential for erosion during such events, the OWD has been designed with an intermediate 10m wide berm and low (16 degree) batter angles. These design instigations will reduce the velocity of flowing water down the outer edges of the OWD and therefore the erosional force of this water also. Rip rap, chutes and drop structures are not expected to be needed.

In addition, surface water collection trenches, bunds and sumps shall be installed around the OWD, ROM Pad, the Office and Mining hardstand area, the TSF, and within the landfill. Spoon drains or toe drains shall be nominally 2 m wide by 300 mm deep and bunds shall be constructed to enable surface water to drain to local low points adjacent to each structure. Small sumps, approximately 1.0m deep will be constructed at the end of each drain to allow suspended sediment to settle. As the sumps are designed to capture surface run-off and benign sediment loadings caused by run-off during heavy rainfall. Accordingly, the surface water collection sumps will not be lined.

All surface runoff control measures implemented for the site were designed using the 1 in 10 year 72 hour average recurrence interval (ARI) for the site of 88mm. This recurrence interval is considered appropriate for the projects intended operational life of 18 months.

Due to the flat topography, surface water inflows to the site will not occur. The abandonment bund will preclude surface runoff from entering the pit. This will be augmented during operation, by a low bund constructed on the haul road at the entrance to the pit to prevent water funnelling into the open pit via the ramp entrance as well as safety bund placed approximately 10 metres away from the crest of the pit.

A map showing surface runoff controls is presented as Figure 3.18.



BENAGERIE GOLD

Portia Project

Figure 3.18
Surface Run-off
Control Locations

Drawn by: JDM	
Date: 29-Jul-2014	Scale: 1:28000
Drawing No: 2	Grid System: AGD66

3.7 SUPPORTING INFRASTRUCTURE

Supporting site infrastructure will include:

- offices for administration, management and technical staff (refer to Section 3.7.2);
- workshops for routine servicing and maintenance of the processing plant as well as mobile equipment. Site workshops will be temporary constructions. Workshops and laydown yards will be levelled, sheeted where necessary with suitable road base and cross-graded with drainage installed to control storm water run-off and erosion;
- the laydown area and 'Go-bay' for mobile equipment will be located adjacent to the workshop, fuel bay and within the contractors' assigned area. The laydown area will be levelled, sheeted where necessary with appropriate material and cross graded to control storm water run-off and erosion;
- a car parking area for light vehicles will be located adjacent to the site offices and contractors assigned area and established as required;
- a small fully-catered accommodation complex (refer to Section 3.7.4);
- a lunch room and ablutions facility will be provided on site;
- a dedicated first aid post located in the site office (refer to Section 3.7.2);
- internal haul roads.
- a water disposal re-injection well field (refer to Section 3.7.5);
- pit dewatering and water management infrastructure (refer to Section 3.10.5);
- a TSF (refer to Section 3.6.2);
- a process plant area (refer to Section 3.5)
- a small landfill for disposal of non-recyclable and putrescible waste (refer to Section 3.6.5);
- potable water supplied by a reverse osmosis plant (refer to Section 3.6.3)

Supporting Site infrastructure is shown in Figure 3.7.

3.7.1 Access

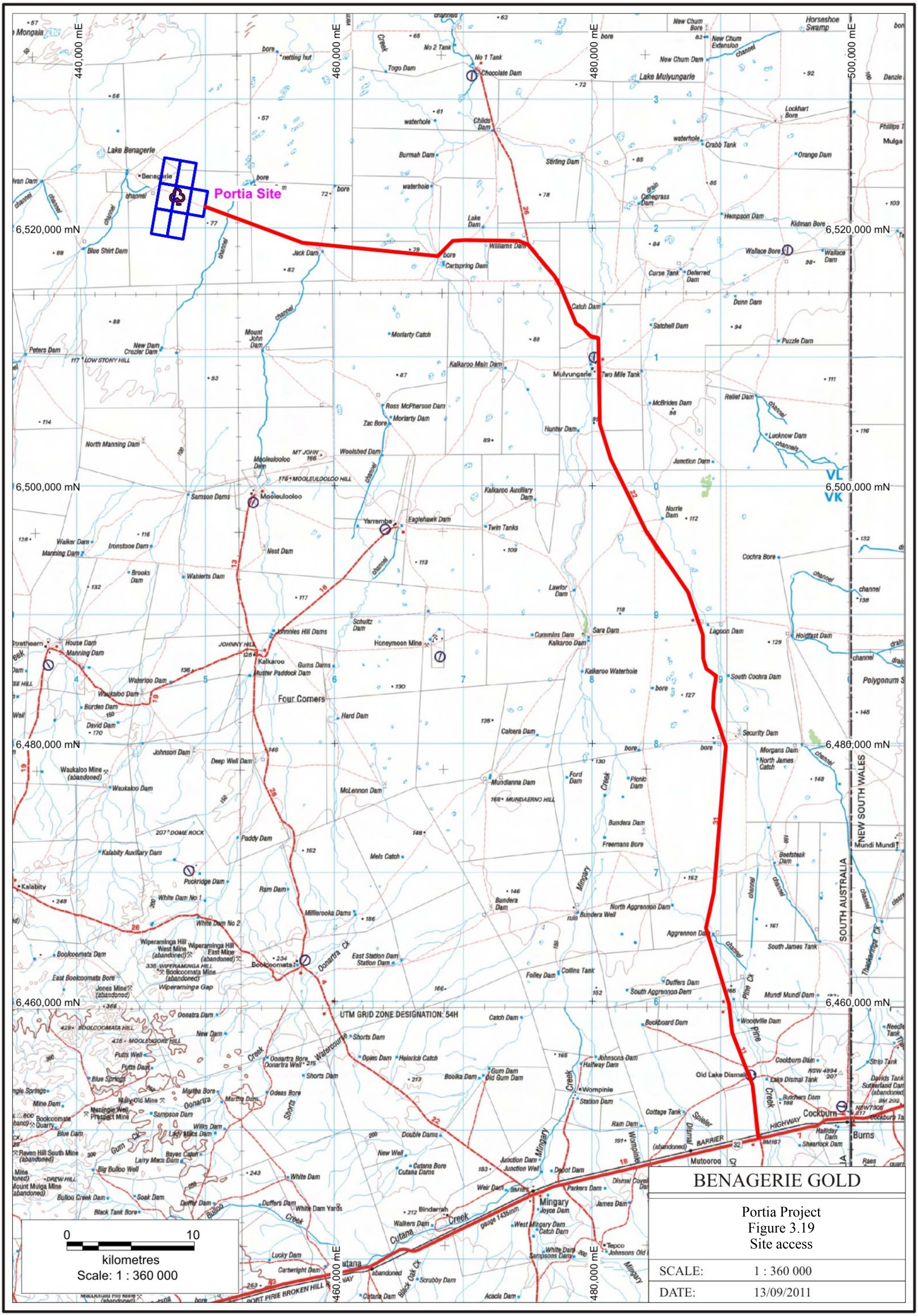
Access to Portia is via the unsealed public road from the Barrier Highway to Mulyungarie, followed by station track to site. The location of the Portia access route is shown in Figure 3.19. As shown in Figure 3.7, the access track from the east splits into two tracks near the site, with one track passing directly through the centre of the site (adjacent the pit, processing facility and through the dusky hopping mouse exclusion zone), whereas the other track passes to the north of these features. The track passing through the centre of the site will be decommissioned by ripping and the placement of fencing across it, with signage stating no access.

The entrance to the site from the access road will be appropriately sign posted to notify the public that unauthorised access to the site is not permitted.

An access agreement has been negotiated with the property landholder.

A 5 strand wire (station standard) fence will be erected, enclosing the open pit and all supporting site infrastructure, excluding the re-injection well field. It will be fitted with lockable gates to prevent unauthorised vehicular access and prevent livestock from entering.

A 5 strand fence will be constructed around the perimeter of the campsite to preclude interactions between stock and project personnel. Fence line perimeters are shown in Figure 3.7.



BENAGERIE GOLD

Portia Project
Figure 3.19
Site access

SCALE:	1 : 360 000
DATE:	13/09/2011

3.7.2 Accommodation and offices

A camp to accommodate about 52 people will be constructed near the main access road. The camp will incorporate catering and recreational facilities, and will be provided with a waste water treatment plant. Further details pertaining to the campsite can be found in Section 3.7.4.

Offices and crib rooms will be prefabricated buildings, also placed on blocks. Gold bars will be stored in a combination safe located within the Gold room prior to despatch to the Perth mint for refining and sale.

The site will be supplied with potable water produced by reverse osmosis from a portion of the water available from mine dewatering.

Potable water supply line routes to office buildings and the campsite will consist of small above ground pipelines. Pipelines will be routed around claypans and local depressions as necessary to prevent hydrological disruption during rainfall events.

A series of one way valves will be placed in the pipeline at strategic locations to limit draining of pipes in the event of pipeline failure or maintenance needs if necessary.

The office complex will include an emergency first aid post. It will have a bed, stretcher and an RFDS Medical chest. At least one person trained in first aid will be available at all times when the mine is operating.

3.7.3 Communications

On-site communications will be by UHF radio. Off-site internet communications will be via satellite. A 3G telephone system will be installed at the site to provide off-site communication services.

3.7.4 Campsite

The camp site covers a total area of 5.2 hectares (ha) and comprises of a 3.1 ha irrigation area and a 2.1 ha area containing the balance of the infrastructure pertaining to the camp. It is typical of a modern small mining camp and consists of a number of prefabricated building components and related infrastructure which includes:

- 13 units of 4 bedrooms, each with an ensuite;
- kitchen (12mx3m) and mess complex (19mx 12m), including cool rooms and storage suitable for catering purposes;
- laundry (12mx3m);
- separate ablution block (6m x 3m);
- office / visitor reception (12mx3m);
- recreation room (12mx6m);
- Small Hydrocarbon storage area (used for power generation)
- Enviroflow septic waste management system; and
- Irrigation area for Class B treated water

The area chosen for the camp is generally flat and adjacent to the main mine access road.

Topsoil will be left intact over much of the proposed campsite area in order to preserve the existing soil structure and native vegetation as much as possible. Trees, will be left undisturbed. Topsoil will be removed systematically from locations within the proposed work area where infrastructure will be established and windrowed for later re-use during rehabilitation activities.

The layout will be efficient in terms of the total camp size and for connection of services, including water, sewage and electricity. The prefabricated buildings will be placed on dry laid blocks, precluding the need for concrete footings or any permanent fixtures. All buildings will be connected by either concrete or gravel pathways. The proposed general arrangement drawing for the campsite and related infrastructure is shown in Figure 3.20.

An Enviroflow septic waste management system will be set up and maintained in accordance with the manufacturer's specifications.

Two independent generator sets and an associated bunded diesel fuel tank will be used to supply power generation requirements at the camp.

The entire camp is designed such that it can be easily removed and the site fully rehabilitated in an efficient manner upon lease surrender.

To enable safe management and control of traffic flow into and out of the campsite, the camp entrance road shall be 7.5m wide, have a carriageway width of 3.75m and a 1.5m shoulder on either side of each road. The road ways shall be cleared of topsoil and formed and compacted with appropriate drainage cross fall installed. The camp entrance road may be subsequently sheeted with road base so as to provide a durable surface during wet weather and to minimise excessive dust at the camp in dry times if required.

Due to the nature of the terrain and vegetation, it will not be necessary to undertake any major earthworks in order to construct the camp. The campsite area is dominated by low sandy rises and shallow depressions with sandy loam soils, all dominated by low bluebush, saltbush, bindii. Trees (black oak) have been identified during a survey of the site and have been avoided during planning to avoid unnecessary disturbance to this plant life during construction activities. No hardstand areas will be constructed within the drip line of any existing trees.

To limit unauthorised access during construction, the entrance road to the campsite will be appropriately sign posted to notify the public that unauthorised access to the site is not permitted.

Vehicle parking will be provided adjacent to the camp entrance road in front of the camp site.

Campsite Energy sources

Portable diesel generator sets will be used to supply power to the proposed Camp. Power will be 415V and 240V.

Generator sets required to supply the campsite will be located within the hydrocarbon storage area footprint as shown in Figure 3.21. Fuel to the camp generators will be supplied from a bunded diesel fuel tank.

Predicted power requirements for the camp during its operation will be 270 kW and this operational design criteria has been used in the basis of design of the proposed campsite and the quantity of diesel necessary to be stored at the campsite.

The Camp has no LPG facilities and therefore will not require the use of LPG fuel.

There is limited scope for energy efficiency gains due to the fact that there are no other practical sources for more than 95% of energy required other than diesel generators.

Figure 3.20 Campsite General Layout Drawing

Campsite Hydrocarbon Storage Area

The diesel storage tank and Campsite Generator sets (each with day tanks) shall all be stored in a HDPE lined hydrocarbon storage area specifically designed for this purpose. A General Arrangement drawing of the hydrocarbon storage area is shown in Figure 3.21.

The design parameters of the hydrocarbon storage area are as follows;

- The bund walls shall be 0.3 metres in height and 1.0 metres wide at the crest.
- The bund walls shall be constructed at a slope of 1V:3H.
- The bund walls and the floor of the hydrocarbon storage area shall be constructed to achieve between 90 and 93% compaction of the on site subsoil clay material available on site.
- The hydrocarbon storage area floor shall have inside base dimensions of 14m wide by 14m long which shall be graded and drained to a small pit to enable collection of fluids if required.
- The hydrocarbon storage area will be installed with a 0.5mm thick HDPE liner.
- A minimum separation distance of 3.0m from the diesel storage tank location to the inside crest of the bund walls shall be maintained. This is equivalent to the height of the diesel tank from the ground.
- A separation distance of 5.0m from the location of the diesel storage tank to the location of the Generator sets shall be applied.

The hydrocarbon storage area has a gross capacity of 69,000L. In calculating the storage requirements, the following storage criterion has been considered.

- 1 in 25 year 24 hour rain event for the area (112mm), equivalent to a volume of 29,000lt of water.
- 12,000L of hydrocarbons comprising of nominally 1 x 10,000lt self bunded diesel tank, 2 x 800lt generator day tanks installed within each generator and up to 2 x 200lt drums of oil.

Using the above storage criteria, the hydrocarbon storage area has a surplus capacity available of 28,000L. This is equivalent to a second 1 in 25 year rain event. The hydrocarbon storage area has a capacity overdesign allowance of 1.7 times the intended volume of hydrocarbons to be stored in this bunded area. This over design allowance is considered satisfactory.

Campsite Car parking Area

Vehicles will not be permitted in the camp area, other than for delivery of fuel, general supplies, the removal of waste or during emergency situations. A small carpark area for light vehicles shall be installed in front of the Camp and adjacent to the office. The location of the carparking area is shown in Figure 3.20. The parking area shall be cleared of topsoil, formed and compacted with appropriate drainage cross fall and may be subsequently sheeted with roadbase aggregate in order to provide a durable surface during wet weather if needed.

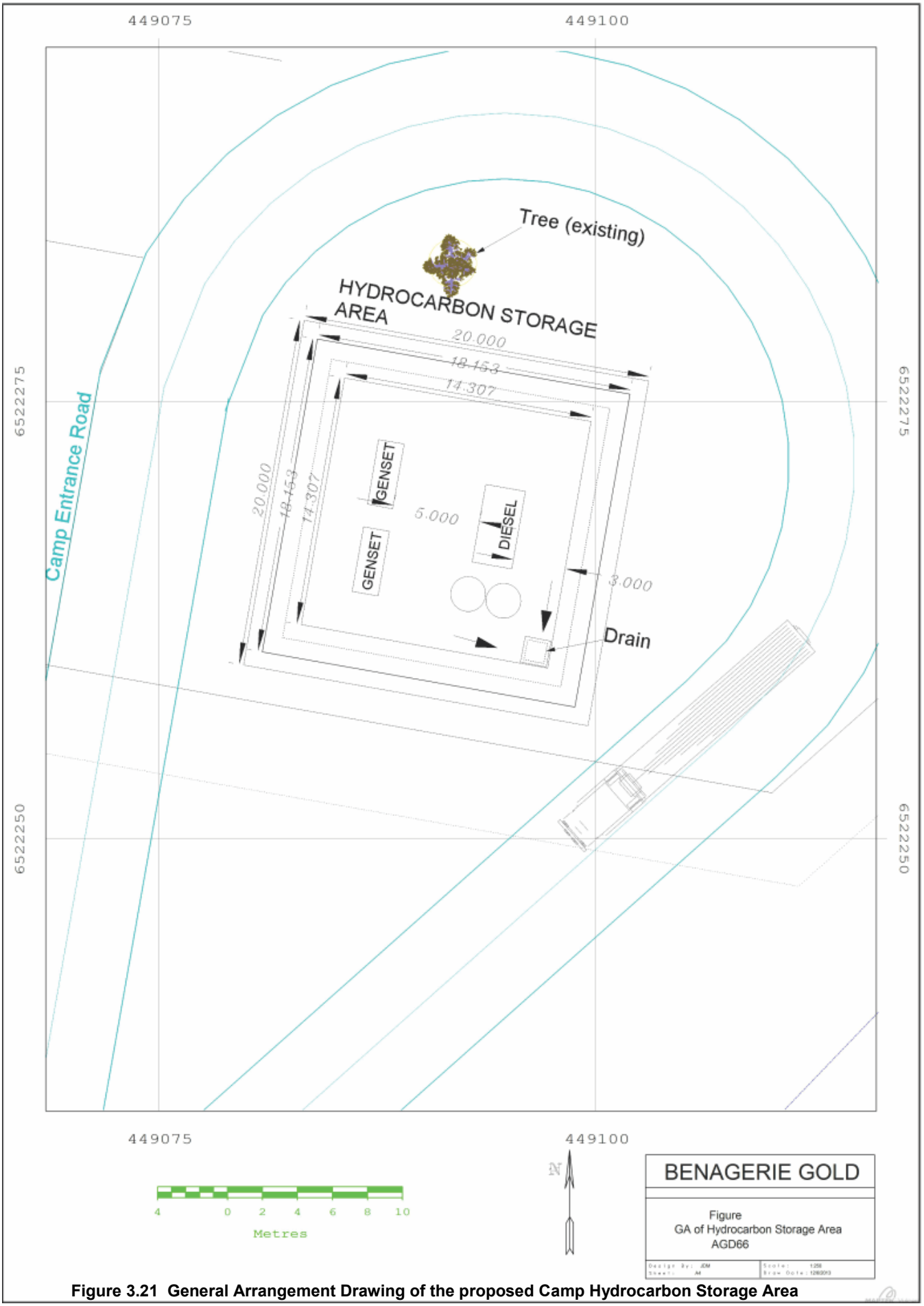


Figure 3.21 General Arrangement Drawing of the proposed Camp Hydrocarbon Storage Area

Waste Water Treatment Plant (WWTP)

The WWTP is an Enviroflow deployable sewage treatment plant designed for camps of up to 60 personnel. The unit provides secondary treatment to achieve class B final effluent water quality suitable for evaporation irrigation. The minimum final effluent quality for the proposed plant is:

- E coli (median) <100 cfu/100mL;
- BOD (median) <20 mg/L;
- Suspended Solids (median) <30 mg/L;
- TDS (median) 1000 mg/L;
- pH 6-8.5.

The WWTP is small in footprint and requires no major civil work prior to its installation. The Enviroflow treatment process consists of the following stages and processes:

- Delivery of influent via pumpwell and maceration pump to a balance tank for flow equalisation;
- A primary tank for sedimentation, digestion and storage of solid matter;
- An aeration compartment for biological degradation of organic matter;
- A clarifier for further removal of residual suspended solids; and
- A final effluent tank for disinfection and storage of treated water.

The WWTP will be installed, commissioned and maintained in accordance with the manufacturers instructions. A service agreement with the suppliers of Enviroflow treatment plants in South Australia is currently being investigated.

Evaporation Irrigation Area

Treated water from the WWTP shall be pumped to an evaporation irrigation area where it will be discharged via a series of low pressure microsprinklers and discharge lines onto the ground for evaporation and some take up by the existing vegetation. The irrigation area is 3.1 ha in total area. The irrigation area shall be 150m wide and 180m long, identical dimensions to the current evaporation irrigation area which exists at the White Dam project. The irrigation system will duplicate the current irrigation system that currently exists at the White Dam project which is designed for the camp.

The evaporation irrigation area is not intended to be cleared of vegetation other than for a fenceline/fire break as shown in

Figure 3.22. Based on the experience gained from the White dam project, the levels of phosphorous and nutrient loadings in which Class B water contains had no affect on existing similar vegetation as is found to occur at Portia. Based on this experience and the similar vegetative associations which occur, the affects to native vegetation in the irrigation area caused by the discharge of Class B quality treated water within it are unlikely to cause any adverse impacts to existing vegetation. The general arrangement drawing of the campsite irrigation area is shown in Figure 3.22.

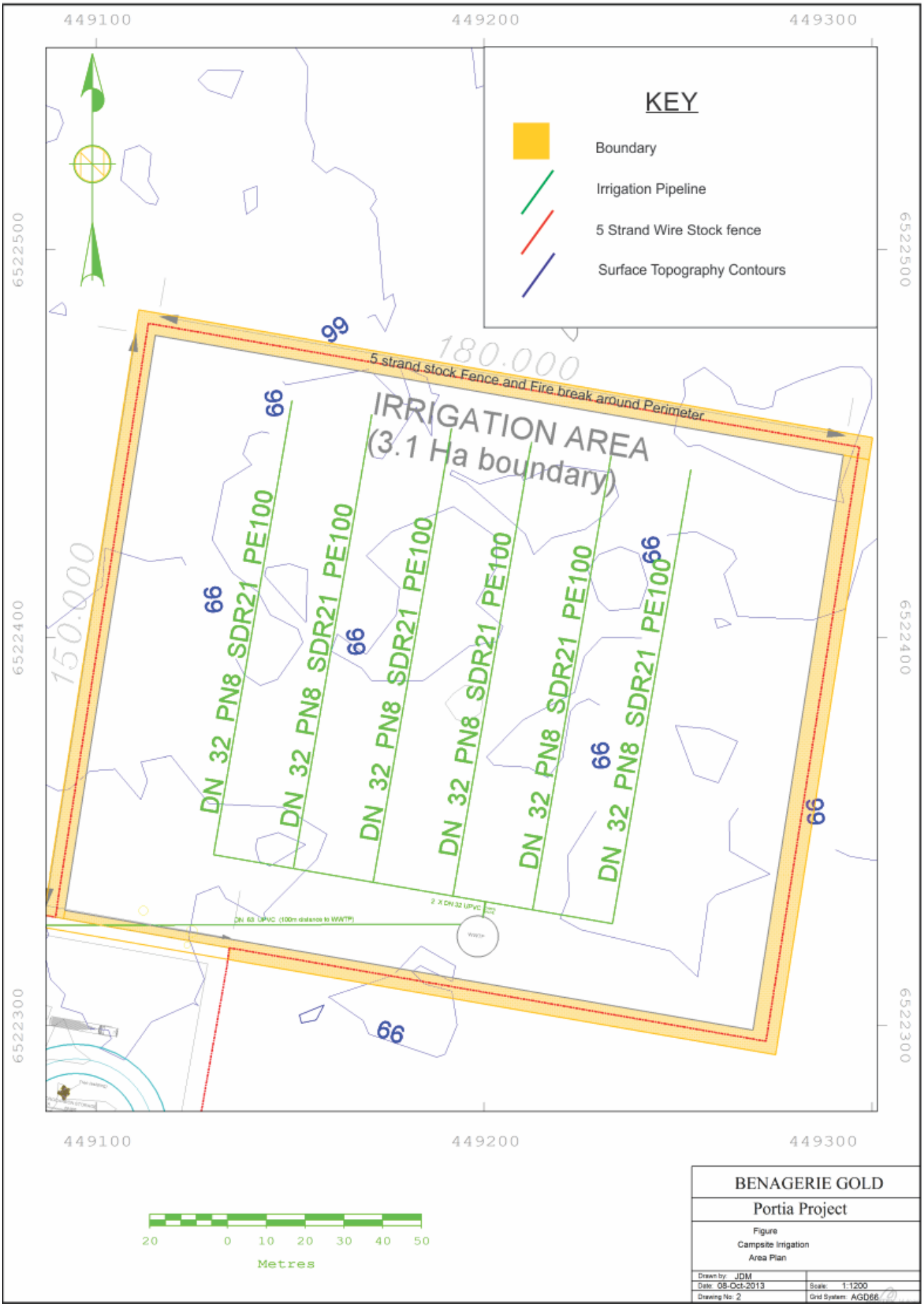


Figure 3.22 General arrangement drawing of the Campsite evaporation irrigation area

3.7.5 Re-injection Well field

As discussed in Section 3.3.1, total dewatering rates during mining are predicted to be:

- Stage 1: Beginning at time T = 0 days, Project construction, to T = 340 days, dewatering at a rate of 1,500 m^3/day from 9 initial dewatering wells;
- Stage 2: From T = 340 days to T = 480 days, total dewatering at a rate of 1,860 m^3/day from 12 wells;
- From T = 480 days to T = 540 days, total dewatering at a rate of 2,810 m^3/day from a combination of 12 wells and in pit sumps;
- From T = 540 days to T = 820 days, total dewatering at a rate of 2,525 m^3/day from a combination of 12 wells and in pit sumps;
- From T = 820 days to T = 925 days, total dewatering at a rate of 2,225 m^3/day from a combination of 12 wells and in pit sumps;
- From T = 925 days to completion, total dewatering at a rate of 1,930 m^3/day from a combination of 12 wells and in pit sumps;

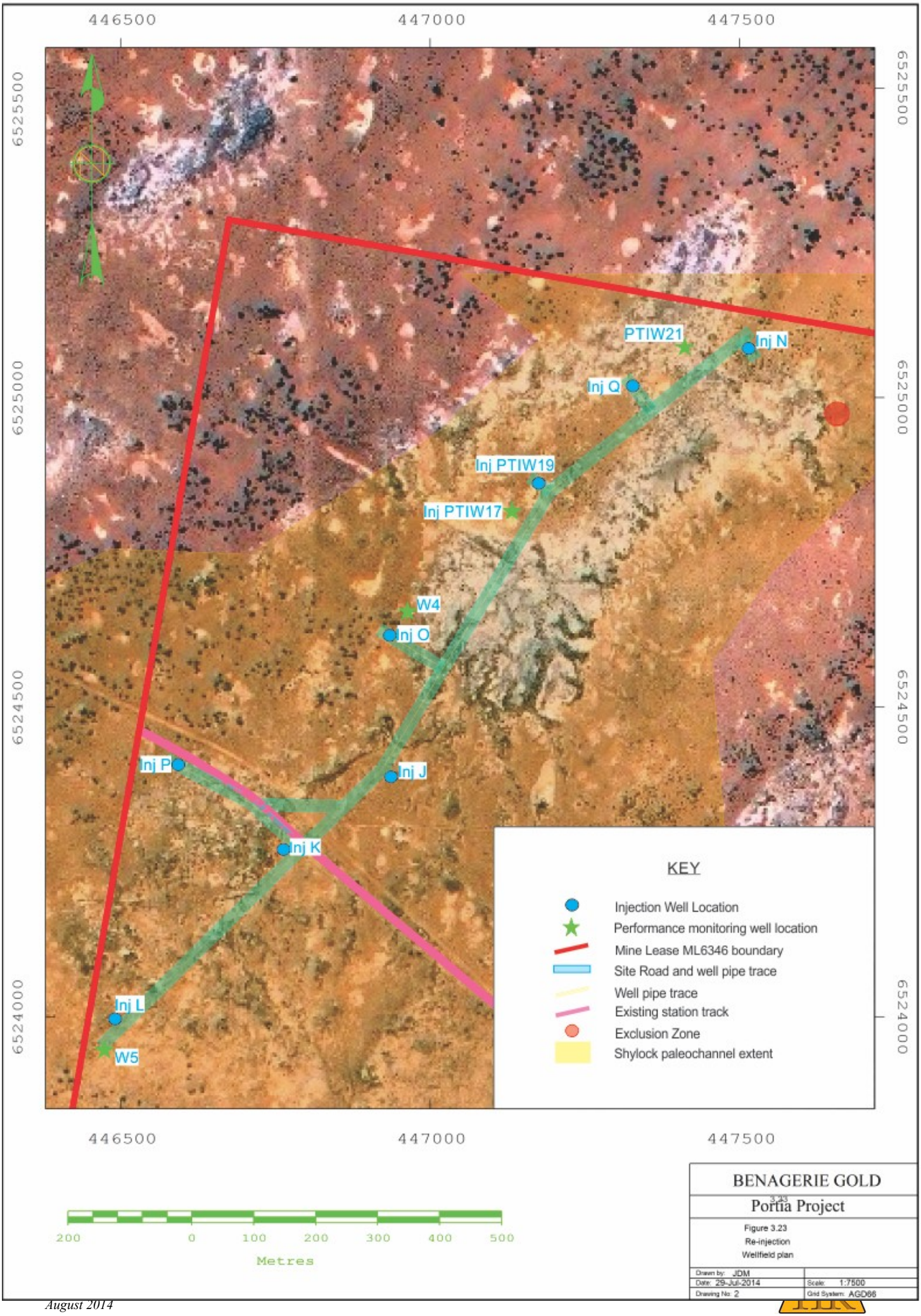
Whilst a portion of the dewatering volumes (refer Section 3.10.3) is anticipated to be used as part of mining operations, surplus mine water abstracted from the pit dewatering wells deemed excess to site requirements will need to be disposed of.

Australian Groundwater Technologies (AGT) accordingly undertook additional hydrogeological investigations to evaluate the potential to dispose of excess water from pit dewatering via injection into the Shylock palaeochannel, located on the north west corner of ML6346. A copy of this report can be found in Appendix F. In response to concerns raised by the Department for Environment, Water and Natural Resources (DEWNR) as to whether the Shylock palaeochannel had the capacity to receive excess water from mine dewatering, Havilah commissioned a series of pumping and injection trials in June/July 2014 in consultation with AGT. The results and findings from the injection trials are detailed in the concise technical addendum letter report provided in Appendix P. The trial provided important results and findings necessary to support this Program for Environmental Protection and Rehabilitation (PEPR) and to support an application for a drainage and discharge permit for mine production. The key findings from the investigations are summarised as follows.

Revised groundwater modelling indicates that injection of water into eight wells at an average rate of 146 kL/d/w (1.69 L/s) per well is viable.

As previously indicated, dewatering of the pit will be undertaken in a staged approach, thereby providing Benagerie Gold with added flexibility to first review the ongoing dewatering requirements and secondly to modify and expand the injection well field to suit the pit dewatering requirements if necessary.

The proposed layout plan of the Re-injection well field can be found in Figure 3.23.


446500
447000
447500
6525500
6525000
6524500
6524000
PTIW21
Inj N
Inj Q
Inj PTIW19
Inj PTIW17
W4
Inj O
Inj P
Inj J
Inj K
Inj L
W5
KEY
Injection Well Location
Performance monitoring well location
Mine Lease ML6346 boundary
Site Road and well pipe trace
Well pipe trace
Existing station track
Exclusion Zone
Shylock paleochannel extent
200
0
100
200
300
400
500
Metres
BENAGERIE GOLD
Portia Project
Figure 3.23
Re-injection
Wellfield plan
Drawn by: JDM
Date: 29-Jul-2014
Drawing No: 2
Scale: 1:7500
Grid System: AGD66

Geological and Hydrogeological Setting

Geological logs obtained from recent drilling in the Shylock palaeochannel (together with drill logs obtained from historic exploratory drilling) show clay from near surface to a depth of around 70 m below ground, followed by sand or clayey-sand lenses ranging in thickness from about 5-8 m (average 6 metres) thick in the central channel (Eyre Sand), followed by highly weathered basement (saprolite) at 73 to 76 m below ground level.

All recent investigation wells target the lower 10 m of the Shylock palaeochannel which incorporates, clay (Eyre Clay), and interbedded sand and clayey sand (Eyre Sand) sequences.

The field program outlined in the following sections of this report revealed the following characteristics of the Shylock Palaeochannel:

- Depth to groundwater is 22 m below ground level (mbgl) or about 38 mAHD.
- Groundwater is highly saline, ranging from 18,800 to 23,500 mg/L, and therefore there are no known groundwater users that source groundwater from the palaeochannel.
- The closest known groundwater users are located well outside of the palaeochannel, much further to the south.(these have been documented in Section 3.3.1).
- Well airlift yields ranged from about 2.7 to 4 L/s.
- Aquifer transmissivity ranged from 15 to 30 metres per day (m/d) with a geometric mean = 20 m/d and aquifer storage coefficients were in the order of 2 $x10^{-4}$ to 4 x 10^{-4}.
- The aquifer was characterised as a leaky confined strip aquifer.

Groundwater Quality Results

Sampling of groundwater chemistry of the source water (from nine wells within and encircling the proposed open pit mine) and the receiving aquifer (from six wells which target the Shylock palaeochannel) was undertaken to evaluate the suitability of the source water for injection into this palaeochannel. Samples were submitted to ALS laboratory for a full suite of hydrochemical parameters.

Groundwater salinity of the source water ranged from 12,300 to 14,800 mg/L, compared to 18,800 to 23,500 mg/L at the Shylock palaeochannel. This demonstrates that water captured from the open pit is of better quality than the receiving aquifer.

Major Ions

Major ion concentration analysis of the source water and the receiving aquifer water are shown in Table 19.

Groundwater that will be pumped from the Portia dewatering bores was sampled so that a comparison can be made between the chemistry of the source water (pit disposal water) and the receiving groundwater (Shylock palaeochannel).

Comparisons between the source and receiving waters were made by plotting the major ion chemistry on a Piper Trilinear diagram to see how different or similar the two water types are.

The graphical presentation of the water quality data shown in Figure 3.24, shows that groundwater from the pit and the Shylock sand aquifer are of the same type, and multi element analysis of sand samples from the Shylock palaeochannel demonstrate that any dissolution of heavy metals from the formation matrix will not adversely impact the groundwater quality of the receiving water. This supports the conclusion that the injection of pit disposal water will not have any adverse effects on the groundwater quality of the palaeochannel, (AGT, 2014).

Table 19 Major ion chemistry of Source (Mine) and Receiving (Palaeochannel) waters

			Injectant (Source Mine Water)									Receiving Water Quality Results					
Well Sample Date			TJ_1 2/01/2014	PTDW_1 2/01/2014	JARED'S BORE 18/06/2014	TJ_5 2/01/2014	TJ_8 2/01/2014	PTDW_6 2/01/2014	PTDW_4 2/01/2014	PTDW_3 2/01/2014	WB1 27/05/2013	PTIW17 6/05/2013	PTIW19 27/05/2013	Inj-J 13/04/2014	Inj-K 12/04/2014	Inj-M 13/04/2014	Inj L 10/05/2014
	UNIT	**LOR**															
pH Value	pH Unit	*0.01*	8.02	8.04	7.27	8	7.78	8.1	8.43	8.07	6.88*	7.31	6.88*	7.78	7.74	7.54	-
Electrical Conductivity @ 25°C	µS/cm	*1*	23100	22200	21700	21500	22000	21800	23800	24100	-	31000		28100	29900	33700	-
Total Dissolved Solids @180°C	mg/L	*10*	14200	12300	13300	13100	13300	13900	15400	13500	14480*	19800	21000	18800	19600	23500	-
Hydroxide Alkalinity as CaCO3	mg/L	*1*	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-
Carbonate Alkalinity as CaCO3	mg/L	*1*	<1	<1	<1	<1	<1	<1	11	<1	<1	<1	<1	<1	<1	<1	-
Bicarbonate Alkalinity as CaCO3	mg/L	*1*	216	158	146	168	132	269	315	152	148	159	151	159	151	159	-
Total Alkalinity as CaCO3	mg/L	*1*	216	158	146	168	132	269	326	152	148	159	151	159	151	159	-
Sulfate as SO4 - Turbidimetric	mg/L	*1*	1660	1810	1720	1750	1770	1870	1740	1850	1660	2340	2150	2000	2180	2480	-
Chloride	mg/L	*1*	7030	6840	6950	6380	6530	7170	7210	7350	6330	10300	10300	8890	9660	10900	-
Calcium	mg/L	*1*	566	538	470	485	456	518	576	541	460	740	650	636	660	767	-
Magnesium	mg/L	*1*	269	303	291	283	299	328	359	324	305	499	469	420	451	523	-
Sodium	mg/L	*1*	4220	3820	3810	3500	3700	4020	4510	4080	3740	5980	5920	5180	5700	6600	-
Potassium	mg/L	*1*	28	25	23	23	22	20	26	26	33	-	46	50	43	46	-
Total Anions	meq/L	*0.01*	237	234	235	220	224	246	246	249	216	-	338	296	321	362	-
Total Cations	meq/L	*0.01*	235	218	214	200	209	228	255	232	212	-	330	293	319	370	-
Ionic Balance	%	*0.01*	0.54	3.37	4.71	4.64	3.44	3.88	1.78	3.56	1.06	-	1.3	0.47	0.29	0.98	-

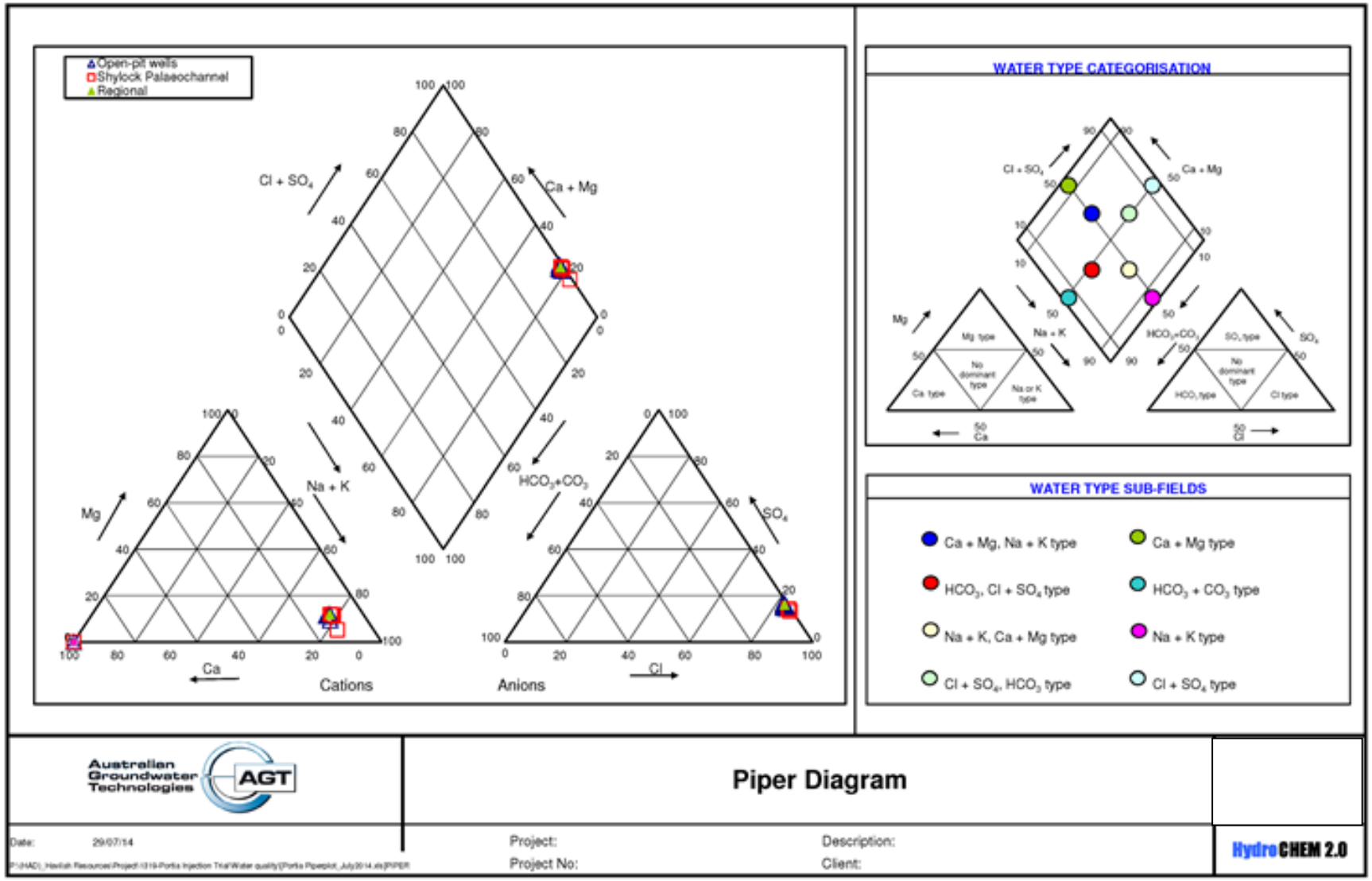


Figure 3.24 Piper Trilinear diagram showing comparative results of groundwater quality between Shylock palaeochannel and the Portia Pit location

Dissolved Metals

Dissolved metal concentrations measured in six Shylock wells and groundwater measured from nine wells within and encircling the proposed Open pit at Portia are shown in Table 20.

Arsenic concentrations in the Shylock palaeochannel wells ranged between 0.009 and 0.057 mg/L (Table 20). Arsenic concentration ranged between 0.191 and 0.277 mg/L for sampled pit water (Jared's bore) during the re-injection trial and sampling and analysis of back-flush water (post injection) showed major and trace chemistries consistent with the source injectant. (Refer to Appendix P)

The arsenic concentration of the other pit wells tested (TJ-1, TJ-5, TJ-8, WB1 and PTDW1, PTDW3, PTDW4 and PTDW6, also ranged between 0.031 and 1.49 mg/L (average of 0.4 mg/L from 9 samples). Although the arsenic concentrations are higher at the pit than the receiving aquifer, the composite average concentration of the blended injectant is expected to be consistently below the EPA guideline limit of 0.5 mg/L, (refer to Table 5, page 19).

All other dissolved metals were at concentrations that were lower than the palaeochannel aquifer.

Table 20 Dissolved metal concentration

			Injectant (Mine Water)									Receiving Water Quality Results					
Well			TJ_1	PTDW_1	JARED'S BORE	TJ_5	TJ_8	PTDW_6	PTDW_4	PTDW_3	WB1	PTIW17	PTIW19	Inj-J	Inj-K	Inj-M	Inj L
Sample Date			2/01/2014	2/01/2014	18/06/2014	2/01/2014	2/01/2014	2/01/2014	2/01/2014	2/01/2014	27/05/2013	6/05/2013	27/05/2013	13/04/2014	12/04/2014	13/04/2014	10/05/2014
	UNIT	**LOR**															
Arsenic	mg/L	*0.001*	0.114	0.124	0.276	0.786	1.49	0.031	0.152	0.134	0.546	0.082	0.137	0.057	0.019	0.009	0.037
Barium	mg/L	*0.001*	-	-	-	-	-	-	-	-	0.023	-	0.023	-	-	-	-
Beryllium	mg/L	*0.001*	-	-	-	-	-	-	-	-	<0.001	-	<.001	-	-	-	-
Cadmium	mg/L	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0002	<0.0001	<0.0001	<0.0001
Cobalt	mg/L	*0.001*	-	-	-	-	-	-	-	-	0.001	-	0.002	-	-	-	
Chromium	mg/L	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<.001	<0.001	0.001	0.002	0.001
Copper	mg/L	*0.001*	0.004	0.005	0.004	0.024	0.004	0.004	0.004	0.004	0.004	0.006	0.006	0.026	0.006	0.008	0.003
Nickel	mg/L	*0.001*	<0.001	<0.001	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.003
Lead	mg/L	*0.001*	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	*0.01*	-	-	-	-	-	-	-	-	<.01	-	<.01	-	-	-	
Zinc	mg/L	*0.005*	0.007	<0.005	<.005	0.012	<0.005	<0.005	<0.005	0.009	<0.005	0.08	0.048	0.056	0.014	0.007	0.024
Iron	mg/L	*0.05*	-	-	-	-	-	-	-	-	0.16	-	0.99	-	-	-	-
Manganese	mg/L	*0.001*	0.393	0.799	0.341	0.531	0.273	0.951	0.556	0.54	0.377	1.59	1.78	1.48	1.4	2.47	1.69
Mercury	mg/L	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Summary of Re-injection Modelling results

Simulated heads for the each of the modelled injection wells are shown on Figure 3.25. The injection rates are also shown for reference.

Modelling results indicate that groundwater levels will be artesian (above land surface) for the majority of the mine life (Figure 3.25). Injection well pressures were predicted to steadily rise during pre-mining and early-mining dewatering operations (0 – 340 days), then increase once disposal volumes increase. This corresponds with the period when extra dewatering wells and sumps are introduced to the mine pit floor.

Predicted injection well impress head peaked at approximately 65 m above standing water level (-65 m drawdown) with this peak occurring twice (500 days and 820 days, Figure 3.25). Impress head was predicted to be sustained at greater than 55 m above SWL for more than half of the modelled mine life (Figure 3.25). Considering the SWL to be 22 m below ground, the peak predicted impress head was 43 m above ground (420 kPa) with the injection pressures sustained above 33 m (320 kPa) and artesian for more than half of the modelled mine life.

The available safe injection head has been estimated by AGT (refer to Appendix P for calculation) to be 75 m (this has been estimated based on the available head and is equal to 85% of the fracture pressure level of the overlying confining bed above the aquifer).

It is proposed that dewatering of the pit will be undertaken in a staged approach, thereby providing Benagerie Gold with added flexibility to first review the ongoing dewatering requirements and secondly to modify and expand the injection well field to suit the pit dewatering requirements. This is further discussed in Section 3.10 of this document.

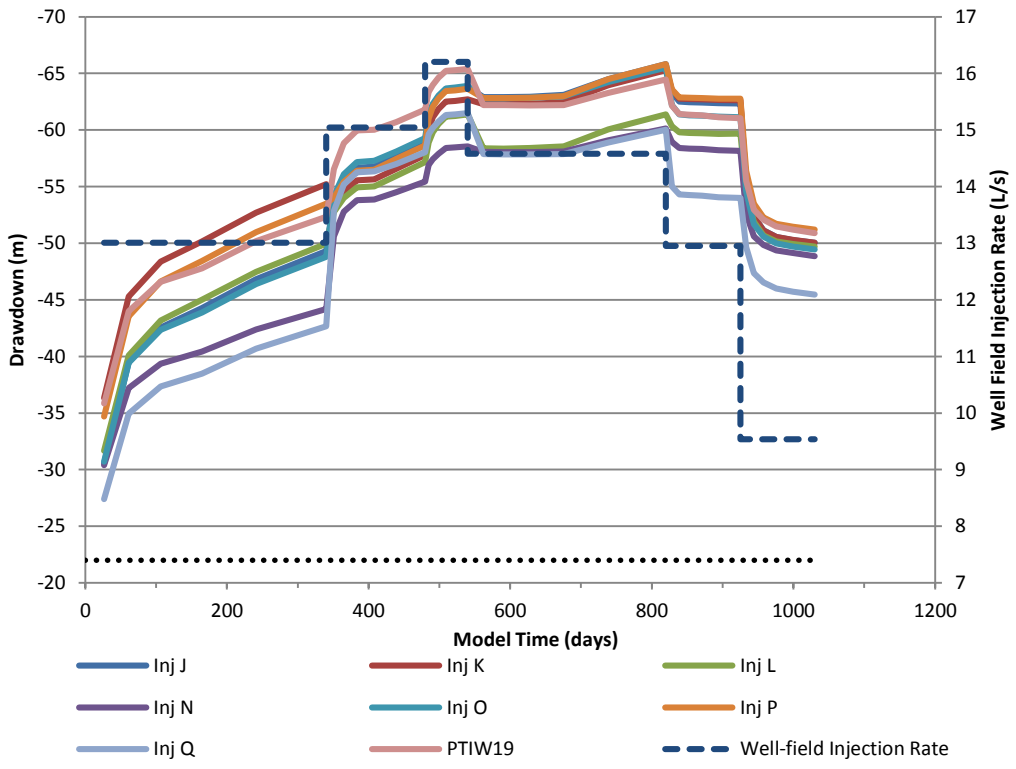


Figure 3.25 Simulated injection heads versus injection rate for 8 well injection pattern

The simulated potentiometric surfaces (mAHD) for the Shylock palaeochannel are shown in Figure 6.4, Figure 6.5 (pages 152 and 153) for injection periods of 540 days (representing maximum predicted pressure) and 1,030 days (representing completion of mining). The impress head contours are also shown at the top of each figure for reference. The impress head (negative drawdown) represents the rise in groundwater elevation (m) as a result of all wells operating simultaneously.

There are no private wells which target the Shylock palaeochannel or that lie in close proximity to the palaeochannel that could be affected by injection. (AGT, 2014)

Away from the injection wells, the maximum predicted rise in groundwater level in the palaeochannel is approximately 55 m (95 mAHD) in the vicinity of the MAR well field (Figure 6.5, page 153). The current standing water level is approximately 22 m bgl (and the ground surface is approximately 62 mAHD). Therefore artesian heads of around 33 m above ground surface are expected in the area surrounding the well field. These are modelled to occur for more than half of the mine life. The extent of the impress head is mostly confined to the extent of the palaeochannel.

Re-injection Well Field Functional Design

A number of design factors have been included within the design, construction and operation of the re-injection wells. These are summarized as follows;

Well Construction

All injection wells shall be cased using nominal 150mm Class 9 PVC Casing. Casing shall be pressure cemented in place to the surface in accordance with National Well Drilling Standards. Sand screens shall be installed with a nominal aperture size of 0.8 to 0.9mm and wells shall have end caps installed.

Well Headworks

A schematic of the proposed headwork design for each injection well is shown in Figure 3.26. This headwork design is suitable for applications containing low flow injections and similar head pressures.

Water will enter each of the wells via a nominal PN12 50mm HDPE Poly pipe and valve from an offtake from the Main re-injection delivery line from the Pit dewatering dam. The pipeline to each well head shall be supported and stabilized utilizing a 50mm post and clamp embedded into a concrete base at each well head. This will prevent the risk of injury to personnel from an unplanned failure of a pipe fitting at the well.

A 50 mm electronic Turbine flow meter shall be installed to enable both Flow rate and Total Batch volumes to be recorded at each injection well.

A 50mm diameter Inline Pressure Reducing Valve shall be located at each well head to maintain pressure at or below the prescribed maximum pressure head of 590 kPa (including an estimated 5m component of well loss) at each injection well head. A 12mm diameter Pressure gauge capable of reading pressures up to 750 kPa shall be installed at each well head to verify and record pressure at the top of the well head.

A ball valve will be installed in order to manually regulate and isolate the flow of water to each well if necessary for maintenance or management requirements. At each well head, a 50mm diameter one way Air Valve shall be installed to enable air to escape during normal operation of the wells. The entire well head, shall be bolted to each well casing utilizing typical Table D flanges with a minimum pressure rating of PN16. A Steel T-piece shall be utilized at the headwork to provide added rigidity and strength and enable wells to be quickly and easily redeveloped in the event that well clogging becomes problematic.

The downhole injection pipe, shall be secured to the Steel Flange base of each well head using a typical galvanised BSP threaded Pipe Fitting. The injection pipe shall consist of threaded 50mm HDPE poly pipe which shall installed to a depth of approximately 60 metres below ground level. Typically the pipe will sit at a depth of around 38 metres below the standing water level. This will minimize air entrainment and reduce the likelihood of well screens clogging up during operation and allow for this pipe to be utilized for airlift redevelopment of the wells if necessary. The injection pipe diameter has also been calculated to ensure that the velocity of the injectant entering each injection well will not introduce air entrainment.

At each well, the well casing shall extend approximately 200mm above ground level and the Head works shall extend a further 700mm (approx..) above this. The Casing above the ground shall have a cemented apron footing 200mm thick and be 1.5m in length and width which will provide secure anchorage for the well casing during operation at the anticipated flow rates and pressure.

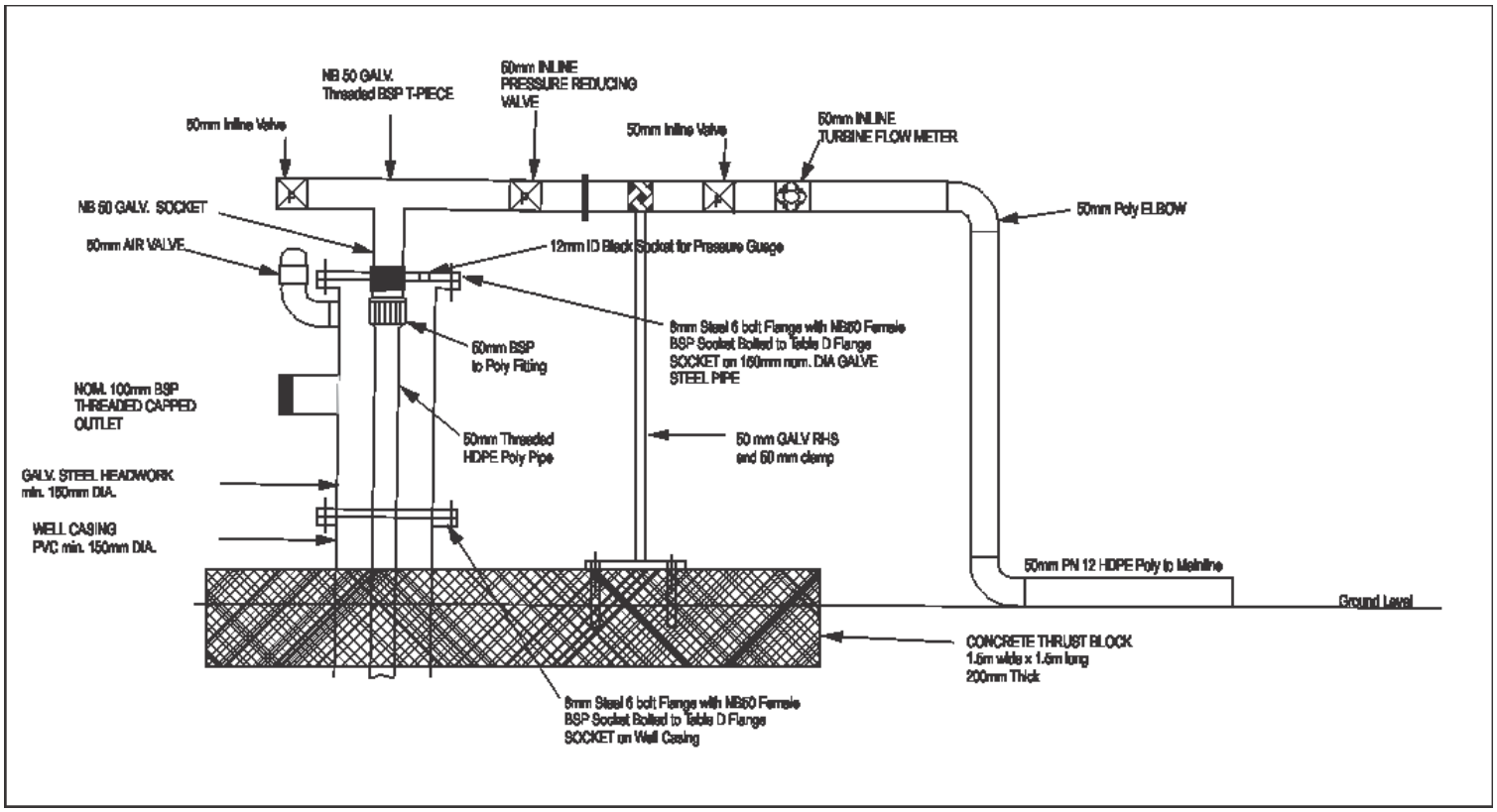


Figure 3.26 Schematic Well Headwork Design (not to scale)

Re-injection Well Field Process Control

The pump system at the Pit Dewatering Dam (PDD) delivering water to the injection well field shall have a Variable Speed Drive and pressure control module to allow the PDD pump system to continually monitor and maintain constant pressure through continuous adjustment of speed of the individual pumps. This consideration will prevent the over-pressurisation of the well field water delivery pipeline.

Raw mine water delivered to the PDD from the pit wells shall pass through a multistage filter skid before entering the PDD pump system for final delivery to the re-injection well field. The filter skid shall be designed to capture all sediment greater than 1 micron in size. A two stage filtration process is likely to be employed utilising readily available, industrial application water filtration technology.

The first stage of filtration will consist of removing all sediment greater than 20 micron in size utilising a manifold of 80mm nominal "Spin Klin" backwashable disc filters, with the Backwash water stream reporting back to the PDD. The backwash cycle of these filters will be activated utilising pressure differential switchgear and solenoids. The final stage of filtration shall consist of either "bag filtration" or a self-cleaning cartridge filtration system capable of capturing all sediment down to 1 micron in size. Either system will comprise of a manifold of filters and valving operating in parallel which will enable the individual elements of the filtration system to be cleaned without interruption to the flow of water to the reinjection well field.

As described above, in line pressure reducing valves installed at each re-injection well shall regulate well head pressures to ensure that the maximum prescribed pressure limit of 590 KPa (60m) of head pressure (measured at the top of each well head) is not exceeded during injection of water into each well. Along with these engineering controls, pressure and flow measurements shall be recorded daily by on site personnel to monitor the performance of each injection well and make adjustments to flows if necessary to maintain flow rates in accordance with the prescribed re injection disposal schedule (Table 21).

Pipelines and infrastructure shall be inspected by site personnel daily for leaks which if found, shall be promptly rectified.

Re-injection Well Field Performance Monitoring Parameters

Pumping Schedule

The preliminary re-injection well field disposal rate schedule to which Benagerie Gold shall adhere to is summarized in Table 21. The intended locations of the proposed wells are shown in Figure 3.23.

Table 21 Disposal rate schedule

Stress Period		Modelled Injection Flow Rate (kL/day)								
	Stress period length (days)	Inj-J	Inj-K	Inj-L	Inj-O	Inj-P	Inj-N	Inj-Q	PTIW19	Total (m^3/d)
1	340	0	196	196	34	172.8	262.6	0	262.6	**1124**
2	140	84.5	62.5	253.5	83.5	150.3	280.1	187.5	198.1	**1300**
3	60	97	75	266	96	172.8	292.6	200	200.6	**1400**
4	280	90	100	196	100	172.8	320.6	120	160.6	**1260**
5	105	77	102	196	67	149	351	0	177	**1119**
6	105	43	44	163	34	115	281	0	144	**824**

Performance Monitoring

To confirm the injection pressure is less than the safe injection pressure limit estimated by AGT to be 590Kpa measured at the top of each well head and also characterise the palaeochannel aquifer response, Benagerie Gold shall monitor and record at each injection well on a daily basis:

- Head pressure at each well,
- Injection rates at each well, and
- Total cumulative injection volumes disposed of at each well.

Performance monitoring is also proposed at locations, PTIW21 (existing investigation well), PTIW17 (existing investigation well), W4 and W5 to confirm that the injection pressure within the aquifer is less than the safe injection pressure limit estimated by AGT to be 540Kpa (measured at the top of each monitoring well head).

At PTIW21, PTIW17 and W5, the following information shall be recorded:

- Head pressure above ground level (ie. at the well head), utilising a pressure gauge on top of the well monthly.

To monitor pore pressure in the overlying Namba Formation and confirm that injection pressures are less than the safe injection pressure limit for the aquifer, monitoring well W4 shall be installed within the Namba Formation with the following information shall be recorded on a monthly basis:

- Head pressure above ground level (ie. at the well head), utilising a pressure gauge on top of the well.

Water Sampling and Analysis

Monitoring of the water quality of the injectant (mine water) shall occur on a monthly basis for field parameters EC/field TDS, pH, ORP and field Arsenic (As) to confirm As concentration of the blended injectant is below 0.5 mg/L. In addition to this, the injectant shall be sampled and tested on a quarterly basis for Laboratory Arsenic and Major ions in order to confirm field Arsenic measurements.

All Groundwater monitoring and management aspects for the project will be conducted in accordance with the Benagerie Gold - Portia Gold Project Groundwater Management Plan. See Appendix Q.

3.7.6 Public roads, services and utilities used by the operation

As stated in Section 3.7.1, access to the site is from the Barrier Highway by public road to Mulyungarie Station and then via station tracks (Figure 3.19). Due to anticipated limited vehicle movements and the remote location, vegetation and screening is not considered necessary. In addition, due to the short period of operation and very low rainfall and high evaporation, it is unlikely that screening vegetation would be successfully established during the period of operation.

To limit unauthorised access, the entrance to the site from the access road at Mulyungarie Station will be appropriately sign posted to notify the public that unauthorised access to the site is not permitted.

The track that passes through the site between the pit and the processing plant will be fenced off and ripped to prevent vehicular use and signage will be erected advising travellers to use the track immediately to the north.

3.8 WORKFORCE

Approximately 50 personnel will be directly employed at Portia with a maximum of 37 people on site at any given time. The operation will also have additional technical support provided by specialists in key fields of environmental management, mining engineering, geotechnical engineering and ore processing.

A summary of personnel required during mining operations is presented as Table 12.

It is expected that the majority of personnel will be recruited from nearby settlements, Broken Hill, and the northern towns in South Australia.

3.9 ENERGY SOURCES

Portable diesel generator sets will be used to supply power to the mine site and infrastructure. Mine site power will be 415V and 240V.

Generator sets required to supply the process plant and offices will be located within the general infrastructure layout. Fuel will be supplied from a bunded diesel fuel tank.

Each dewatering well will be powered by an individual diesel powered generator. These generators will be refuelled and inspected on a daily basis.

Independent generator sets and a bunded fuel tank will be used to supply the power requirements of the accommodation complex.

Predicted power requirements for the operation are estimated to be 660kW. A breakdown of the estimated power requirements is shown in Table 22.

Table 22 Predicted site power requirements

Infrastructure	**Power** (kW)
Processing Plant	200
Site offices and Ablutions	20
Workshop and Pump Delivery	110
Dewatering wells	60
Camp	270
Total	660

The fuels needed for the operation are presented in Table 23.

Table 23 Expected fuel usage and storage volumes

Reagent	**Annual use**	**Stored mass or volume**
Diesel (kL)	4,400	170
Oils (L)	5,000	1,600
LPG (t)	50	4.9

The gold room will use LPG as the fuel to supply the heat required during the smelting operations to produce gold bars.

There is limited scope for energy efficiency gains due to the fact that there are no other practical sources for more than 95% of energy required other than diesel generators. Solar hot water services will be used where practicable. Due to the short mine life there will be no scope for setting up alternative sources of energy such as wind or geothermal. Consequently no carbon off-sets are possible.

3.10 WATER SOURCES AND SITE WATER MANAGEMENT

3.10.1 Water Sources

As stated in Section 3.5.2, water for processing and other forms of site usage will be sourced from dewatering wells constructed around the periphery of the open pit and from in pit sumps. Pit dewatering activities are expected to provide average dewatering rates of 1,653 m^3/d (19.1 L/s) during prestrip and

advanced dewatering and an average of 2,369 m^3/d during the period of ore mining until completion of processing (27.4 L/s), as discussed in section 3.3.1.

3.10.2 Site Water Management

Havilah intends to re-inject all water deemed excess to site requirements, however the injection scenario utilised will provide spare capacity/contingency in case the actual dewatering volumes/aquifer storage capacity have been underestimated.

Water from the pit dewatering wells will be discharged into the Pit dewatering dam (PDD). A proportion of this water will be used for on site dust suppression and for the Reverse osmosis (RO) plant that will supply potable water for the Project. Water deemed excess to site requirements, shall be filtered to remove all sediment above 1 micron and then pumped to the re-injection well field for disposal (See Section 3.7.5).

A small amount of site water not able to be handled by the re-injection well field (predicted to peak at 304m^3 per day for a duration of 60 days) will be diverted from the PDD to the Raw water dam (RWD) for disposal and evaporation within the Tailings Storage Facility (TSF) footprint utilising mechanical evaporators (eg pivot sprinklers or wobble tees). This is predicted to occur concurrent with the introduction of additional well pumping in Stage 2.

During Ore Processing, more water from the PDD will be diverted to the RWD for use by the gravity separation plant as required.

During Mining, any water ponding within in pit collection sumps after periods of high rainfall or during mining of the ore zone will be pumped directly to the Raw Water Dam for disposal into the TSF.

Pit dewatering (via perimeter wells) will commence before overburden stripping to enable water levels to be drawn down to below the ore zones before ore mining starts.

Benagerie Gold's intended plan is that dewatering of the pit shall be undertaken in a staged approach. The first stage will involve progressively installing the first 9 dewatering wells around the perimeter of the pit and monitor the effectiveness of pit dewatering over the first four months of pumping during the construction period and prior to installing the final second stage of in-pit wells. This approach will provide Benagerie Gold with added flexibility to recalibrate the numerical hydrogeological model with the long term operational/monitoring data obtained during Stage 1 of the pit dewatering plan and establish whether additional bores are required as part of Stage 2. It also allows the flexibility to revise the configuration of the Stage 2 bore field to further optimise dewatering and provides contingency for internal bores on the western side of the pit.

Installation and commissioning of the re-injection well field will occur concurrently and progressively along with the proposed installation of the first stage of the pit dewatering plan. The progressive installation and commissioning of the individual re-injection wells will enable Benagerie Gold the opportunity to monitor the effectiveness and performance of the re-injection wells. This approach will provide long term operational/monitoring data which will be used to recalibrate the existing shylock palaeochannel hydrogeological model during this time. This measured approach will define the operational performance of the injection well field and allow the flexibility to revise the configuration of the re-injection well field if necessary.

No water will be discharged off site. A schematic of the water supply circuit for the project during operation is shown in Figure 3.27.

3.10.3 Site Water Balance

During the entire operation, the project will have a positive water balance, meaning that water will be extracted at a greater rate than it will be used.

The predicted average raw water demand for the project during ore processing is approximately 2,378 kL/d for the following uses:

- process water - average consumption 1,972 kL/d
- potable water - average consumption 66 kL/d (generate 20 kL/day of drinking water)
- dust suppression and construction - average consumption 340 kL/d

During operation, groundwater modelling completed by AGT (refer to Appendix P) predicted dewatering and disposal flow rates for the site, calculated after taking into account all site usage inputs. These have been summarised in Table 24. As mentioned in Section 3.10.2, the injection scenario utilised includes spare capacity/contingency in case the actual dewatering volumes/aquifer storage capacity have been underestimated. Table 24 shows that during operation, the peak disposal rates are predicted to occur for only a short length of time (60 days) and are considered to be the worst case scenario.

Table 24 Predicted dewatering and disposal flow rates

Stress Period	Length (days)	Model Time (days)	Total Dewatering Flow Rate (kL/day)	Additional Disposal Flow Rate (kL/day)	Additional Disposal Volume (kL)	Reinjection Disposal Flow Rate (kL/day)
1	340	340	1500			**1124**
2	140	480	1860	184	25,760	**1300**
3	60	540	2810	304	18,240	**1400**
4	280	820	2525	159	44,520	**1260**
5	105	925	2225			**1119**
6	105	1030	1930			**824**
				Total Additional Disposal (kL)	88,520	

A water balance of the site showing peak disposal rates over the operational period of the mine once ore mining commences is presented in Table 25 and clearly summarised in the schematic shown in Figure 3.27.

Over the operational life of the project a summary of water flow rates are as follows:

- Average dewatering volumes are predicted to be 1,653 kL/d (peak at 1,860kL/day) during prestrip mining and advanced dewatering.
- Average dewatering volumes are predicted to be 2,369 kL/day (peak at 2,810 kL/day) during the period of ore mining until completion of processing.
- Average re-injection volumes are 1168 kL/day (peak at 1400 kL/day).
- Disposal of excess water not able to be re-injected of up to 304 kL/day but an overall average disposal rate of 184kL/day during ore mining and processing.

Table 25 Site Water balance

Site ***peak conditions***	Flow m^3/day Pre-production	Flow m^3/day Production	Flow m^3/day Post Closure
Inputs			
Dewatering	1,860	2,810	-
Rainfall	116	249	249
Ore Moisture	-	237	-
Total	**1,976**	**3,296**	**249**
Losses			
Tailings - all losses	-	1,100	117
Dust Suppression	340	340	-
Evaporation Pit	132	132	132
Additional evaporation	184	304	-
Reinjection	1,300	1,400	-
RO	20	20	-
Total	**1,976**	**3,296**	**249**

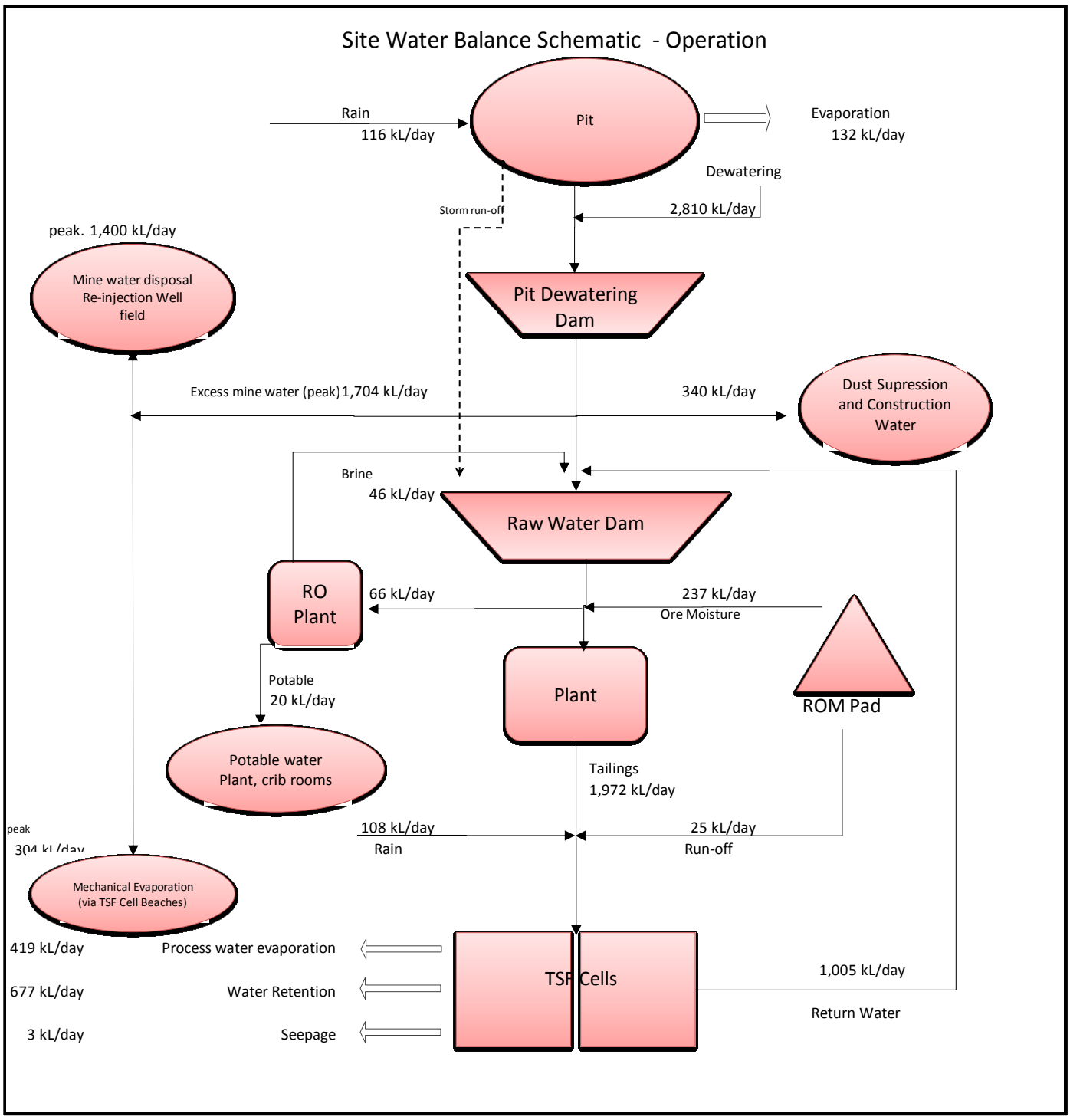


Figure 3.27 Schematic showing the Portia Project Site Water Management Strategy

TSF Evaporation area calculation

As described in Section 3.10.2 and shown in Figure 3.27, Benagerie Gold intends to re-inject all water deemed excess to site requirements, however the injection scenario utilised will provide spare capacity/contingency in case the actual dewatering volumes/aquifer storage capacity have been underestimated. In this scenario, a small amount of water from pit dewatering activities will be directed to the TSF where it will be evaporated off using mechanical evaporation devices, such as wobble tees, or sprinklers. The TSF has a combined inside cell footprint area of 20 ha. The yearly average evaporative capacity of the TSF has been evaluated using the equation:

V = A x (0.7E – R) where;

V = evaporation volume (m^3);

A = TSF inside area (20 x 100 x 100=200,000 m^2);

0.7 = Conservative Saline water evaporation efficiency factor;

E = Average daily pan evaporation for the site in metres (0.0074 m/day);

R = Average daily rainfall for the site in metres (0.0006m/day)

The average evaporative capacity of the TSF is 912m^3 (ie. ~10 L/sec). At peak site water disposal requirements as detailed in Table 24 and illustrated in Figure 3.27, only 30% of the evaporative capacity of the TSF cell footprint would be utilized. Furthermore, the evaporative capacity of the TSF is considered to be conservatively quantified on the assumption that only 70% of evaporation efficiency shall occur at the site due to the salinity of the groundwater.

Given this design over capacity and with regular water disposal rotations between TSF cells, using appropriate mechanical evaporation devices to ensure water does not pool against the TSF embankments and by ensuring that each TSF cell decant area does not exceed 10,000m^2, the use of the TSF to dispose of up to 304m^3/day (but an average during the operational life of the project of only 184 m^3/day) via evaporation as part of the site's water management strategy is considered appropriate based upon the revised groundwater modelling predictions.

3.10.4 Site Water Management Contingency Plan

As discussed in Section 3.10.3, the project has a positive water balance throughout the operational life of the project.

Benagerie Gold intends to re-inject all water deemed excess to site requirements, however injection scenarios have included contingency measures through the use of additional evaporative capacity within the 20 Ha TSF footprint. The site water management strategy has the following intrinsic contingencies:

- TSF design has an average conservative evaporative overcapacity of 70% above predicted peak disposal volumes and excess water could be delivered to the TSF for disposal via evaporation limited to a maximum decant pond area of 10,000m^2, in accordance with BTM Solutions TSF Operations and Surveillance Manual, found in Appendix N.
- The adopted decant water return estimate from the TSF of 51% is very conservative and not typical of normal clay materials. Traditionally, decant return estimates of 20-30% represent more typical "operational" decant return percentages with greater losses to retention and evaporation and would be equally applicable in this situation (pers. Communication BTM Solutions). Adopting these values would create a deficit in the current peak site water balance meaning more makeup water would need to be delivered for processing than predicted.

- The PDD pumping and filtration system will be designed to operate at approximately 60% of its design capacity (meaning the disposal delivery system shall be capable of dealing with unforeseen water inflows (eg from rain events) with no issue,
- The Pit dewatering wells are capable of delivering up to 25% more water than predicted to occur,
- Re-injection well performance is conservatively modelled and designed. The progressive commissioning of re-injection wells will allow for long term injection monitoring data to be obtained in order to verify and/or recalibrate the existing hydrogeological model for the well field and;
- Pit dewatering requirements remain conservatively modelled.

Benagerie Gold acknowledge that it will be critical to quantify dewatering and reinjection rates, characterise drawdown and impress cones and if required calibrate the model at an early time stage (eg within 4 months of commissioning of the site water management strategy and infrastructure). Whether the groundwater model needs calibration will be determined by whether drawdown and impress cones are behaving according to model predictions.

In consideration of this and as part of the Sequence of Mining as described in Section 3.3.2, Benagerie Gold intend to install and commission the site water management infrastructure during the construction phase of the project with the intention of having bores commissioned 6 months prior to commencement of pre-strip mining.

If it is found (after 4 months of operational data) that the groundwater model requires calibration and that water disposal volumes are greater than those which can be handled by the current site water management strategy (and contingencies described above), Benagerie Gold shall commit to restricting mining operations through extending the prestrip mining schedule to match revised groundwater model predictions until the design, approval and construction of an evaporation basin within ML6346 to meet the balance of surplus disposal requirements can be completed. Benagerie consider that to design an evaporation basin to meet an unknown excess disposal requirement which has a high probability of not being needed for the reasons described above is unjustified at this juncture in time.

3.10.5 Water Management Infrastructure

Pit Dewatering and Pit Dewatering Dam

Up to Twelve Grundfos Ultrasub SP17-16 9.2kW 415V submersible pumps will be installed around the pit which are capable of pumping at a flow rate of up 4.6 L/s. The pumps will each be set at 90-95m below ground level. Each pump will be connected to the dewatering ring main around the pit perimeter using “Crusader” 75mm diameter flexihose or similar pipe.

The “ring main” will consist of nominal 160 mm PN6.3 poly dewatering lines. Each line shall be approximately 870m in length. The lines have a relief valve in each to bleed the lines on startup and inline turbine flow meters and ball valves shall be installed at each dewatering well head to enable individual flows to be measured and maintained.

The two ring main dewatering lines will report back to Pit Dewatering Dam (PDD). The PDD shall consist of a truncated inverted pyramid and will measure 10m x 20m at the base, be 5.0m deep and have dimensions at the inside crest of 40m x 50m. It has a capacity to hold 4.7ML. The PDD will have side slopes of 3H:1V and an embankment crest width of 1.0m.

In maintaining an operational freeboard of 1.0 m, the live capacity of the PDD will be 3.0 ML. This capacity will provide approximately one day of storage from the pit dewatering wells.

The location of the PDD can be seen in Figure 3.7. A plan and cross section of the PDD is shown in Figure 3.28 and Figure 3.29.

PDD Pumping system and injection well field delivery pipeline

Pumping from the PDD to the re-injection well field and also the RWD will occur via the PDD pumping system. This will comprise of up to six vertical mulit-stage, pressure controlled, centrifugal pumps mounted on a skid complete with valves.

At present the PDD pumping system is a proposed as a duty / standby arrangement, as any issue with the pumping system would shut the Pit Dewatering system down. The pump skid would deliver water approximately 2600m to the re-injection well field and the Raw Water Dam through a nominal 200NB HDPE extruded white pipeline appropriately classed with a higher burst pressure rating than the peak designed disposal pressures.

To contain saline water as well as prevent soil erosion should a pipeline burst during operation, all pipelines shall be appropriately bunded or buried. All pit dewatering infrastructure will be monitored regularly throughout each day to ensure suitable operation occurs.

At the high point of the PDD delivery line, a relief valve would be installed to negate suction pressure within the line on shutdown.

Raw Water Dam (RWD)

The flow of water to the RWD from the PDD will be controlled by demand via a throttling valve connected to a pressure transmitter on the Plant ring main as well as a level switch on the RWD dam. A manual valve can be opened to feed the raw water into the dam at a prescribed flow rate which shall be measured and monitored daily with an inline flow meter.

The RWD shall consist of a truncated inverted pyramid and will measure 10m x 20m at the base, be 5.0m deep and have dimensions at the inside crest of 40m x 50m. It has a total capacity to hold 4.7ML. In maintaining an operating free board of 1.0m, the live capacity of the RWD will be 3.0 ML. This capacity will provide approximately 2 days of storage for Ore processing operations. The RWD will have side slopes of 3H:1V and an embankment crest width of 1.0m.

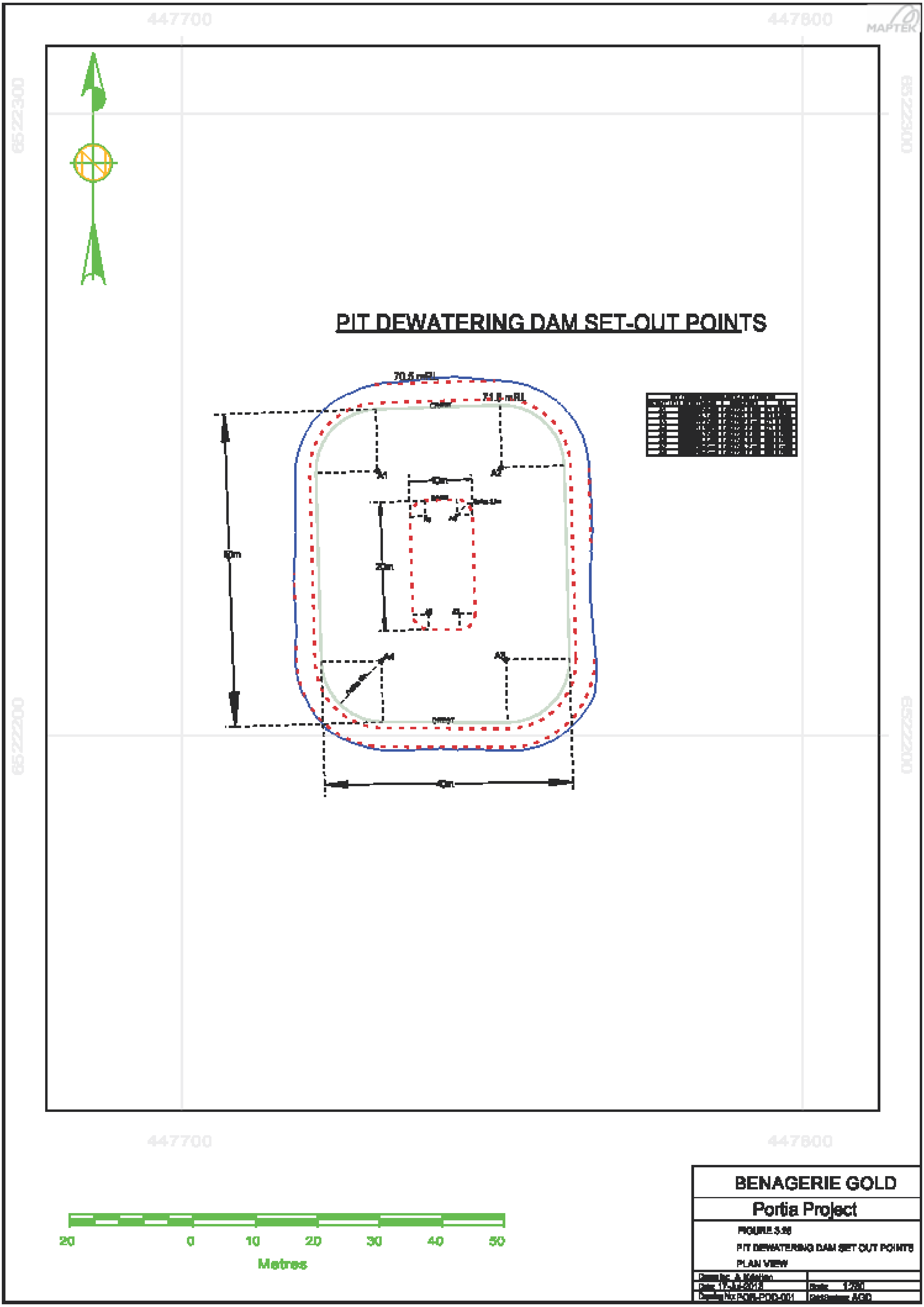
The location of the RWD can be seen in Figure 3.7. A plan and cross section of the RWD is shown in Figure 3.30 and Figure 3.31.

Dam Construction

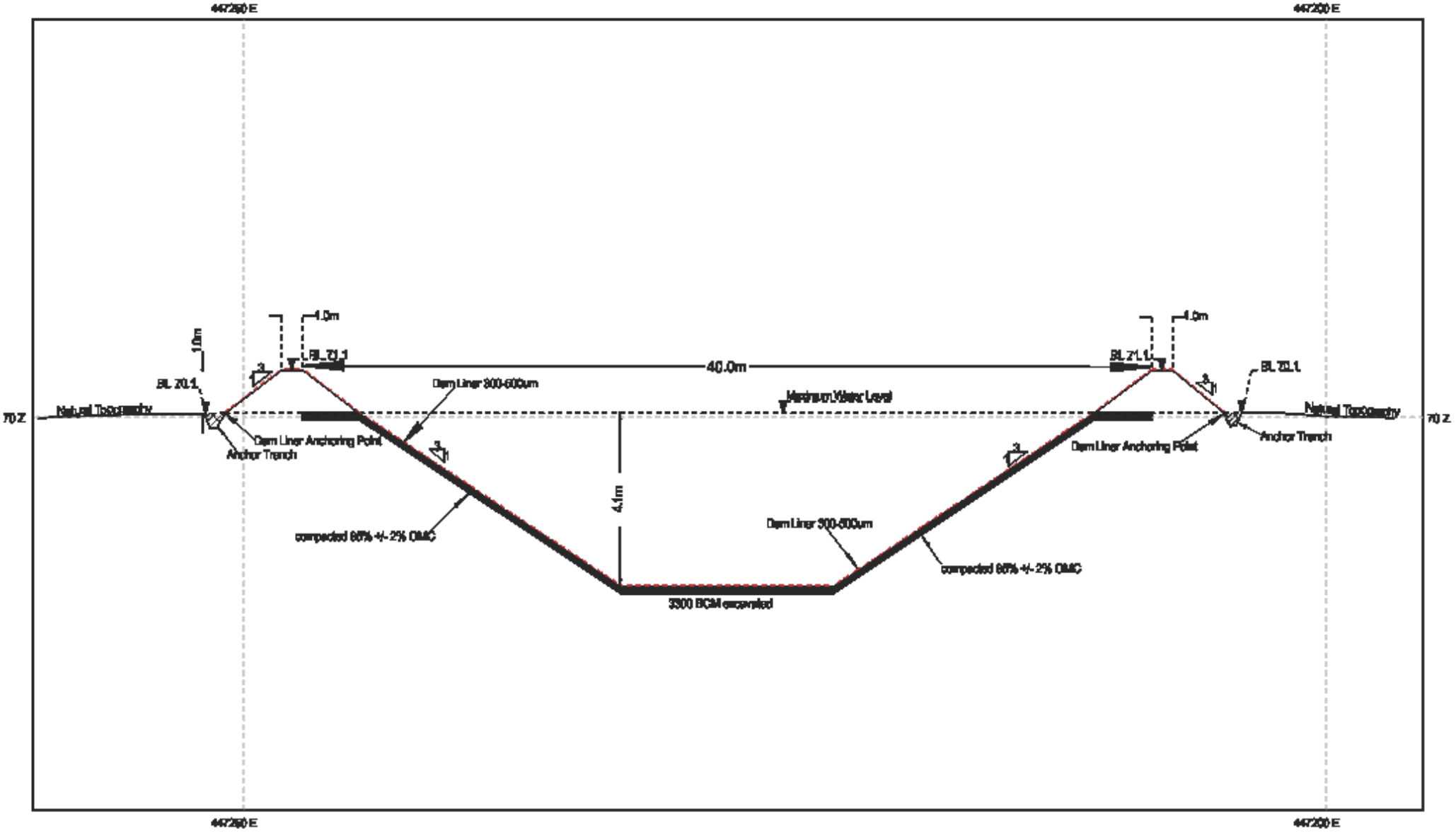
Both the PDD and RWD dams shall be lined with a nominal 0.5mm HDPE geomembrane on a sand/clay base. The walls and floor of the PDD shall be excavated neatly from solid material. All soft, yielding or other unsuitable material shall be replaced with sound material and the subgrade shall be compacted to provide a minimum of 95% compaction.

The geomembrane shall be laid on the clay foundation following specific working procedures and anchored into the ground utilizing a small trench 300mm deep V- trench which shall be backfilled afterwards.

After placement, the geomembrane shall be inspected for evidence of holes, tears or defective seams. If these features are present the liner shall be repaired in accordance with the manufacturer's specifications.



PIT DEWATERING DAM SET-OUT POINTS
70.5 mRL
71.5 mRL
A1
A2
A4
A5
80m
20m
447700
447800
6522300
6522200
MAPTEK
20
0
10
20
30
40
50
Metres
BENAGERIE GOLD
Portia Project
PIT DEWATERING DAM SET OUT POINTS
PLAN VIEW



BENAGERIE GOLD	
Portia Project	
FIGURE 3.29 PIT DEWATERING DAM CROSS SECTION Looking South	
SCALE:	horiz 1:250 vert 1:125
DATE:	17/07/2013

447200

447300

6523000

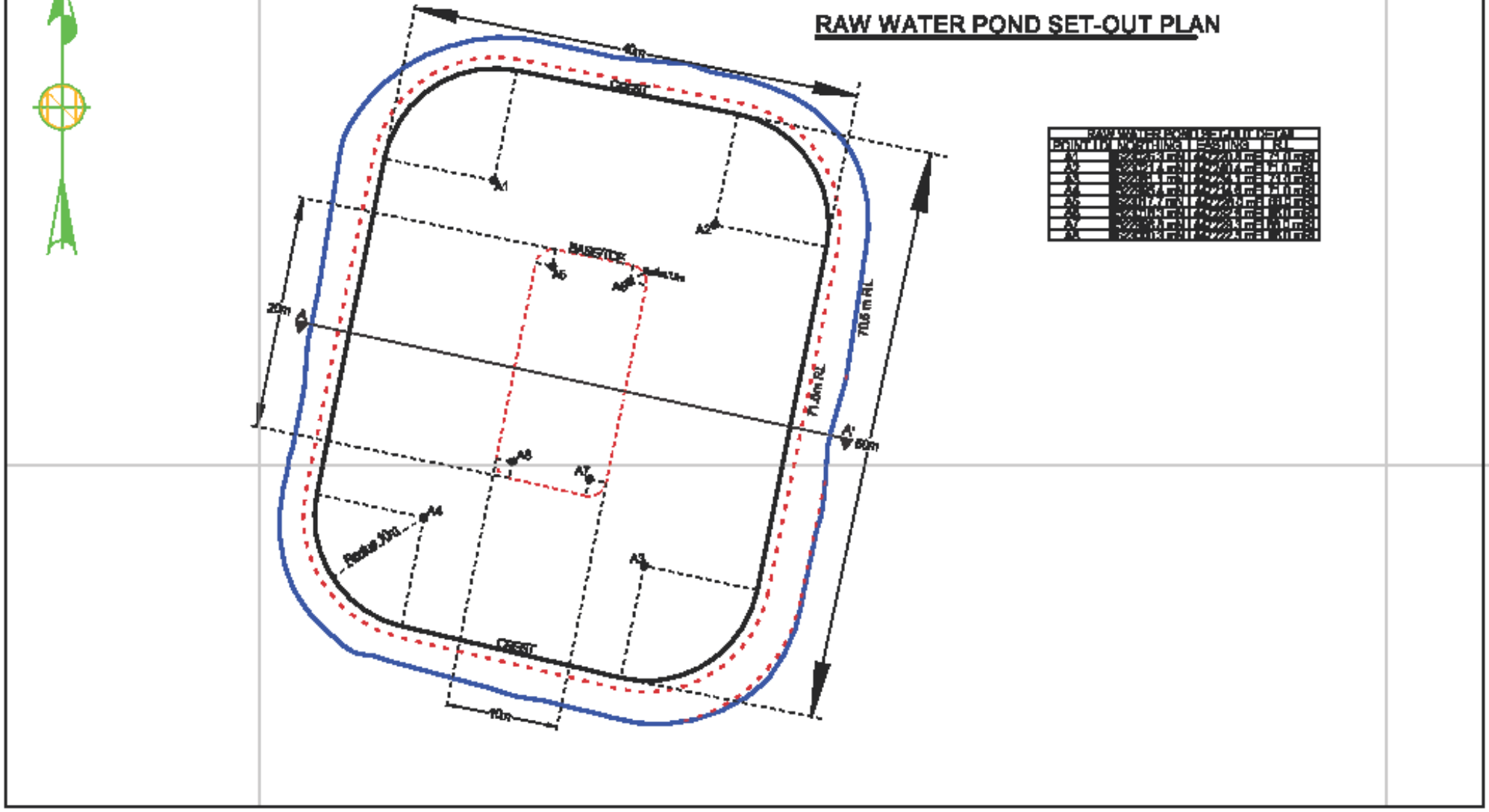
6523000

447200

447300

MAPTEK

RAW WATER POND SET-OUT PLAN



RAW WATER POND SET-OUT COORDINATES			
Setout Point	Northing	Easting	RL
A1	6523xxx.xxx	447xxx.xxx	711.8m
A2	6523xxx.xxx	447xxx.xxx	711.8m
A3	6523xxx.xxx	447xxx.xxx	711.8m
A4	6523xxx.xxx	447xxx.xxx	711.8m
A5	6523xxx.xxx	447xxx.xxx	708.6m
A6	6523xxx.xxx	447xxx.xxx	708.6m
A7	6523xxx.xxx	447xxx.xxx	708.6m
A8	6523xxx.xxx	447xxx.xxx	708.6m

10 0 5 10 15 20 25

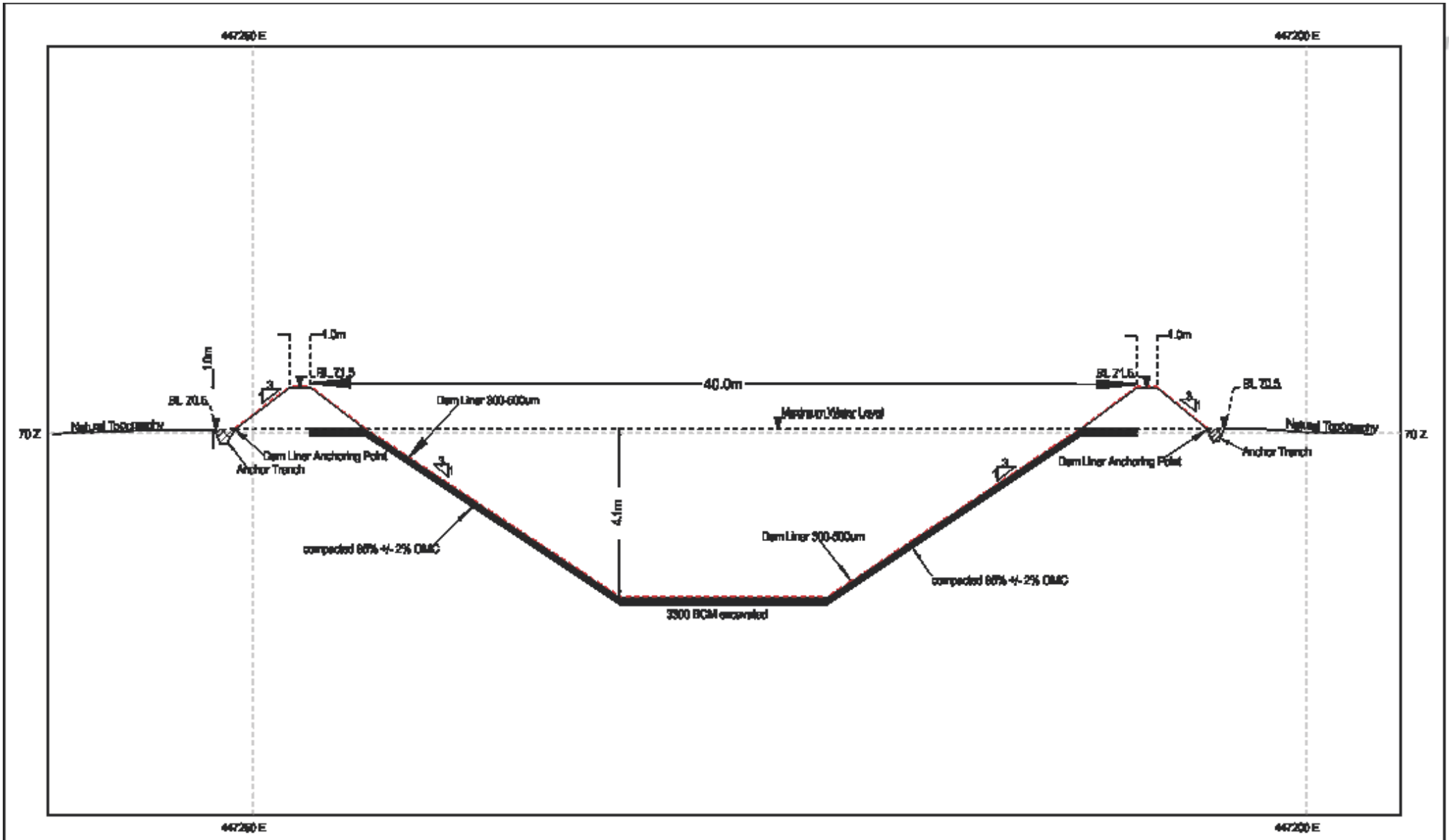
Metres

BENAGERIE GOLD

Portia Project

FIGURE 3.30
RAW WATER DAM SET-OUT POINTS
PLAN VIEW

Drawn by: A.KRISTIAN	
Date: 17-Jul-2018	Scale: 1:500
Drawing No: POR-RWD-001	Grid System: AGD



BENAGERIE GOLD	
Portia Project	
FIGURE 3.31 RAW WATER DAM Section Design Looking South	
SCALE:	horiz 1:250 vert 1:125
DATE:	17/07/2013

3.11 MINE COMPLETION

On completion of the operation, remnant structures at the Portia site will be limited to the open pit, the abandonment bund, the Tailings Storage Facility and the Overburden Waste Dump. The office, camp, workshop, access road, pit dewatering dam, raw water dam, water collection systems, landfill and processing areas will all have been removed and or levelled, covered with topsoil and seeded. The tailings cells (TSF) will be allowed to dry out prior to infilling with stored capping material and covering with topsoil, and reseeding. Trees will not be planted as the soils and rainfall in the disturbed areas generally do not support larger vegetation.

Post mine land use will revert to normal pastoral activities.

Rehabilitation is described in detail in the closure section. Progressive rehabilitation measures will include the rehabilitation of access and ancillary tracks not used during operations (operational period), followed by 2 stages of rehabilitation upon completion of pit mining. These are

1) the drying out and filling in of the tailings cells, the covering and rehabilitation of the overburden waste dump (OWD), the infilling and levelling of the pit dewatering and raw water dams, the completion of the abandonment bund and the construction of stock grade fencing around the abandonment bund; and,
2) the removal of the camp, office and workshop facilities, the filling in of the landfill followed by topsoil placement and revegetation.

Concerning stage 1, overburden will be used where required to infill structures, the faces of the OWD and TSF's will be battered and sculpted, stockpiled topsoil will be spread over disturbed areas, and locally sourced seed stock will be spread to facilitate revegetation.

A rehabilitation map is presented in the rehabilitation and closure section.

3.11.1 Abandonment Bund

On completion of open pit mining and processing, an abandonment bund will be constructed around the perimeter of the pit. It will be built in accordance with the design report "Portia Abandonment Bund, December 2013" provided by Rocktest Consulting. A copy of this report is provided in Appendix G.

There is no regulatory guideline in South Australia specifically pertaining to bunds. The most detailed guideline is that developed by the WA Department of Industry and Resources (DoIR) Document No. ZMA048HA 'Safety Bund Walls around Abandoned Open Pit Mines' (1997). This guideline, is considered as being applicable to Portia:

- in lieu of a specific South Australian guideline;
- as it is often referenced when selecting characteristics for abandonment bunds elsewhere in Australia;
- because it represents current best practise.

The Abandonment bund design is to be located outside of the area specified in the DoIR Guidelines as being appropriate. It is also located outside of the area indicated in geotechnical stability analyses as being potentially unstable. The bund is not therefore expected to be encroached upon by any long term instability of the pit walls.

The DoIR Guideline requires a bund having a minimum height of 2 m and a base width of 5 m. The proposed bund is 3 m high and has a base width of 14 m, specifications that significantly exceed the dimensions in the Guideline.

Two Dimensional modelling was conducted by Rocktest Consulting to determine the worst case for an unstable scenario (i.e. SF<1) on the eastern wall of the pit having an overall slope angle up to 34^0. The modelling demonstrates that none of these surface daylights further than 91 m behind the pit crest. The bund will be located up to 100 m behind the crest on the other walls.

To maximise the long term effectiveness of the bund, the pit-side toe of the bund will be positioned outside of the "potentially unstable pit edge zone". On the east wall of the pit, having an overall slope angle up to 35^0, a minimum width of 100 m is specified. On the west wall, the inside slope of the proposed bund will be located 87 m behind the crest on the west wall. (Figure 3.32). The west wall will contain the ramp switchback and hence will have a significantly lower overall slope angle and hence greater stability than does the modelled wall.

Therefore, for all walls, the bund is likely to be located a considerable distance behind any potentially unstable area and considerably further away than otherwise specified by the DoIR Guideline.

The bund will comprise a core of compacted clay derived from quaternary overburden clay material sourced from the first bench to be mined on the pit. Once built, the clay, being impermeable, will prevent overland flows of water that develop outside of the bund from eroding the area between the bund and the pit crest and will prevent the water from entering the pit. Mined rocks will be placed over the clays, 300 mm to 500 mm thick. The rocks will provide erosion protection and prevent persons that approach the bund from driving over it. The materials from which the bund will be constructed will provide it with long term competence against erosion.

The height of the bund (3 m) and the gradient of its outside slope (2H:1V) will be sufficient to provide a visual indication of the presence of a feature beyond.

A 5 strand post and wires fence will be installed at the toe of the outside slope of the bund to act as a secondary barrier. The fence will be temporary and will be removed at lease surrender unless the landholder requests otherwise and is prepared to take over its maintenance (Figure 3.33).

Signage noting "Danger Deep Excavation" will be placed on posts at appropriate spacing around the outside of the bund at not greater than 400 m centres.

Water that collects in depressions adjacent to the outside toe of the bund will be directed to contour lows along drains.

As described in Section 3.3.1 and Section 3.3.2, materials required to build the clay core for the bund will be stockpiled within the planned abandonment bund footprint for later use in construction of the bund on closure. As stated in Section 7.12, the abandonment bund forms a part of the planned Pit (Domain 4) rehabilitation requirements. The bund is scheduled to be completed within the first 12 months of commencement of the rehabilitation schedule, (refer to section 7.16).

The Rocktest abandonment bund specifications are presented in Appendix G.

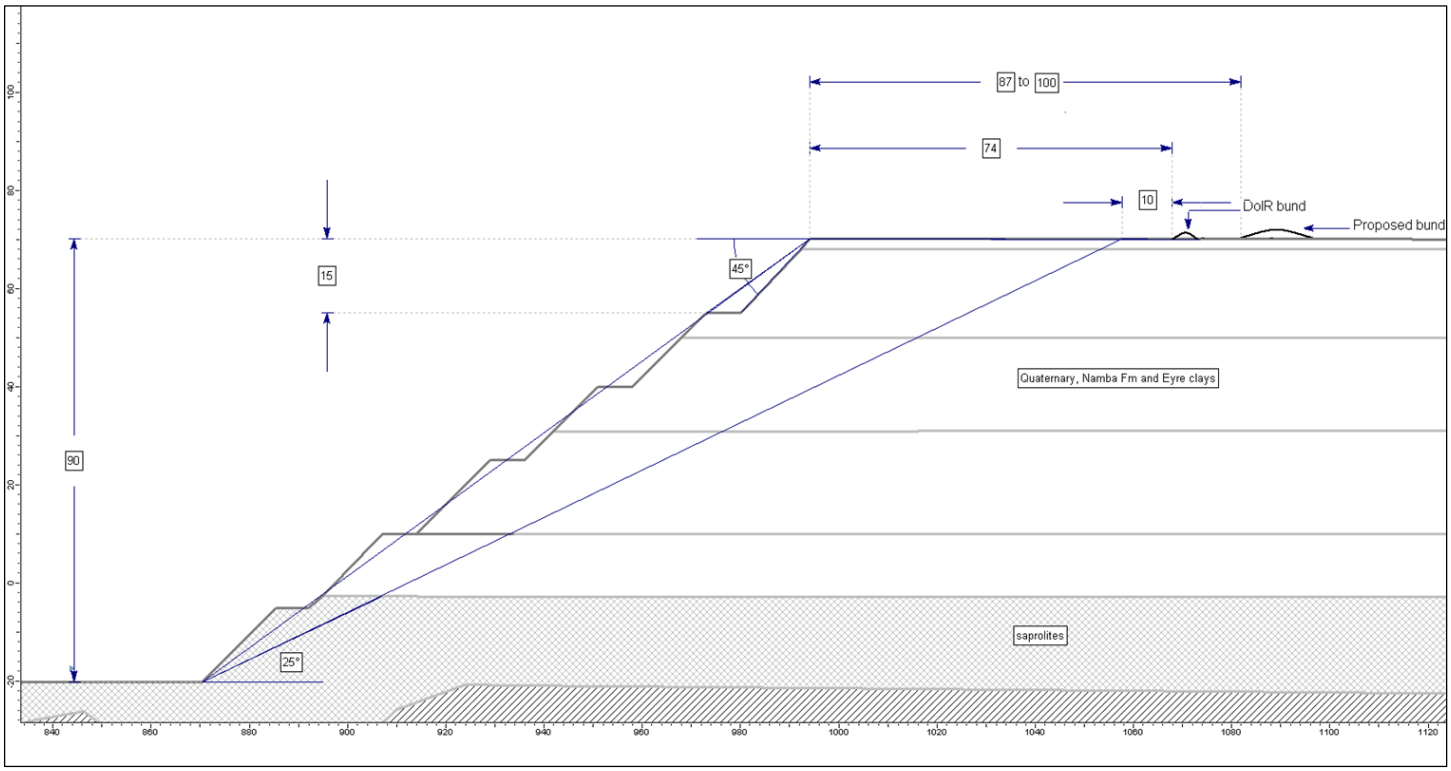


Figure 3.32 General view of a pit wall at Portia showing the range of offsets of the proposed bund from the crest and the location of the bund based on the DoIR Guideline.

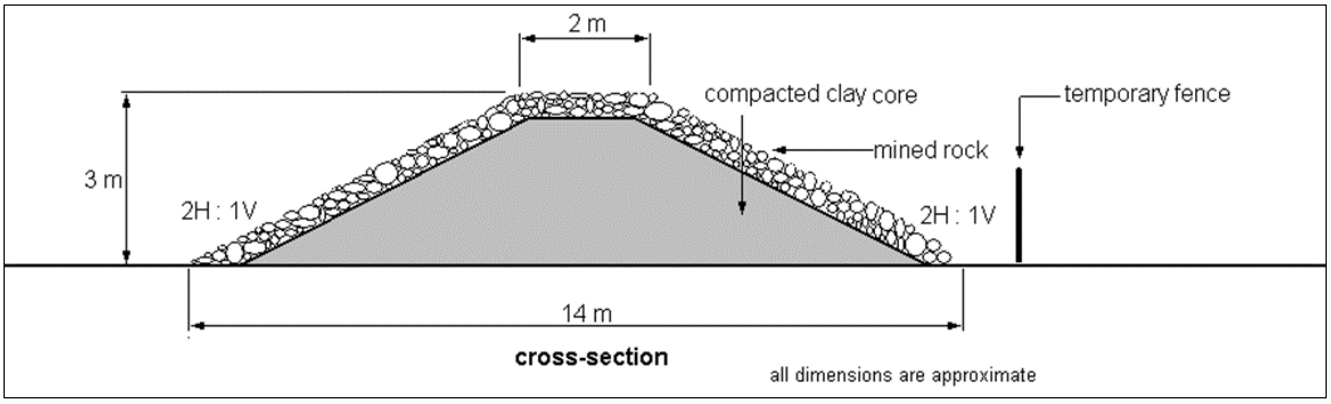


Figure 3.33 Schematic cross section of the pit abandonment bund

4 Description of potential benefits

This section describes the benefits of the Portia Gold Project in terms of its social, economic and environmental effects.

4.1 SOCIAL BENEFITS

The local station residents, while they are self-contained and resilient people, exist in a lonely environment. Havilah, when conducting its exploration activity, has strived to engage and use the services of the local station owners and offer jobs to local people as a priority.

We have been well supported by the local population in our endeavours.

We will continue our active involvement with the local residents and engage them both in awareness of our operations as well as offering employment wherever possible. This will improve their social interaction and create a new flux of activity and development in the area. Remembering that the local permanent population is less than 10 people, mining at Portia will have a significant helpful impact on the local people and a positive effect in the Broken Hill region.

With the vagaries of the rural industry, employment is at best, low paid and unreliable. There is an excellent skill pool of staff on the rural properties and they are well suited to mining activities. Already several local people are employed in Havilah and its associated companies' exploration activities.

All mining activities will integrate and co-operate at all levels with pastoral activities.

The number of full time employees is as stated in section 3.8. Company staff will be bussed to site from Broken Hill at the beginning of each rostered working period and similarly bussed back to Broken Hill at the end of each roster. The mining contractor may choose to fly in employees from Adelaide. It is expected employees will be largely drawn from Broken Hill, the northern rural parts of SA and Adelaide. As part of the Native Title agreement Havilah has undertaken to train and employ aboriginal people who are willing to travel and work at Portia. Where skilled workers are not readily available, the Company will offer training to bring skill levels to those required. The jobs offered will assist in reducing unemployment in the northern areas of South Australia and adjacent Broken Hill.

Local communities will directly benefit via employment and increased prosperity. Since the project area is remote from the communities, other infrastructure spin-offs, such power, water, medical facilities will be of minimal impact.

4.2 ECONOMIC BENEFITS

4.2.1 Flow-on economic benefits

The Portia mine development will make a large financial contribution to the local economy. Small settlements at Yunta, Olary and Cockburn, not to mention the major settlements of Broken Hill and Peterborough will reap the benefits of the cash influx from the Havilah operational and investment expenditure. This is likely to be of the order of $20 million per annum in salaries and related outgoings alone. Many services like fuel supply, engineering and electrical services will be supplied by local firms.

The aim of the operation is to make a profit for the shareholders of Havilah. A large number of these live in South Australia and any dividends we pay, or capital appreciation the Havilah stock accrues, will flow into the local economy creating new wealth and opportunities. Via the terms of the Native

Title Agreement, the Adnyamathanha people are shareholders in Havilah, and therefore will receive dividends or other returns due to shareholders.

4.2.2 Royalty

The Portia mine will pay royalties to the South Australian Government at the prescribed rate in accordance with the SA Mining Act, 1971, and based on projected production of 53,800 ounces should generate a royalty of approximately $1.79 million (Table 26).

Table 26 Operating economics

Revenue 53,200 ounces @ 95% recovery x A$1500 / ounce	75,810,000
Expenses	
Waste mining cost @ $3.30/$m^3$	23,100,000
Ore mining cost @ $2/t	710,000
Ore processing cost @ $5/t	1,775,000
Admin and overheads est.	1,500,000
Site works including road upgrade	2,000,000
SA Royalty @ 2% (concessional rate)	1,516,000
Pasminco Royalty @1%	758,000
Capex (process plant, camp)	4,000,000
Total Costs	35,359,000
Cash Surplus	**40,451,000**

It is evident that the greatest operating expenditure by far relates to the waste mining cost, all of which will be paid to the mining contractor, which in turn includes a large labour component. Other expenses, such as site works, camp, administration and overheads will largely be paid to local contractors and employees.

The great majority of capital and operating expenditure will flow into the State, with the usual multiplier effect. Since gold metal is the only commodity produced there is little opportunity for value adding.

It is not envisaged that any land will be acquired, but it is expected that a lease and compensation arrangement will be entered into with the local pastoralist, as part of the access agreement.

4.3 ENVIRONMENTAL BENEFITS

In the area of the mine there will be no stock and this will allow significant regeneration of flora and fauna to occur. Site rehabilitation will start at the beginning of the operation (where practicable) and have visible benefits early in the cycle.

Detailed study and monitoring of the environment will provide new baseline observational data and also record the local meteorological inputs. The dusky hopping mouse exclusion zone will also enable this species to maintain and possibly increase it population.

Currently, the site has suffered degradation from historical overgrazing. Mining will stop this degradation, as during mining no stock will be carried on site; this will allow a restorative process to begin.

5 Stakeholder consultation

This section summarises the consultation that has taken place with stakeholders leading up to the preparation of the mining lease application.

5.1 CONSULTATION PROGRAM OBJECTIVES

The primary goals of Benagerie Gold's consultation program are to:

- achieve mutual understanding between Benagerie Gold and its stakeholders, and
- ensure the smooth and efficient development and operation of the Portia Gold Project.

The specific objectives that will allow these goals to be met are to ensure that:

- stakeholders are included in the impact assessment and permitting process,
- stakeholders are well informed about the project and its potential impacts,
- issues or concerns are addressed as early as possible,
- the appropriate regulatory requirements are met, and
- positive stakeholder relationships are established and maintained throughout the project life (i.e., from permitting through to construction, operations and closure phases).

These objectives are being met by the establishment of a consultation framework and program that is supported by relevant technical investigations during project development. A feature of the program is, and will continue to be Benagerie Gold's willingness to ensure that the focus is on consultation, i.e., a two-way communication process that involves both talking and listening, rather than simply information dissemination. The consultation program associated with the project is therefore consistent with Benagerie Gold's corporate consultation program, which is based on the principles of communication, transparency, collaboration, inclusiveness and integrity.

An example of the implementation of such an approach at a corporate level is the preparedness over the past three years for the Directors of the Company to directly and personally liaise with the local community at all levels. All members of the local community have been continually made aware of plans and Havilah's commitment to environmental sustainability in its exploration work. Benagerie Gold will ensure that the philosophy that is reflected in these initiatives will be equally reflected in the Portia Gold Project.

5.2 STAKEHOLDER ANALYSIS

A preliminary list of stakeholders has been identified. Additional stakeholders will be added as required as the project progresses.

Stakeholders with an interest in the Portia Gold Project include:

- The 'local 'community which comprises pastoralists on a number of properties (i.e., Mooleulooloo, Mulyungarie, Yarramba, Kalkaroo, Boolcoomata and Strathearn pastoral leases).
- The Adymathanha Native Title Claimants (in relation to the mine site).
- Commonwealth Department of Environment and Heritage, now Department of Sustainability, Environment, Water, Population and Communities.
- South Australian Department for Environment and Heritage and Department for Water (DfW), now Department of Environment, Water and Natural Resources.
- Native Vegetation Council.

- Primary Industries and Resources South Australia (PIRSA), now DSD.
- Planning SA and Department for Transport Energy and Infrastructure (DTEI), now Department of Planning, Transport and Infrastructure.
- South Australian Arid Lands Natural Resources Management Board.
- South Australian Environmental Protection Authority (EPA).
- 'Peripheral 'communities (i.e., communities that are located near the project area and may or may not be affected by the project in some way, e.g., through increased employment opportunities); these comprise the townships of Yunta, Olary, and Cockburn, and the city of Broken Hill (the likely source of most staff).
- 'Other 'communities i.e., communities that are distant from the project area and that may still be affected by the project in some way. These include Aboriginal communities of the Southern region and Adelaide, and the cities of Port Pirie and Adelaide.
- Media (regional, state and national).
- General public (particularly within South Australia).
- Mining industry (e.g., other mineral explorers or producers in the area, South Australian Chamber of Mines and Energy (SACOME) and the Minerals Council of Australia (MCA)).

5.3 CONSULTATION UNDERTAKEN

An effective, ongoing consultation program involving Havilah Resources and its operator, Benagerie Gold, State Government, 'local' residents and communities, indigenous groups and other stakeholders is essential to the successful development of the project. Consultation has commenced with key interest groups and will continue during the remaining project planning process, the construction and operational phases through to mine closure and lease surrender.

Consultation study focusses on liaison with key state and Australian government agencies, and with pastoral leaseholders. Project information is also posted on Havilah Resources' web site.

Since the early consultation, consultation has expanded to include a broader range of organisations and individuals. Table 27 below details some of the consultation efforts to date.

Table 27 Stakeholder Consultation Summary

Date	Stakeholder	Issues Discussed
15 Aug 2014	DEWNR	Review of Groundwater Monitoring plan for the Project
12 Aug 2014	DSD/DEWNR	Presentation of reinjection trial results, discussion and finalisation of monitoring commitments and PEPR.
17 Dec 2013	DMITRE/DEWNR	Finalisation of complete PEPR ready for conditional approval subject to second pump test being conducted within the southern section of the Shylock palaochannel to confirm Modelling assumptions and better characterise water quality of injectant.
26th November 2013	EPA/DMITRE	Abandonment bund and consultant disclaimer, "Not for Construction" labels on drawings, EPA clarifications to questions raised, closure activities conducted during mining.
15th November 2011	EPA	Email of questions concerning TSF
30th October	DMITRE	Run through of final version
18th October 2013	DMITRE/DEWNR	Discussion on Re-injection monitoring and Site Water Management strategy. Issues discussed: Salinity differences between the source (lower salinity) and receiving (higher salinity) aquifers Heavy metal analysis of the source (higher in arsenic) and ANZECC limits. Monitoring requirements to meet DENWR discharge permit requirements
2 July 2013	DMITRE/EPA	Update on progress with Portia. Re-emphasis placed on evidenced based decision making. Generally good feedback on update and additional work. DMITRE to consider requirements for re-injection.
24th June 2013	Mutooroo Pastoral Company Pty Ltd (owner of Mulyungarie Station)	Project briefing and seek approval for pump test. No issue raised.
10 May 2013	DEWNR	Water injection application
1 May 2013	ATLA (Native Title Claimants)	Report on progress at Portia
20 March 2013 and 19 April 2013	DEWNR	Request regarding policy on water re-injection with accompanying information. No reponse.

Date	Stakeholder	Issues Discussed
15 Aug 2014	DEWNR	Review of Groundwater Monitoring plan for the Project
12 Aug 2014	DSD/DEWNR	Presentation of reinjection trial results, discussion and finalisation of monitoring commitments and PEPR.
1 February 2013	ATLA (Native Title Claimants)	Report on progress at Portia
December 2012-present	Mulyungarie Station	Numerous informal discussions with station manager on logistical details re use of station tracks, replacement of gates with grids etc
24 August 2012	ATLA (Native Title Claimants)	Report on progress at Portia
August 2012 - November 2012	Mutooroo Pastoral Company Pty Ltd (owner of Mulyungarie Station)	Compensation payment for loss of use of land and inconvenience caused by mining operations, leading to an agreement on the terms of the compensation payment.
5 October 2012	DMITRE and EPA	Meeting to consider final version of Portia PEPR, issues raised by EPA, which have been the subject of additional work and PEPR revision until the present time
22 August 2012	DMITRE	Advice from DMITRE that revised PEPR submitted on 3 August 2012 addressed all the issues raised previously
January 2012-present	DMITRE	Frequent liaison with DMITRE personnel on aspects related to PEPR and SEB
January 2012	DMITRE	Lodged revised Portia PEPR document
September 2011	ATLA (Native Title Claimants)	Meeting to report on progress of Portia project
22 April 2011	PIRSA	Detailed written feedback on draft Portia MARP document
15 April 2011	PIRSA	Meeting with PIRSA re draft MARP document
November 2009	PIRSA	Project update briefing
February 2009	EPA and DWLBC	Open forum briefing and presentation of project
June 2008	Native Title Claimants	Site Layout and location of Infrastructure
February 2008	Local Pastoralist	Meeting and discussion of Site layout and potential impacts and management strategies to minimise effects on current land use operation with Station Manager.
November 2007	Local Communities	Review of the project and status.
October 2006	Mooleulooloo Station	Review of project and discussion of access Road and request for endorsement support.
October 2006	Outalpa Station	Review of project and discussion of access Road and request for endorsement support

Date	Stakeholder	Issues Discussed
15 Aug 2014	DEWNR	Review of Groundwater Monitoring plan for the Project
12 Aug 2014	DSD/DEWNR	Presentation of reinjection trial results, discussion and finalisation of monitoring commitments and PEPR.
October 2006	Yarramba Station	Review of project and discussion of access Road and request for endorsement support
March 2006	Local Pastoralists	Pastoral access and compensation agreements. Ongoing Informal meetings on a regular basis agreement
January 2006	Local Communities	Jan 2006 Project status and native vegetation issues discussions (including Significant Environmental Benefit offsets).
October 2005	Native Title Claimants	Informal Meeting
June 2005	Native Title Claimants	Informal Meeting
May 2005	Native Title Claimants	Informal Meeting

5.4 ONGOING CONSULTATION PROCESS

The consultation program is ongoing and will continue through the life of the project to ensure due consideration of all project-related opportunities and concerns. Benagerie Gold's approach to ongoing consultation is outlined in Table 28.

Table 28 Planned ongoing consultation

Stakeholder	Planned Consultation Process
Local Pastoralists	Provide regular briefings on work programs. Provide information sessions on the impacts of the operations and the outcomes. Regular and ongoing consultation during construction and operations.
Federal, State and Local Government Authorities	Establish contact with other key stakeholders as new issues arise. Supply latest information on the project activities through planned information sessions. Identify and respond to key issues and concerns of all stakeholders during the assessment phase. Prepare and consult with relevant stakeholders regarding the PEPR application.

Local Community	Include newspaper advertisements, web page and mail out to key stakeholder communities with contact details so that business and employment opportunities within the nearby surrounding communities of Olary, Yunta, Broken Hill and Cockburn can be identified and any comments can be directed to the appropriate person for response.
Native Title Claimants	Abide by the terms and conditions contained within the Native Title Agreement.

5.5 ON-GOING COMMUNICATION

Consultation and communication does not end with project approval and Benagerie Gold is committed to providing information on its performance through all phases of the project. To this end, project staff will compile relevant information from monitoring and management programs and reports regularly. These reports will be clearly written and illustrated (where appropriate) to aid understanding.

Statutory reports will be submitted to relevant authorities at intervals determined during the approval process.

Benagerie Gold will publish HSE reports on the company website annually. The reports will present:

- corporate policies,
- objectives,
- targets,
- progress towards objectives and targets,
- revised or new objectives and targets,
- results of research initiatives, and
- initiatives for continuous improvement.

Benagerie Gold will respond in a timely manner to all communications received through its consultation and communications program. A register of all communications will be maintained.

Meetings will be held with government bodies at a location that is convenient to all parties. Annual Reports will be provided to government departments and provided to other stakeholders on request.

The Project Manager will be responsible for liaison with local pastoralists and the residents of Cockburn and Olary.

6 Environmental, social and economic aspects

This section summarises those aspects of the project that have the potential to impact on the natural, social or economic environments and outlines the proposed environmental management objectives, actions and commitments by Benagerie Gold to mitigate the identified adverse environmental impacts.

6.1 IMPACTS

Actual or credible potential impact events associated with the proposed activities that could pose a threat to the environment as stated by PIRSA in the second schedule of the mining lease conditions (document T02606) for the project are:

- Adjacent land use
- Aboriginal and European Heritage
- Native Fauna
- Native vegetation
- Weeds and pests (feral animals)
- Soil
- Groundwater and hydrology
- Waste disposal and hazardous substances.

A risk assessment for each potential impact event is presented below, along with the definition of objectives / outcomes, measurement criteria, leading indicator criteria and monitoring actions.

Assessments for each of the identified credible potential impact events identified above are provided below and are carried out based on ISO 14001 Standard for Environmental Management Systems referred to in the PIRSA MARP Guidelines, version 4.11 (January 2011). For each potential impact event, likelihood and consequence ratings have been applied using the five point scales, abridged below.

Qualitative measures of likelihood:

- Almost certain – will occur, is of a continuous nature, or the likelihood is unknown.
- Likely - will probably occur.
- Possible - could occur.
- Unlikely - could occur, but is not expected to do so.
- Rare - has almost never occurred in similar operations but conceivably could occur.

Qualitative measures of consequence:

- Insignificant - possible impacts but without noticeable consequence.
- Minor -very local consequence but with no significant long term changes.
- Moderate - significant local changes but can be alleviated or rehabilitated.
- Major - substantial and significant changes, only partially able to be alleviated or rehabilitated.
- Catastrophic – extreme permanent changes to social or natural environment, deaths or widespread health and economic effects on public, major public outrage or unknown consequences.

The risk associated with any particular potential impact event has then been defined according to the following risk matrix (Table 29) that uses the likelihood and consequence ratings (above).

Table 29 Risk matrix

			Likelihood of Consequences				
			E	D	C	B	A
			Rare	Unlikely	Possible	Likely	Almost Certain
Severity of Consequence	5	Insignificant	Low	Low	Low	Moderate	High
	4	Minor	Low	Low	Moderate	High	High
	3	Moderate	Moderate	Moderate	High	High	Extreme
	2	Major	High	High	Extreme	Extreme	Extreme
	1	Catastrophic	High	Extreme	Extreme	Extreme	Extreme

6.2 ADJACENT LAND USE

Context

Environment

The Portia Deposit is located on Mulyungarie Station, about 105 km to the north west of Cockburn and Broken Hill, about 190 km by road and track to the north west of Broken Hill. Rainfall is less than 200 mm per year, whilst evaporation is about 2800 mm per year.

Due to the harsh climate, agricultural land use is restricted to grazing.

Stakeholders

PIRSA, now DSD (as the regulator for mining developments), has stated that there are to be no adverse impacts to adjacent land use. The landholder (Mutooroo Pastoral Company) has been consulted and initially expressed concerns about potential impacts on local stock water supplies and introduction of exotic weeds. He was relieved to learn that no chemicals (e.g., cyanide) would be used in the gold processing circuit. He did not raise loss of stock grazing areas as a major concern, acknowledging that this would be dealt with under a compensation arrangement. The residents of Cockburn have also been consulted many times and have always been supportive of the project (partly due to the potential benefits for local employment and business).

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Impacts to adjacent land use are regulated by the *SA Mining Act 1971*. DSD guidelines provide details.

Potential Impact Event

Site activities may adversely impact adjacent land use

The mining of the Portia Deposit has the potential to adversely impact adjacent land uses by:

- damage to water supply infrastructure,
- damage to stock fencing and gates,

- degradation of station access tracks by vehicle use,
- stock losses due to collision with vehicles, and
- stock losses by poisoning/ingestion of chemicals.

Failure to protect adjacent land uses may result in:

- loss of stock, and therefore financial losses to the landholder.

Control and management strategies

The potential for impacts to adjacent land uses can be reduced by the implementation of the following control strategies:

- ensuring that all personnel working at the mine site undergo appropriate awareness training with respect to stock and related infrastructure,
- avoiding disturbance to stock fencing, gates and water supply infrastructure,
- repairing/replacing any items of infrastructure that may be removed or damaged by activities associated with the operation,
- limiting vehicle speeds to those that significantly reduce the potential for collision with livestock or infrastructure,
- grading and repairing access tracks shared with pastoral activities,
- rehabilitating disturbed areas (in consultation with the pastoral landholder) as soon as practicable following the completion of mining,
- ensuring that all fuels and any chemicals are stored securely, and
- maintaining an ongoing consultation program with adjacent landowners.

Likelihood and Severity of Consequences

The probability of adverse impacts to adjacent land use occurring due to mining at Portia is low.

Control measures will be used to further reduce the potential for such impacts to occur.

Risk Levels

The results of the risk analysis for adjacent land use are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
loss of stock, financial losses to the landholder	possible	minor	control measures as outlined above	rare	minor	low	yes

Justification for risk acceptance

From the above risk analysis, it would appear that the most significant risks from adverse impacts to adjacent land use are possible stock and financial losses. Given the control measures proposed, it is expected that the potential for adverse impacts to occur will be low.

Outcome/Objective

No adverse impacts to adjacent land use due to the mining of the Portia Deposit.

Measurement Criteria

The Mine Manager will maintain an incident register for the Portia mining lease area and access tracks, to record all incidents and complaints. It will record the date and time of the incident / complaint, a description of damage / losses, remedial actions to be taken, and the date when the action has been completed.

The incident/complaints register demonstrates that, as required, all incidents or complaints are resolved or addressed to the satisfaction of the complainant or DSD within 7 days of the incident or complaint or a longer time frame agreed with DSD.

The incident register will be reviewed both monthly and after any incident during the mining phase and then less frequently until lease surrender. Reviews will focus on the development of additional control measures to avoid incidents and impacts to adjacent land use.

Monitoring Program

An incident register is to be kept by the Site Manager and entries made of complaints by the landholder, stock losses, and damage to infrastructure as a result of activities associated with mining operations until the completion of site rehabilitation. It will include:

- the date and time of the complaint, stock loss, or damage;
- details of the complaint, loss or damage;
- records of discussion with the landholder relating to the complaint, loss or damage;
- an assessment of the validity of the claim;
- the identification of the persons or processes leading to the complaint;
- reason(s) for the actions leading to the complaint, loss or damage;
- remedial measures actioned;,
- communications with the landholder (date, time, means of communication);
- landholder response; and
- outcomes/landholder satisfaction.

The register will be reviewed monthly and results will be presented in site management reports prepared by the Site Manager. The review will include the identification of possible improvement measures (i.e., procedural changes) to reduce impacts to adjacent land use if complaints, stock losses or damage to infrastructure occur.

Results will also be presented in the close out report for the operation.

6.3 ABORIGINAL AND EUROPEAN HERITAGE

Context

Environment

The Portia site is located in the southern Strzelecki Desert, over 10 km from the nearest ephemeral watercourse, and over 60 km distant from permanent water sources such as the mound springs in Lake Frome and springs and seeps in the Barrier and Olary Ranges. The nearest quarries and resource centres are also likely to be in these ranges.

With regard to Aboriginal heritage, proximity to water supply is generally considered the primary factor determining the location of Aboriginal occupation. On major creek-lines and rivers, archaeological sites often indicate the presence of more permanent or repeated occupation. Resource rich zones such as quarries can also contain evidence of complex and long term occupation sites. Further from permanent water, sites are generally smaller, less complex and can be the result of one-off or episodic occupation. Sites near ephemeral water sources can be generated by single event occupation or multiple (seasonal, flood episodic) occupation.

The Portia project area is subject to a registered native title application made by the Adnyamathanha people (SC99/1). A search of the Australian Heritage Database indicated that there were no sites of heritage located in or nearby the Project Area.

Work area surveys have been conducted with representatives of the traditional owners of the area. The representatives identified no areas on site that they considered to be of significant cultural value.

With respect to European heritage, the area has been subject to pastoralism since around the mid eighteen hundreds with wire fencing introduced shortly afterwards. Extensive use was made of storage drains by an early pastoralist, Edwin Crozer. He deepened water courses that flowed to Lake Frome, to form long dams. Other European heritage items could include pastoral tracks, old gates, farm and other machinery, windmills and tanks.

Stakeholders

DSD (as the regulator for mining developments) has stated that there is to be no disturbance to Aboriginal or European artefacts or sites of significance unless prior approval is obtained under relevant legislation.

The Department of Premier and Cabinet, Aboriginal Heritage Branch generally advises that an activity must be authorised by the minister if the activity is likely to damage, disturb or interfere with a site or object.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Legislation relevant to activities at Portia includes the *Aboriginal Heritage Act 1988*, the *Heritage Places Act 1993* and the *Mining Act 1971*.

Potential Impact Event

Mining at Portia has the potential to disturb Aboriginal and European heritage artefacts or sites of significance.

Disturbance to Aboriginal or European artefacts or sites of significance could occur by:

- earthworks associated with construction of site infrastructure, and
- construction of access roads and tracks.

Failure to protect Aboriginal and European heritage artefacts or sites of significance may result in:

- disturbance to or destruction of Aboriginal or European artefacts or sites of significance.

Control and management strategies

The potential for disturbance to Aboriginal or European artefacts or sites of significance can be reduced by the implementation of the following control strategies:

- fencing off the known sites in the mine lease
- providing training to contractors and staff working at the site, enabling them to recognise sites of significance prior to disturbance;
- halting work in any area in which Aboriginal artifacts or sites are identified and where disturbance of them may occur due to mining related operations, followed by contact with appropriate authorities for advice on how to proceed; and
- adhering to the requirements of relevant legislation at all times during the period of operations and rehabilitation.

Likelihood and Severity of Consequences

The probability of disturbance to Aboriginal or European artefacts or sites of significance at the Portia site is low.

Control measures will be used to further reduce the potential for such impacts to occur.

Risk Levels

The results of the risk analysis for adverse impacts to adjacent land use are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
disturbance to or destruction of Aboriginal or European artefacts or sites of significance	possible	moderate	control measures as outlined above	rare	minor	low	yes

Justification for risk acceptance

From the above risk analysis, it would appear that the most significant risk disturbance to or destruction of Aboriginal or European artefacts or sites of significance is during the construction stage (overburden stripping and construction of accommodation and office facilities, roads, ROM, OWD, TSF etc.). Given the control measures proposed, it is expected that the potential for disturbance will be low.

Outcome/Objective

There is to be no disturbance to or destruction of Aboriginal or European artefacts or sites of significance during construction and operation of the mine unless prior approval under the relevant legislation is obtained.

Measurement Criteria

An incident register will show no unauthorised disturbance to or destruction of Aboriginal or European artefacts or sites of significance during construction and operation of the mine.

Records demonstrate that work ceased in the immediate area of the discovery of Aboriginal artefacts or sites, appropriate authorities were advised, and work recommenced only after authorization under the *Aboriginal Heritage Act, 1998*.

Monitoring Program

Should any evidence of Aboriginal artefacts or heritage be identified on site, the relevant authorities will be notified in accordance with the *Aboriginal and Heritage Act 1988*.

In addition, an incident register will be kept by the site manager and entries made of Aboriginal or European artefacts or sites of significance discovered at the Portia site.

This register is to record:

- the date and time of the discovery,
- who made the discovery,
- a description of what was discovered, the means of discovery (e.g., backhoe, exposure due to wind erosion),
- discovery site location (GPS coordinates),
- a description of the physical features of the area in the near vicinity of the discovery,
- details of any damage caused to the discovery,
- the Site Manager's written acknowledgement of the discovery,
- actions taken to preclude access and additional disturbance to the discovery,
- notification measures,
- instructions obtained from the relevant authorities,
- final outcomes.

Procedures followed post discovery are to be recorded and outcomes documented, including:

- where the measuring (monitoring) will occur,
- how it is to be measured (monitored),
- the frequency of monitoring,
- documentation, record keeping, data management

The register will be reviewed monthly and results will be presented in monthly site management reports prepared by the Site Manager. The review will include the identification of procedural changes (if needed) to reduce or preclude damage to sites of heritage significance.

Results will be presented in the close out report for the operation.

6.4 NATIVE FAUNA

Context

Environment

Environmental databases up to 2008 indicate that 111 bird species have been recorded within a 50 km radius of the Portia site and 9 mammal species were recorded within the same area. There is a low frequency and diversity of small terrestrial mammals recorded for the wider region which

reduces even further within a 5 km search of the site with only 3 species being recorded, 1 of which was introduced. Thirty reptile and 1 amphibian species have been recorded for the wider region. Only six reptile and one amphibian species have been identified to occur within a 5 km radius of the site.

More recent surveys of the site in 2011 confirmed that there are more species present in the site than database records indicate, but the majority of animal species are relatively common and do not have a formal conservation status. However, dusky hopping-mouse is present on one relatively large, low sand dune and that the dune provides an important habitat for that species. This dune has been designated a No-go Zone to all construction and mining activities.

Other than dusky hopping-mouse, no fauna species listed under the EPBC Act have been reported within a 5 km radius of the ML.

Species such as grey falcon and letter-winged kite will continue to occur in the region following above average rainfall. During drought years the species are not present. Plains-wanderer has not been recorded in the ML or adjacent areas and limited suitable habitat for this species occurs in the site. The proposal is considered to be low risk for each of these bird species.

Stakeholders

Stakeholders who have may have concern over potential impacts of mining operations on native fauna abundance or diversity include the South Australian Arid Lands Natural Resources Management Board (SAALNRMB) and The Department of Environment and Heritage (DEH), but no such concerns have been communicated with respect to the mining area.

DSD, as the regulator for mining developments, has stated a requirement that there is to be no net adverse impacts to native fauna abundance or diversity in the lease area and in adjacent areas.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Legislation relating to fauna include the *Mining Act, 1971*, the *Environment Protection Act, 1993*, the *Native Vegetation Act, 1991* and the Federal *Environment Protection and Biodiversity Conservation Act, 1999*. These acts provide mechanisms for the preservation of abundance and diversity of native fauna.

Potential Impact Event

Operations impact native fauna abundance or diversity in the lease area and in adjacent areas.

The proposed development has the potential to impact native fauna abundance and diversity by:

- the clearance of vegetation (habitat),
- death or injury by collision with vehicles,
- effects to avifauna by their drowning or consumption of fluids from the RWD, PDD and the TSF,
- the introduction and proliferation of feral animal populations, and
- uncontrolled fires.

Failure to effectively control impacts to native fauna abundance and diversity may result in:

- permanent reduction in native fauna abundance and diversity.

Control and management strategies

Impacts to native fauna abundance and diversity can be significantly reduced by the implementation of the following control strategies:

- minimizing the areas of clearance and disturbance to reduce habitat loss,
- restricting vehicle access to designated roads and tracks to reduce habitat loss,
- restricting vehicle speeds to reduce the potential for collisions with fauna,
- progressively rehabilitating disturbed areas where possible to restore habitat,
- establishing and maintaining a fire break between infrastructure and vegetation or ground with a high fuel load,
- installing and maintaining fire extinguishers and control systems (including alarms), and
- establishing an exclusion zone for the dusky hopping mouse.

Likelihood and Severity of Consequences

The probability of adverse impacts to native fauna abundance and diversity in the lease area and in adjacent areas is low and will be further reduced by the control measures stated above.

Risk Levels

The results of the risk analysis for adverse impacts to native fauna are presented in the table below.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Clearance of vegetation	likely	minor	control measures as outlined above	rare	insignificant	low	yes
Death or injury by collision with vehicles	possible	minor	control measures as outlined above	rare	insignificant	low	yes
Consumption by avifauna of fluids from the TSF and raw water dams	likely	minor	control measures as outlined above	rare	minor	low	yes
The introduction and proliferation of feral animals	possible	minor	control measures as outlined above	rare	minor	low	yes
Uncontrolled fires	unlikely	minor	control measures as outlined above	rare	minor	low	yes

Justification for Risk Acceptance

From the above risk analysis, it would appear that the most significant risk of adverse impacts to native fauna is through extended drought over which the mining operators have no control and through land clearance and loss of habitat. Given the abundance of similar vegetation and habitat nearby and measures to rehabilitate the site on completion of activities, it is expected that permanent impacts to the abundance and diversity of native fauna will be insignificant.

As a consequence of this analysis, adverse impacts to native fauna abundance and diversity in the lease area and in adjacent areas will be monitored.

Outcome/Objective

No net adverse impacts from the site operations on native fauna abundance and diversity in the lease area and in adjacent areas as a result of constructing and operating the mine.

Measurement Criteria

The mine manager shall ensure that records are kept (using an incident register) of fauna trapped by infrastructure and subsequently released during the operational period, and the recording of accidental deaths of native fauna due to interaction with infrastructure.

The mine manager shall ensure that a fauna survey prior to lease surrender will show similar abundance and diversity, in the opinion of a suitably qualified expert, as identified by surveys carried out prior to the commencement of mining.

Monitoring Program

A fauna survey is to be carried out prior to lease surrender. This survey is to use the same methodology as used in the baseline fauna survey conducted prior to the commencement of operations and is to be carried out at a time of year most likely to result in the maximum number of fauna species to be identified. A fauna survey report is to be prepared by the fauna consultant, and the results of the survey are to be compared with the results from control sites identified from the baseline survey results. Differences in species numbers and populations are to be identified and a discussion of the significance of results documented.

An incident register is also to be maintained of fauna species trapped by site infrastructure and subsequently released. This register will include:

- dates and times of discovery of the trapped fauna,
- fauna species name or common name,
- who made the discovery,
- trapped fauna location (description),
- condition of the animal, details of any damage/injury,
- fate of the animal,
- release location,
- the Site Manager's written acknowledgement of the trapping, discovery and release of the animal, and
- actions taken to preclude future entrapment.

The register will be reviewed monthly and results will be presented in monthly site management reports prepared by the Site Manager. The review will include the identification of procedural changes (if needed) to reduce or preclude the trapping of animals by site infrastructure. The results

will also be taken into consideration by the fauna consultant when preparing the fauna survey closure report for the project.

6.5 NATIVE VEGETATION

Context

Environment

The Portia Deposit is located on the plains of the Lake Frome Basin and is within the Broken Hill Complex Bioregion (Neagle 2003). Vegetation of the area is dominated by low shrublands of *Maireana astrotricha* (Low Bluebush) on the plains, with areas of *Atriplex vesicaria* (Bladder Saltbush) and *Maireana astrotricha* on low dunes. There are some isolated stands of *Casuarina pauper* (Black Oak) low woodlands.

Other less common vegetation types are tall shrublands on sandplains and Eragrostis australasica (Cane-grass) in swampy areas.

No vegetation species listed as threatened under either the Commonwealth EPBC Act 1999 or the South Australian National Parks and Wildlife Act 1972 were recorded as occurring at the Portia site.

Stakeholders

DSD (as the regulator for mining developments) has stated that there is to be no permanent loss of abundance or diversity on or off the lease through vegetation clearance, dust / contaminant deposition or other means unless prior approval under relevant legislation is obtained. No concerns were been expressed by the local landholder and residents of Cockburn during the ML application response period.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Legislation that applies to vegetation and mining includes the *Mining Act, 1971*, the *Environment Protection Act, 1993*, the *Native Vegetation Act, 1991* and the Federal *Environment Protection and Biodiversity Conservation Act, 1999*. These Acts provide mechanisms for the preservation of abundance and diversity of native flora.

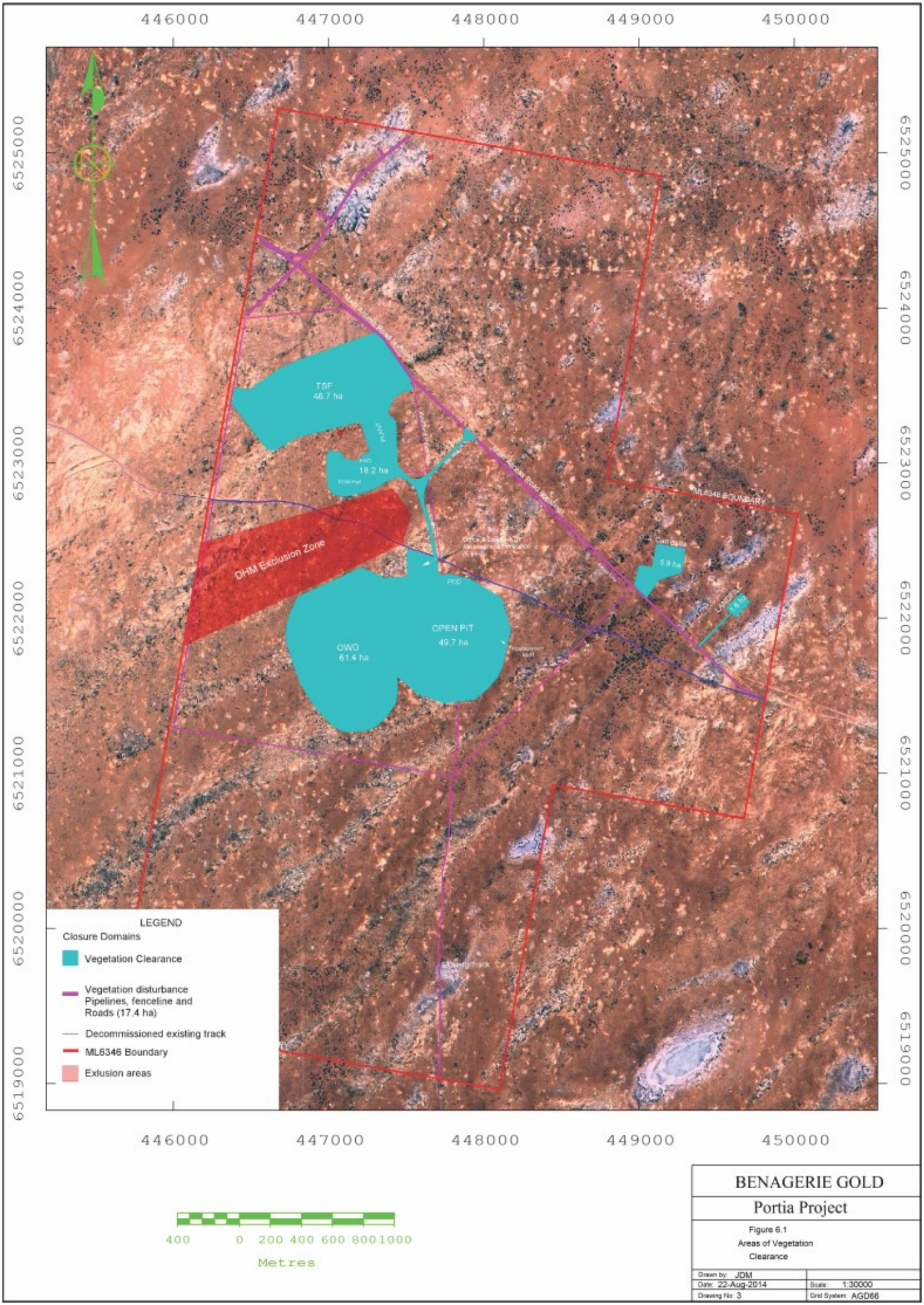
Potential Impact Event

Land clearance, dust or contaminant deposition or other damage to native vegetation leads to a permanent loss of vegetation abundance or diversity.

The proposed development has the potential to impact vegetation abundance or diversity by:

- the clearance of vegetation,
- vegetation health impacts due to dust / contaminant deposition,
- mining related fires, and
- reduction in native flora abundance and diversity.

Up to 194 ha of vegetation may be disturbed or cleared for operations at Portia (refer Figure 6.1).


446000
447000
448000
449000
450000
6525000
6524000
6523000
6522000
6521000
6520000
6519000
TSF
46.7 ha
18.2 ha
DHM Exclusion Zone
OPEN PIT
49.7 ha
OWO
61.4 ha
PDD
ML6346 BOUNDARY
Campsite
5.8 ha
LANDFILL
6 ha
LEGEND
Closure Domains
Vegetation Clearance
Vegetation disturbance
Pipelines, fenceline and
Roads (17.4 ha)
Decommissioned existing track
ML6346 Boundary
Exlusion areas
400 0 200 400 600 800 1000
Metres
BENAGERIE GOLD
Portia Project
Figure 6.1
Areas of Vegetation
Clearance
Drawn by: JDM
Date: 22-Aug-2014
Drawing No: 3
Scale: 1:30000
Grid System: AGD66

This area includes clearance for the pit, pit dewatering dam, OWD, ROM, the TSF, raw water dam, roads, campsite, office and laydown area, landfill area and the processing plant.

Failure to effectively control impacts to vegetation may result in:

- a reduction in native flora abundance and diversity

Control and management strategies

Impacts to native flora can be significantly reduced by the implementation of the following control strategies:

- minimizing the areas of clearance and disturbance,
- Native Vegetation clearance permit process where all clearances are pre-approved by the Mine Manger or delegate.
- the use of dust suppression measures (e.g., water cart) during periods of significant dust generation to reduce dust effects to vegetation,
- containing contaminants (e.g., fuel, reagents) within fully bunded sections of the site to preclude spills impacting vegetation,
- restricting vehicle speeds to reduce the potential for dust generation,
- revegetating disturbed areas as soon as practicable on completion of operations in that particular area,
- siting infrastructure in a manner that reduces vegetation disturbance, and
- reducing the potential for uncontrolled fires.

Likelihood and Severity of Consequences

The probability of permanent loss of abundance or diversity of native flora in the lease area and in adjacent areas due to activities associated with mining operations is moderate but will be reduced by the control measures stated above.

Risk Levels

The results of the risk analysis for adverse impacts to native fauna are presented in the table below.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Vegetation clearance	likely	minor	control measures as outlined above	unlikely	minor	low	yes
Vegetation health impacts due to dust / contaminant deposition	possible	minor	control measures as outlined above	unlikely	minor	low	yes
Mining related fires	unlikely	minor	control measures as outlined above	rare	insignificant	low	yes

Justification for Risk Acceptance

From the above risk analysis, it would appear that the most significant risks of adverse impacts to vegetation abundance or diversity are through land clearance, dust / contaminant deposition and possibly through uncontrolled fires. Given the control measures proposed, it is expected that impacts to the abundance and diversity of native vegetation will be low. Rehabilitation at closure will also reduce the impact on abundance and diversity of native vegetation.

As a consequence of this analysis, native vegetation in the lease area and in adjacent areas will be monitored for adverse impacts to abundance and diversity.

Outcome/Objective

No permanent loss of abundance or diversity to native vegetation on or off the lease area through clearance, dust contaminant deposition, fire or other damage unless prior approval is obtained under the Native Vegetation Act (1991).

Measurement Criteria

An annual audit of vegetation clearance using on ground survey undertaken by a suitably qualified person demonstrates that the area of vegetation clearance (including that by dust, contaminant, fire and other damage) does not extend beyond the clearance footprint shown in Figure 6.1 unless prior approval is obtained under the Native Vegetation Act (1991), and no clearance has occurred in the dusky hopping mouse exclusion zone. Note vegetation clearance has the meaning as defined in the Native Vegetation Act 2005.

Leading Indicator Criteria

A log will be maintained of native vegetation clearance during the period of operations and compared to the approved clearance plan monthly. A log (incident register) will also be kept of uncontrolled fires on or off the lease due to site operations.

Monitoring Program

A record is to be kept of the area disturbed by the operation to ensure compliance with SEB evaluations.

Records are to be kept of applications and approvals for additional vegetation clearance.

A monthly site survey will be undertaken by the Site Manager during the period of mining and mineral processing to check that clearance is less than or equal to the approved monthly clearance area and plan.

An incident register is to be kept and entries made of damage to vegetation due to fire.

It will document:

- the date and time of the fire,
- the location of the fire,
- its cause,
- how it was brought under control, and
- damage resulting from it, including areas / infrastructure burnt

The register will be reviewed monthly and results will be presented in site management reports for the operation.

Photo monitoring will be carried out every 6 months at selected locations within and external to the lease to assess impacts to vegetation due to dust/contaminant deposition.

Photo monitoring locations are shown in Figure 6.6 and coordinates are presented in Table 31.

A native vegetation management plan for the operation is presented as Appendix H.

6.6 WEEDS AND PESTS (FERAL ANIMALS)

Context

Environment

Land use in the vicinity of the Portia Deposit is pastoral, predominantly cattle grazing. This activity is likely to have been carried out for over 70 years, with stock and vehicles traversing the site on many occasions in that period. Such activities have led to colonisation by feral animals including rabbits, foxes, feral cats, goats, and mice, and the introduction of weeds including *Brassica tournefortii, Carrichtera annua* and *Schismus barbatus*.

Stakeholders

DSD (in its role as a regulator for new mining developments) has stated that there is to be no introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining land.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Legislation relating to weeds and feral animals includes the *SA Mining Act, 1971*, the *Environment Protection Act, 1993* and the *Native Vegetation Act, (1991)*. Also, the Federal *Environment Protection and Biodiversity Conservation Act, 1999* is likely to apply.

Potential Impact Event

Activities associated with mining at Portia lead to the introduction of new weeds, plant pathogens or pests (including feral animals), and /or increases in abundance of existing weed or pest species in the lease area.

The proposed development has the potential to introduce new weeds and feral animals or increase existing weed and feral animal populations on or near the site. The main mechanisms for this to occur are by:

- new weed species being carried on to the site and nearby areas by vehicles;
- the increased growth or population of existing pest species (flora and fauna) due to the availability of putrescible waste at the landfill; and
- the introduction of new weed or animal species as domestic plants or pets by personnel working on site.

Failure to effectively control weed and feral animal populations may result in:

- damage to flora and habitat, reduction in indigenous fauna populations.

Control and management strategies

The impact of weeds, plant pathogens and feral animals can be significantly reduced by the implementation of the following control strategies:

- minimizing the areas of clearance and disturbance to provide less opportunity for seed growth,
- the revegetation of disturbed areas with locally derived seed stock to act as competition against weeds,
- the banning of domestic pets and plants from site,
- adhering to waste management policies including the deposition of all putrescible wastes in secured bins for disposal within the landfill facility in accordance with the Landfill management plan,
- the regular capping of the landfill to limit the amount of exposed material,
- the spraying or removal of weeds and pest plants when identified, and
- the use of control measures against feral animals.

Likelihood and Severity of Consequences

It is possible that weed and feral animal numbers could increase both on site and in nearby areas due to activities associated mining operations. Control measures will be used to minimize weed, plant pathogen and feral animal impacts. Due to the significant distance between the mine and the nearest residence, it is unlikely that residents will be affected by weed and feral animal populations or control measures at the site. Due to restrictions to site access, effects to the public will be low.

Risk Levels

The results of the risk analysis for weeds and feral animals are presented in the table below.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
damage to flora and habitat, reduction in indigenous fauna populations	possible	minor	control measures as outlined	rare	minor	low	yes

Justification for Risk Acceptance

From the above risk analysis, it would appear that the most significant risks from weed and feral animals are the potential reduction in loss of flora abundance or diversity and a reduction in indigenous fauna populations or diversity. Given the control measures proposed, it is expected that impacts will be minor.

As a consequence of this analysis, weeds and feral animals will be monitored for population and distribution.

Outcome/Objective

No introduction of new species of weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining land as a result of the mining operations.

Measurement Criteria

An annual flora survey consistent with the methods used in the baseline survey (Badman 2008) undertaken by a suitably qualified person finds no new weed species or increase in abundance of existing weed species caused by the operations when compared with control sites on or adjacent the lease as selected by the qualified person.

A fauna survey will be carried out prior to lease surrender to assess the abundance and significance of feral animals on site. The results of this survey will be compared with the results of the baseline survey and will be presented in the close out report for the operation. Outcomes of the consultant surveys and information from the logs will be included in the close out report for the operation prior to lease surrender will show similar abundance and diversity of pest species, in the opinion of a suitably qualified expert, as identified by surveys carried out prior to the commencement of mining.

Leading Indicator Criteria

A log will be maintained of observations by site personnel of feral animal visits / occurrence on site and weed germination and treatment in disturbed areas until lease surrender. These logs will be reviewed quarterly by the site manager until lease surrender.

Monitoring Program

A fauna survey is to be carried out prior to lease surrender. This survey is to use the same methodology as used in the baseline fauna survey conducted prior to the commencement of operations and is to be carried out at a time of year most likely to result in the maximum number of fauna species to be identified. A fauna survey report is to be prepared by the fauna consultant, and the results of the survey are to be compared with the results from control sites identified from the baseline survey results. Differences in species numbers and populations are to be identified and a discussion of the significance of results documented.

Photo monitoring of vegetation and soils is to occur, on a three monthly basis, of areas adjacent to the Pit, office area, refuelling area, the workshop, the camp, the TSF, the OWD, the pit and raw water dam, the gravity separation plant and the landfill during operations.

A log is to be maintained of feral animals observed on the ML or in the vicinity of the site during the period of operations. The log is to also include eradication and control measures employed until lease surrender.

This log will include:

- dates and times of observation,
- observation location,
- the name of the observer,
- species identified (scientific or common name),
- description of observed species (number of animals, condition, activity observed),
- the Site Manager's written acknowledgement of the observation, and
- actions taken (e.g., observation only, eradication)

A log is also to be maintained of weed infestation and measures used up to the time of lease surrender.

This log will include:

- dates and times of observation,
- observation location,
- the name of the observer,
- species identified (scientific or common name),
- description of observed species (number of specimens, area of infestation, vigour),
- the Site Manager's written acknowledgement of the observation, and
- actions taken (e.g., observation only, eradication, method of eradication).

These logs will be reviewed quarterly and results presented in management reports prepared by the Site Manager. A fauna survey will be carried out prior to lease surrender to assess the abundance and significance of feral animals on site. The results of this survey will be compared with the results of the baseline survey and will be presented in the close out report for the operation. Outcomes of the consultant surveys and information from the logs will be included in the close out report for the operation.

6.7 SOILS

Context

Environment

The Portia Deposit is located in the northern Olary plains. These plains extend for many tens of kilometres and includes gently sloping alluvial plains, ephemeral watercourses (none within about 10 km), and dune fields, particularly further north. Soils in the vicinity of the Portia site include:

- Dune sand
- Red brown clay in swales and low lying areas
- Red brown clays in clay pans.

Stakeholders

DSD (in its role as a regulator for new mining developments) has stated that soils affected by mining activities are to be suitable for return to pastoral use. No concerns have been expressed by the local landholder and residents of Cockburn.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Legislation relating to soils and soil management includes the *SA Mining Act, 1971* and associated guidance documents, the *Environment Protection Act, 1993* and the *Natural Resources Management Act, 2004*.

Potential Impact Event

Soils affected by site activities are not suitable for return to pastoral use.

The proposed development has the potential to impact soils by:

- the clearance of vegetation leading to soil erosion and loss,
- contaminated surface runoff from stockpiles ponding and contaminating soils,
- fuel and chemical spills contaminating soils,
- overburden and mine wastes not being properly disposed of,
- topsoil not being appropriately stockpiled (e.g., causing compaction), and
- compaction of soil from vehicle movement.
- leachate contaminating immediate local environment to the landfill
- lateral seepage from the TSF surfacing and affecting local soils

Failure to effectively control impacts to soils may result in:

- loss of pastoral viability of the land

Control and management strategies

Impacts to soils can be significantly reduced by the implementation of the following control strategies:

- minimizing the areas of clearance and disturbance to minimize the potential for soil erosion,
- stockpiling topsoil for use in rehabilitation in mounds or heaps less than 2 m high (to retain seed viability, as described in section 3.4.7),
- the use of dust suppression measures (e.g., water cart) to reduce soil erosion,
- bunds built around all stockpiles to prevent erosion and sedimentation of nearby land during rain events,
- design and construction of all sediment catch drains, bunds and sumps as described in Section 3.6.6,
- containing chemicals and hazardous substances (e.g, fuels, lubricants) within bunded hardstand areas,
- maintaining a 1.0m operational freeboard in the PDD and RWD,
- the storage of overburden in accordance with the design as described in Section 3.4.7,
- remediation of soils visibly contaminated by pollutants in accordance with EPA requirements,
- construction of the tailings storage facility in accordance with construction design as summarised in Section 3.6.2 and Appendix O,
- Operation of the Landfill facility in accordance with Benagerie Gold Operations Landfill Environmental Management Plan, (refer to Appendix K),
- Operation of the TSF in accordance with Section 3.6.2 and in accordance with the Benagerie Gold Operations and Surveillance Manual, (refer to Appendix N),
- Ensuring all water pipelines are bunded to contain saline water.

Likelihood and Severity of Consequences

The probability of impacts to soils during the period of operation is low but will be reduced by the control measures stated above.

Definitive seepage modelling was completed for the TSF by Golder Associates. The results of the modelling can be found in Appendix O. A model was built that included the TSF cell geometry, interpreted subsurface conditions based on the geotechnical and hydrogeological field investigations and the properties of the tailings determined from laboratory testwork.

The lateral seepage model assumed that a 1 m deep pond occurs against the TSF embankment for a period of 14 days with no tailings material coverage in place.

The model results are presented in Figure 6.2 and show the development of the phreatic surface in the gypcrete layer, caused by seepage from water in the pond over a period of 14 days. The figure shows that the lateral seepage does not extend more than 10 m beyond the toe of the embankment. The seepage does not daylight onto the ground surface.

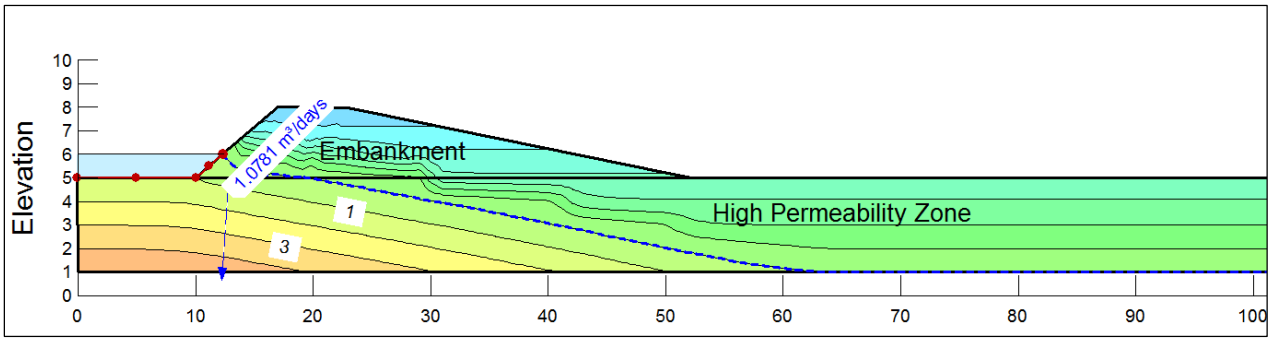


Figure 6.2 Base seepage model results for the TSF

It is noted that this is an unlikely service condition as the design intent is to manage the TSF operating pond around the central decant which is over 100 m from the perimeter embankment.

Figure 6.3 shows the development of the phreatic surface after 14 days and assumes an anisotropy factor increase by a factor of 100 within the gypcrete layer. The results shows that the lateral seepage has extended more than 200 m from the base of the embankment toe and that the seepage also daylights on the ground surface. The zone of surface inundation could occur over about 20 m from the embankment toe, although it is expected that the seepage would evaporate quickly.

The seepage model for this unlikely sensitivity case indicates that lateral seepage does not extend more than 10 m beyond the toe of the embankment and does not daylight onto the ground surface.

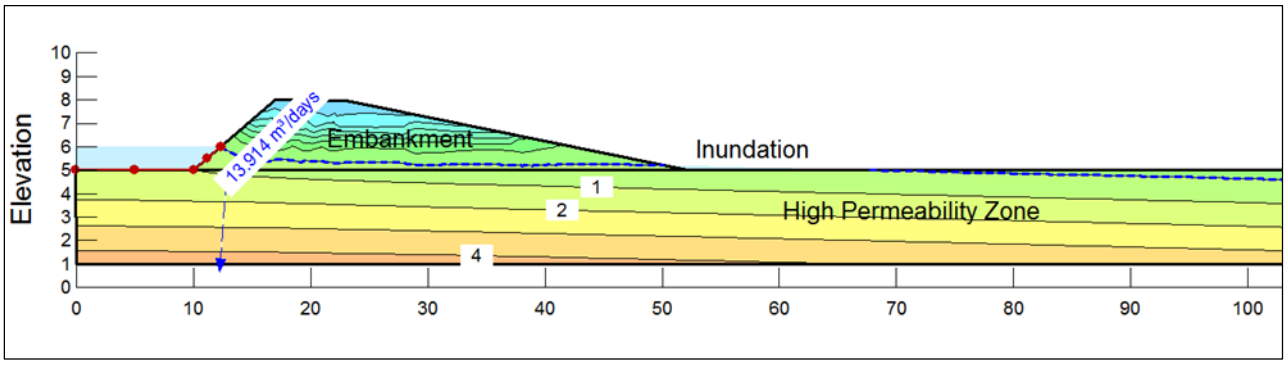


Figure 6.3 Sensitivity analysis worst case scenario using 100 times anisotropy factor

This worst case scenario has been explicitly included within the TSF footprint even though the likelihood of 100 fold increase in hydraulic anisotropy of the gypcrete layer would be extremely rare. Accordingy, the associated area of disturbance and subsequent required rehabilitation of the

TSF domain back to pastoral use based upon this worst case sensitivity analysis has been accommodated.

The likelihood of landfill leachate impacting soils and causing loss of pastoral viability is considered low due to the insignificant volumes of leachate likely to be generated, the management of this leachate (by regular removal on accumulation) and that the landfill excavation has volume sufficient for the temporary storage of a 1-in-100 year AEP rainfall event without overtopping of the facility.

Risk Levels

The results of the risk analysis for adverse impacts to soils are presented in the table below.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
loss of pastoral viability of the land	possible	minor	control measures as outlined above	unlikely	minor	low	yes

Justification for Risk Acceptance

From the above risk analysis, it would appear that the most significant risks of adverse impacts to soils are the potential loss of pastoral viability.

As a consequence of this analysis, soils in the lease area will be monitored for adverse impacts.

Outcome/Objective

Soil affected by mining activities is suitable for return to pastoral use.

Measurement Criteria

The Mine Manager ensures that all spills and leaks of contaminants are recorded in the contaminant spill register and those greater than 20 L are reported to DSD's Principal Mining Regulator within 24 hours of occurrence, and records show that spills (if any) have been remediated to an appropriate EPA standard within 48 hours of the spill, or longer time as agreed with DSD's Principal Mining Regulator.

The Mine Manager will maintain records to demonstrate that monitoring of all topsoil stockpiles by visual assessment is being undertaken at 3 monthly intervals to assess soil stability, signs of erosion, vegetation establishment and the presence and removal of weeds as per the Topsoil Management Plan.

The Mine Manager shall ensure that records demonstrate that no lateral seepage is detected in piezometers S1, S2, S3, S4 during weekly inspections to confirm that collected water has field TDS readings at or below 4,000 ppm.

Monitoring Program

A contaminant spill register is to be maintained during the operational period to record information on the time of the spill, spill chemical(s), spill volumes and remediation measures carried out.

The spill register is to include the following:

- the date and time that the spill was detected,
- who discovered the spill,
- spill location,
- spill material, spill volume, whether the spill/leak has ceased or is ongoing,
- cause of spill/leak,
- remedial measures,
- validation measures,
- measures to reduce the risk of a repeat occurrence,
- notification measures,
- instructions obtained from relevant authorities, and
- final outcomes.

Photo monitoring will be carried out at 3 monthly intervals at selected locations during the period of mining and processing to assess impacts to soils due to site operations.

The piezometers S1, S2, S3 and S4 next to the TSF are to be monitored weekly for seepage.

Monitoring locations are shown in Figure 6.6. The coordinates of the proposed monitoring locations are presented in Table 31

6.8 GROUNDWATER AND HYDROLOGY

Context

Environment

The Portia Deposit occurs in sediments of the Eyre Formation, which is a Tertiary age unit of the Lake Eyre Basin, a sedimentary sequence that extends from about 80 kilometres south of Oban to the Northern Territory border and beyond.

At Portia, the Eyre Formation occurs at depths greater than 60 metres, being separated from the land surface by low permeability clayey sediments of the Namba Formation and recent surficial deposits. The Namba Formation also forms part of the Lake Eyre Basin sedimentary sequence, and acts as a confining layer to the units below. Eromanga Basin sediments do not occur at Portia, as the Eyre Clays rest unconformably on Precambrian age basement rocks and are directly overlain by Namba Formation sediments.

Supplies of groundwater are available from the Eyre Clays and underlying basement rocks. The Namba Formation acts as a confining layer and does not contain extractable supplies of water.

Groundwater modelling carried out to simulate pit dewatering shows that dewatering activities at Portia will not result in measurable drawdown occurring in the Yarramba palaeochannel with Predicted drawdown of less than 0.2 m for the entire model simulation indicating a low risk to this groundwater resource.

Predicted groundwater level recovery (through modelling) illustrates that the groundwater level at the pit never reaches full recovery with in-pit water levels stabilising at approximately 23 m AHD. Given pre-mining water levels of 41 m AHD, the Portia pit will remain a groundwater sink in the long term. Predicted groundwater level recovery is presented in Figure 3.6.

Seepage assessments conducted on the TSF by Golder Associates demonstrate that no impact is predicted to occur to the groundwater piezometric surface as a result of vertical seepage flows through the TSF.

Shylock Re-injection Well field

At the proposed re-injection well field, the stratigraphy of the channel consists of a surficial layer of Quaternary-Recent sands, underlain by soapy-plastic clay (+-sand layers) of the Namba Formation, then silky-micaceous clay of the Eyre Formation, which grades into a basal Eyre (palaeo) sand package of medium (+-coarse) to fine grained angular quartz sand with minor silt and clay. The Namba and Eyre clays extend from near surface to a depth of around 70 m below ground, followed by sand or clayey-sand lenses generally 6 m thick in the central channel (Eyre Sand), followed by highly weathered basement (saprolite) at 73 to 76 m below ground level.

The Shylock palaeochannel sand aquifer where re-injection is to take place is about 450 to 650 m wide and the palaeo-sands range in thickness from about 5-8 m (average 6 metres), pinching out to <1 m at the edge. The palaeo-sands are overlain by 70 m of clay. Depth to groundwater is 22 m below ground level (mbgl) or about 38 mAHD.

Groundwater quality is poor with salinity of the source (mine) water ranging from 12,300 to 14,800 mg/L, compared to 18,800 to 23,500 mg/L at the Shylock Palaeochannel. This demonstrates that water captured from the open pit is of better quality than the receiving aquifer. As such there are no existing users which source groundwater from this aquifer system.

Comparison of major ion chemistry between the source and receiving waters using a Piper Trilinear Diagram was completed.The graphical presentation of the water quality data (Figure 3.24) shows that groundwater from the pit and the Shylock sand aquifer are of the same type. From a geochemical perspective, multi element analysis of sand samples from the Shylock palaeochannel demonstrate the palaeochannel sands as predominantly clean, with low concentration of secondary pyrite or sulfidic material (Total Sulphur values of less than.05%). This indicates a low risk of trace metal mobilisation during the introduction of injectant and supports the conclusion that the injection of pit disposal water will not have any adverse effects on the groundwater quality of the palaeochannel.

Arsenic concentrations in the Shylock Palaeochannel wells ranged between 0.009 and 0.057 mg/L (Table 20). Arsenic concentration ranged between 0.191 and 0.277 mg/L for sampled pit water (Jared's bore) during the re-injection trial and sampling and analysis of back-flush water (post injection) showed major and trace chemistries consistent with the source injectant. (Refer to Appendix P)

The arsenic concentration of the other pit wells tested (WB1, TJ-1, TJ-5, TJ-8 and PTDW1, PTDW3, PTDW4 and PTDW6, also ranged between 0.031 and 1.49 mg/L (average of 0.4 mg/L from 9 samples). Although the arsenic concentrations are higher at the pit than the receiving aquifer, the composite average concentration of the blended injectant is expected to be consistently below the EPA guideline limit of 0.5 mg/L (see Table 5). All other dissolved metals were at concentrations that were lower than the palaeochannel aquifer (Table 20).

There are no existing users which target the Shylock palaeochannel which could be impacted by the proposed Re-injection plan. The nearest industry to the site, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east). The nearest known operational stock watering well (Zacs bore) is over 25 km to the south.

As demonstrated in the predicted hydrographs, (Figure 6.4 and Figure 6.5) no drawdown response within 10 km of the mine site was shown to occur and therefore the above operations will not be affected by the proposed dewatering and reinjection scenario.

Summary of Re-injection Modelling results

Modelling results indicate that groundwater levels will be artesian (above land surface) for the majority of the mine life (Figure 3.25). Injection well pressures were predicted to steadily rise during pre-mining and early-mining dewatering operations (0 – 340 days), then increase once disposal volumes increase. This corresponds with the period when extra dewatering wells and sumps are introduced to the mine pit floor.

Predicted injection well impress head peaked at approximately 65 m above standing water level (-65 m drawdown, Figure 3.25). Impress head was predicted to be sustained at greater than 55 m above SWL for more than half of the modelled mine life (Figure 3.25). Considering the SWL to be 22 m below ground, the peak predicted impress head was 43 m above ground (420 kPa) with the injection pressures sustained above 33 m (320 kPa) and artesian for more than half of the modelled mine life.

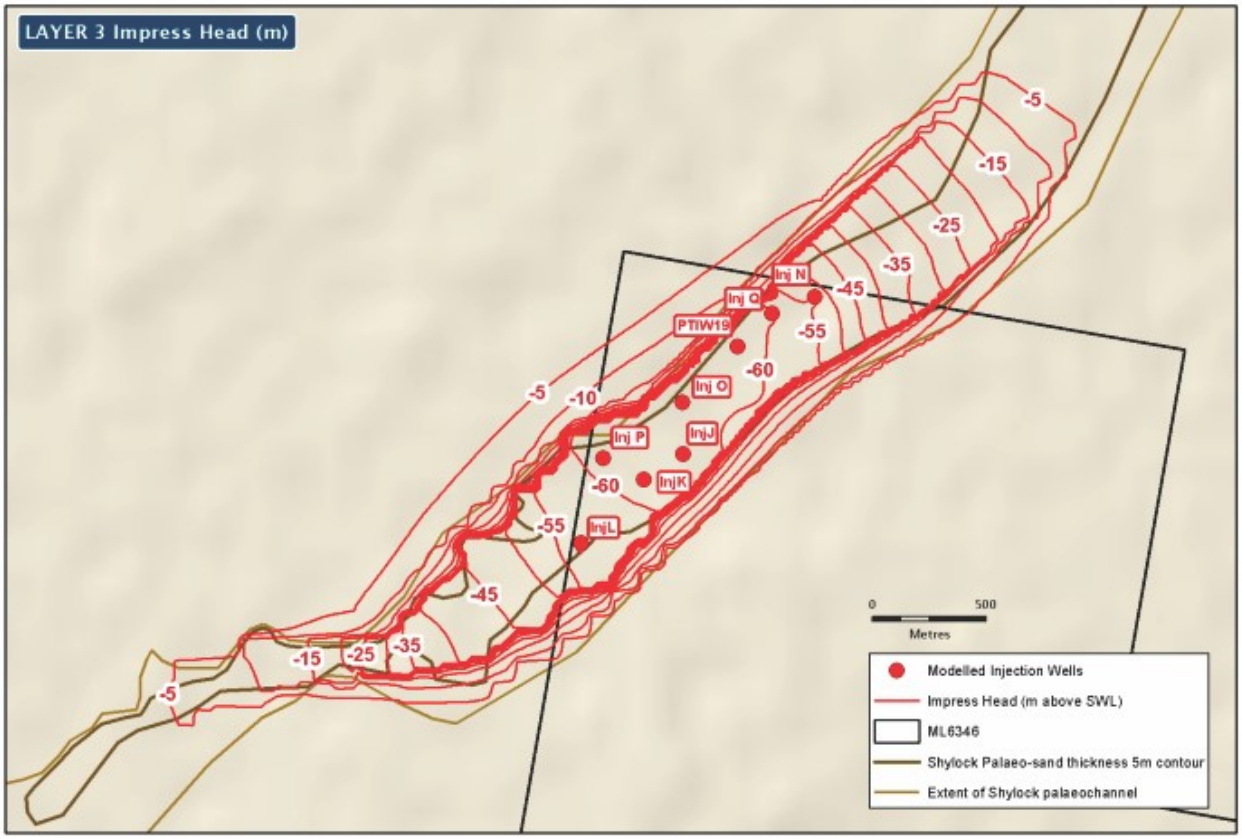
The available safe injection head has been estimated by AGT (refer to Appendix P for calculation) to be 75 m (this has been estimated based on the available head and is equal to 85% of the fracture pressure level of the overlying confining bed above the aquifer).

The simulated potentiometric surfaces (mAHD) for the Shylock Palaeochannel are shown on Figure 6.4 and Figure 6.5 for injection periods of 540 days and 1,030 days respectively. The impress head contours are also shown at the top of each figure for reference. The impress head (negative drawdown) represents the rise in groundwater elevation (m) as a result of all wells operating simultaneously.

Away from the injection wells, the maximum predicted rise in groundwater level in the palaeochannel is approximately 55 m (95 mAHD) in the vicinity of the MAR well field. The current standing water level is approximately 22 m bgl (and the ground surface is approximately 62 mAHD). Therefore artesian heads of around 33 m above ground surface are expected in the area surrounding the well field which are modelled to occur for more than half of the mine life. The extent of the impress head is mostly confined to the extent of the palaeochannel.

Site hydrology

There are no established water courses within 10 km of the Portia deposit and no significant drainage channels occur in the ML area, with primary drainages lying well to the north, south and east. In the immediate vicinity of the mine site, the landscape is characterised by a series of low northeast trending dunes separated by flat interdune corridors. Denuded claypans between the dunes are common in these basins. At Portia, surface water typically occurs only after significant and intense rainfall events. Rainwater generally soaks into surficial soils and sands and may also accumulate on claypans prior to being evaporated.



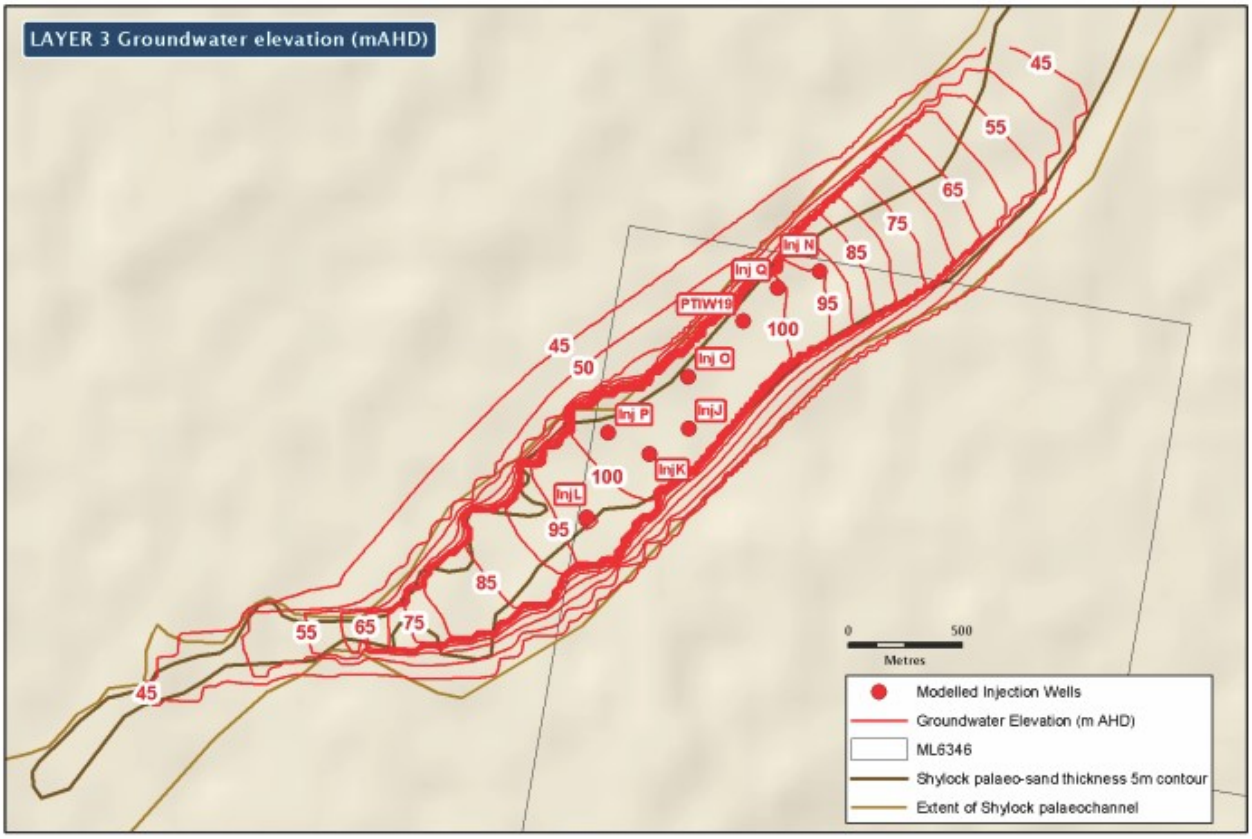
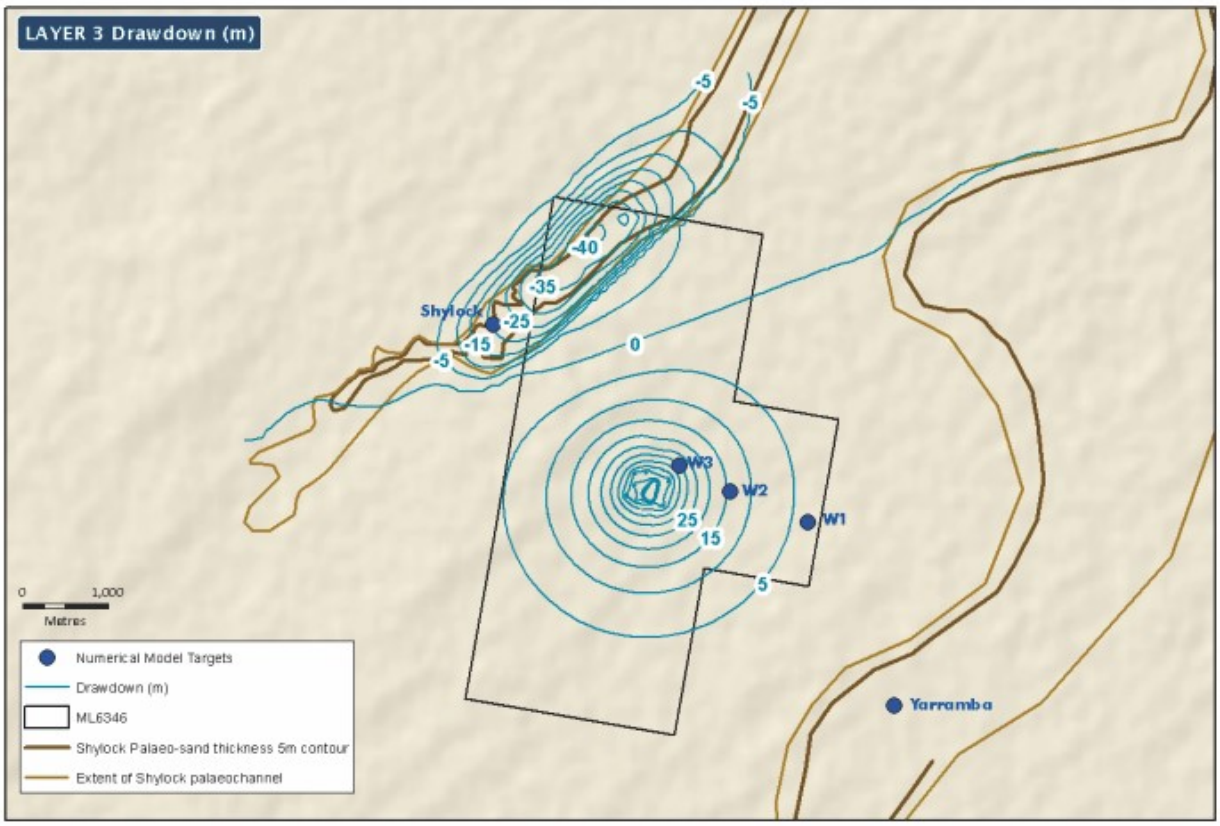


Figure 6.4| **Maximum injection predicted pressure (540 days)**

July 2014 | P:\(HAD)_Havilah Resources\Project\1319\GIS\Maps\1319-HAD Figure 22 Maximum predicted pressure (540 days).mxd



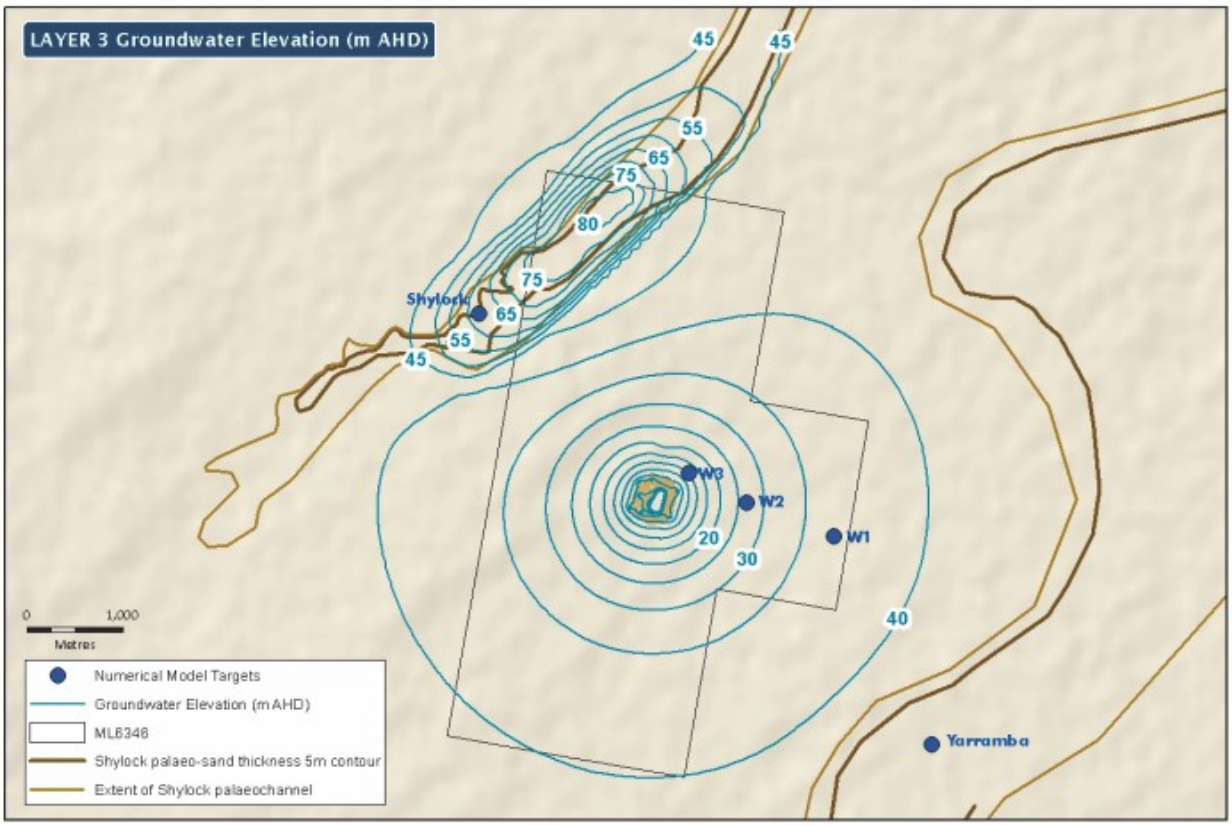


Figure 6.5| Predicted regional groundwater response to dewatering - end of mining (1030 days)

July, 2014 | P:\HAD_Hawlah Resources\Project\9.1319\GIS\Mapsit319-HAD Figure 19 Predicted Regional Impact 1030 days.mxd

Stakeholders

Stakeholders with an interest in groundwater in the area include local pastoralists, none of whom are known to extract groundwater within 25 km of the site.

Stakeholders with an interest in surface hydrology in the area include local pastoralists, some stock watering dams have been constructed across the existing ephemeral drainage lines, the nearest of these drainage channels feeds Jacks Dam 10 km to the east, Blue Shirt Dam, about 7 km to the west of Portia and Swamp Dam 5 km north west of Portia, and are considered a significant distance away from the Project location.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east). The ISR operations at Honeymoon relate to Eyre Formation palaeochannel facies (Yarramba Palaeochannel), whereas at Oban, the mineralisation occurs in a large 'blanket sand' facies of the Eyre Formation. Neither of these sedimentary facies of the Eyre Formation occur at Portia. As described above, the nearest known operational stock watering well (Zacs Bore) is over 25 km to the south.

Modelled groundwater drawdown was greatest at the end of the modelling period (T~1000 days) and at locations nearest to the open pit. Modelling results indicate that drawdown impacts will be largely confined to the mining lease boundary as shown in Figure 6.5, with drawdown generally restricted to less than 5 metres. The exception is a portion in the south-central lease area where the 5 m drawdown contour was predicted to extend approximately 500 metres beyond the lease boundary (Figure 3.5). Predicted drawdown in the Yarramba palaeochannel was less than 0.2 m for the entire model simulation indicating a low risk to this groundwater resource.

The nearest known groundwater use sites (Honeymoon mine and Zacs Bore) are situated to the south, outside the modelled area. However, as indicated by the contours in Figure 6.5, the maximum predicted cone of depression remains a significant distance from the model boundaries (10km x 10km). Hence, drawdown at Honeymoon and Zacs Bore due to dewatering at Portia is modelled to be zero. Refer to Section 3.3.1

Applicable Legislation and Standards

Relevant legislation and standards for groundwater include:

- Mining Act,1971
- Environment Protection Act, 1993
- Natural Resource Management Act, 2004

Benagerie Gold has developed a Groundwater Management Plan (GMMP) to support mining activities at the Portia Gold Mine This GMMP provides detail of monitoring for groundwater affecting activities at Portia ML 6346 and incorporates impacts from the mine dewatering, aquifer reinjection, and tailings storage facility (TSF) seepage. The GMMP is a requirement of a drainage and discharge (D&D) permit and in addition, will be used as an operational document to fulfil monitoring requirements under the approved PEPR. A copy of the Groundwater Management Plan is contained in Appendix Q.

Potential Impact Event

Mining operations at Portia adversely impact the quality and quantity of groundwater in the Eyre Formation available to existing users and the environmental values of the Yarramba Palaeochannel.

Groundwater could be impacted through the following:

- extracting water from dewatering wells,
- re-injection of pit dewatering water into the shylock palaeochannel aquifer causing:
  - excessive injection head compromising the integrity of the confining bed above the aquifer,
  - leakage of injection water into the overlying formation, leading to discharge to surface, (albeit very unlikely),
  - contamination of aquifer from the mine water, and
  - impacts to existing groundwater users. and
- supernatant water from the TSF leaking and infiltrating through the confining layer and contaminating the basement rock aquifer, and
- leachate from landfill contaminating the groundwater.

Surface water could be impacted by:

- leachate from the landfill escaping to surrounding environment,
- lateral seepage from the TSF surfacing and affecting local vegetation,

Failure to effectively control impacts to ground or surface water may result in:

- a reduction in the quality of groundwater available for existing (pastoral) users, and
- a reduction in the quantity of groundwater for existing (pastoral) users.
- leachate contaminating immediate local environment to the landfill

Control and management strategies

The impact of mining operations on groundwater quality and quantity to existing users and environmental values of the Yarramba and Shylock Palaeochannel will be significantly reduced by implementing the following control and management strategies:

- segregating clean and dirty water streams on site to prevent groundwater contamination (refer to Section 3.6.6
- construction of the tailings storage facility in accordance with construction design summarised in Section 3.6.2 and Appendix O,
- construction and operation of the Landfill facility in accordance with Benagerie Gold Operations Landfill Environmental Management Plan, (refer to Appendix K),
- operation of the TSF in accordance with Section 3.6.2 and in accordance with the Benagerie Gold Operations and Surveillance Manual, (refer to Appendix N),
- operation of the re-injection well field in accordance with Section 3.7.5,
- operational monitoring and management of the pumping and reinjection activities in accordance with the Benagerie Gold - Portia Gold Project Groundwater Management Plan, (refer to Appendix Q),
- use of pressure reducing valves, flow meters and flow controlling valves at each re-injection well head to maintain well head pressures at or below 590 kPa,
- managing stormwater run-off into the landfill by constructing a perimeter stormwater cut-off bund,
- maintaining operational freeboard of 1.0m in the RWD and PDD,
- appropriate design of the landfill cell for the temporary storage of a 1:100 year AEP rainfall event without overtopping (refer to Section 3.6.5), and
- appropriate design of the TSF cell to ensure ANCOLD free board design criteria is met. (refer to Section 3.6.2).

Likelihood and Severity of Consequences

The probability of operations negatively affecting the quality and quantity of ground or surface water for existing users and environmental values is low and will be further reduced by the implementation of the control strategies stated above.

Risk Levels

The results of the risk analysis for ground and surface water are presented in the table over.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
A reduction in the quality of groundwater for existing pastoral users	rare	minor	no control measures needed	-	-	-	yes
A reduction in the quantity of groundwater for existing pastoral users	unlikely	minor	control measures as outlined above	rare	minor	low	yes
Impacts to environmental values of the Yarramba and Shylock Palaeochannel	unlikely	minor	control measures as outlined above	rare	minor	low	yes
Leachate escape from landfill	unlikely	minor	control measures as outlined above	rare	minor	low	yes

Justification for Risk Acceptance

From the above risk analysis, it would appear that the most significant risks for groundwater are a reduction in the quality and quantity of water available for existing pastoral users and possible impacts to environmental values of the Yarramba and Shylock Palaeochannel.

Given the considerable distance between the Portia site and existing pastoral supply locations, the significant distance to the Yarramba palaeochannel, the lack of hydraulic connection between the Eyre Formation on site and the sediments in the Yarramba and Shylock Palaeochannels, and the control measures stated above, it is expected that impacts will be insignificant.

Outcome/Objective

No adverse impact to the quality and quantity of groundwater to existing users.

No compromise to the environmental values of the Yarramba Palaeochannel groundwater.

No compromise to the environmental values of the Shylock Palaeochannel groundwater.

Measurement Criteria

Basement Rock Aquifer and Yarramba Palaeochannel

Operational drawdowns, monitored by site staff at 3 monthly intervals during operations, in wells W1A, W2A and W3A (shown in Figure 6.6) do not differ by more than 1 standard deviation from pre-mining drawdown predictions (as reviewed 4 months post dewatering start-up) presented in Table 32. Should operational drawdowns differ by more than 1 standard deviation from pre-mining predictions (as reviewed 4 months post dewatering start-up), the numerical groundwater model will be updated.

Shylock Palaeochannel

Leading indicator 1:

Should pressure at the top of well casing at monitoring wells PTIW17, PTIW21, W4 or W5 reach 540 kPa, injection rates will be reviewed and adjusted to remain within 85% of aquifer pressure level.

Leading indicator 2:

Data collected through fortnightly monitoring at investigation bores PTDW1 to PTDW6 will be used to calibrate the pit model volumetric flow and drawdown rates.

Outcome Measurement criteria

The mine manager shall ensure that Head impress at location PTIW17, PTIW21, W4 and W5 (shown in Figure 6.6) shall be recorded and reviewed by site personnel on a monthly basis to confirm that head impress is less than or equal to 540 kPa measured at the top of the well head, which is equivalent to 85% of the fracture pressure level of the overlying confining bed above the aquifer indicating that there is no failure of the aquitard (Namba Formation).

The mine manager shall ensure that monitoring of the water quality of the injectant (mine water) from the Pit Dewatering Dam on a monthly basis for field parameters (EC, pH, ORP) and Arsenic (As) shows As concentration of the blended injectant is below 0.5 mg/L, confirmed by Laboratory As and Major ion testing of the injectant using an approved NATA registered laboratory on a Quarterly basis.

Surface Water

The mine manager shall ensure that monitoring of water levels in piezometers S1, S2 and S3 and S4 constructed adjacent to the TSF shows that any captured water sampled inside the piezometers have field TDS readings at or below 4,000 ppm.

The mine manager shall ensure that Leachate (if any) generated by the landfill is sampled by site personnel during flow events or at three monthly intervals and found to comply with the requirements of the Environment Protection (Water Quality) Policy 2003, Schedule 2 - Water Quality Criteria, Table 1, using Livestock limits.

The mine manager shall ensure that opportunistic sampling of surface run-off water samples shall be collected during periodic surface water flow events which are retained and captured in surface water collection sumps, bunds and drains within the Mining Lease area. Samples will be tested and assessed to ensure a pH of no less than 5 and TDS of no greater than 4000 mg/L and that there is no statistically significant difference in water total suspended solids (TSS) attributable to the operation measured between upstream and downstream samples collected during opportunistic sampling of periodic surface water flow events.

Monitoring Program

Regional drawdown is to be monitored on a quarterly basis in observation wells W1A, W2A and W3A, located within the predicted dewatering cone of depression during the period of excavation and processing by measuring depth to water in metres.

The two leading indicators provide forewarning to potential over pressurisation of the Shylock Palaeochannel. Leading indicator 1 is 100Kpa less than the calculated fracture pressure to indicate potential over-pressurisation of the palaeochannel aquifer. Leading indicator 2 will determine if the hydrogeological model used in the PEPR is overestimating or underestimating the amount of water in the aquifer.

Investigation wells PTDW1 – PTDW6 around the pit will be monitored fortnightly during dewatering, for standing water level, with pit perimeter wells measured for total volumetric flow rate. This information will be used to confirm model predictions including drawdown rates and the cone of depression. A graph of drawdown verses time, and pumped volume vs time will be compared against the PEPR model predictions and will be submitted to DMITRE 4 months post commencement of pumping. Providing model predictions are confirmed, monitoring PTDW1-W6 will be conducted quarterly thereafter. Should drawdown deviate significantly from the modelled baseline thresholds these will be verified and recalibrated after 4 months of pumping

Head impress (pressure) in wells at locations PTIW21, PTIW17, W4 and W5 shall be monitored monthly at the well head to confirm aquifer pressure remains within the conservative fracture pressure limit for the overlying Namba Formation. A leading indicator pressure of 540 kPa at the top of each monitoring well head has been selected which is 85% of calculated fracture pressure (750 kPa or 75 m above initial standing water level).

Monitoring of the water quality of the injectant (mine water) from the Pit Dewatering Dam on a monthly basis for field parameters (EC, pH, ORP) and Arsenic (As) shows As concentration of the blended injectant is below 0.5 mg/L, confirmed by Laboratory As and Major ion testing of the injectant using an approved NATA registered laboratory on a Quarterly basis.

Piezometers S1, S2, S3 and S4 next to the TSF are to be monitored weekly for seepage by site personnel to confirm field TDS values of captured water inside piezometers of 4,000 ppm.

Groundwater Monitoring locations are shown in Figure 6.6. The coordinates of the proposed monitoring locations are presented in Table 31.

Landfill leachate, if any, will be collected from the leachate sump on a three-monthly basis or after flow events and also analysed against the criteria described in the Environment Protection (Water Quality) Policy 2003, Schedule 2 - Water Quality Criteria, Table 1, using Livestock limits.

Opportunistic sampling of surface run-off water samples shall be collected during periodic surface water flow events which are retained and captured in surface water collection sumps, bunds and drains within the Mining Lease area as shown in Figure 3.18.

6.9 WASTE DISPOSAL AND HAZARDOUS SUBSTANCES

Context

Environment

The Portia Deposit is located on Mulyungarie Station, about 105 km to the north west of Cockburn and Broken Hill, about 190 km by road and track to the north west of Broken Hill.

There are currently no facilities of any kind on site. Soils on site are shallow sands and clays and are underlain by about 60m of low permeability Namba Formation clays.

Activities to be carried out on site include the excavation of a pit, the construction of an overburden waste dump, the recovery of gold through a gravity separation plant, the deposition of tailings from that plant in a TSF, and the construction and operation of a camp, office, workshop and administrative facilities. Potable water for site use will be obtained from an RO plant installed on site.

Wastes generated by the operation will include:

- industrial and domestic wastes such as waste oils, oil/fuel filters, soiled rags, worn out equipment (for example pumps), packaging wastes (refer to Section 3.6.4);
- small amounts of RO brine reject water and antiscalent at very low dosage rates (refer to Section 3.6.3);
- sewerage and putrescible matter such as food wastes (refer to Section 3.6.5);
- mining wastes such as waste rock / overburden (refer to Section 3.6.1); and
- tailings discharge from the gravity separation plant (refer to Section 3.6.3).

Stakeholders

DSD (in its role as a regulator for new mining developments) has stated that all domestic or industrial waste is disposed of in accordance with Environment Protection Act (1993) requirements.

Concerns have not been expressed by the local landholder and residents of Cockburn.

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Legislation and standards that relate to waste disposal and hazardous substances include the:

- Mining Act, 1971;
- Environment Protection Act, 1993; and
- Natural Resources Management Act, 2004.

Potential Impact Event

Discharge of domestic or industrial wastes contaminates land and soils on or off site

The proposed development will generate wastes at this location. The main types of waste likely to be generated are:

- hard rubbish from the office/amenities/and laboratory facilities,
- putrescibles wastes from the office and amenities facilities,
- sewerage from ablution facilities,
- packaging wastes from vehicle servicing areas, and
- spent oils and lubricants from vehicle servicing areas (if carried out on site)
- mining wastes including overburden / waste rock and tailings from the gravity separation plant.

Failure to effectively control domestic or industrial wastes may result in:

- the generation of litter, reducing visual amenity,
- increases in feral animal populations, and
- contamination of land and soils.

Control and management strategies

The impact of industrial and domestic wastes can be significantly reduced by the implementation of the following control strategies:

- placing all hard waste substances (putrescible and packaging) in appropriate bins and then disposing at an approved on site repository in accordance with EPA requirements,
- installing a 1.8m high wire mesh fence and lockable gates around the perimeter of the landfill
- maintaining septic waste systems in accordane with manufacturer requirements,
- collecting spent lubricants and fuels for disposal at an approved repository in accordance with EPA requirements,
- the bunding of fuel and hazardous chemical storages,
- the construction of the OWD, TSF and Landfill in accordance with design specifications,
- managing the landfill in accordance with the Landfill Environmental Management Plan (refer to Appendix K), and
- operation of the TSF in accordance with Section 3.6.2 and in accordance with the Benagerie Gold TSF Operations and Surveillance Manual, (refer to Appendix N).

Likelihood and Severity of Consequences

The probability of waste being generated from site activities is almost certain; further, waste will be generated for the duration of the active mining operation. Control measures will be used to minimize the effects of the generation of these wastes.

The probability of hazardous substances being discharged is low. Control measures will be used to further reduce risks.

Due to the significant distance between the mine and the nearest residence, it is unlikely that residents will be affected by waste generation and hazardous substances at this site. Likewise, the site is a restricted area, so public health and amenity are unlikely to be affected by hazardous substances and waste management during the mining and closure periods.

Risk Levels

The results of the risk analysis for industrial and domestic waste and hazardous substances are presented in the table over.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
The generation of litter	almost certain	minor	waste collection and disposal measures as outlined above	rare	insignificant	low	yes
Increase in feral animal populations	likely	minor	waste collection and disposal measures as outlined above	rare	insignificant	low	yes
Contamination of land and soils	possible	minor	waste and hazardous substance control measures as outlined above	rare	minor	low	yes

Justification for Risk Acceptance

From the above risk analysis, it would appear that the most significant risks from waste generation and hazardous substances are reduced visual amenity, increases in feral animal populations and contamination of soils. Given the control measures stated above, it is expected that impacts will be minor to insignificant.

As a consequence of this analysis, waste and hazardous substances will be monitored for occurrence and impacts to the environment.

Outcome/Objective

There is to be no contamination of land and soils either on or off site, from waste products and hazardous materials used in the mine operations.

Measurement Criteria

The Mine Manager ensures geo-referenced photos matching baseline photos taken every 3 months during the mining operations at locations shown in Figure 6.6 show no litter, and all domestic and industrial waste is securely stored in accordance with the waste management plan in Appendix J and the Sites Landfill Management Plan (in Appendix K).

The mine manager ensures that Fortnightly checks and Records of waste disposal maintained by the Mine Manager show that domestic and industrial wastes have been disposed of fortnightly to appropriate (licensed) repositories in accordance with EPA requirements.

The Mine Manager to ensure that Records of waste disposal to approved facilities will be maintained until lease surrender.

Monitoring Program

Photo monitoring is to occur, on a 3 monthly basis, of areas adjacent to the office, refuelling and mine laydown area, the workshop, the accommodation area, the TSF's, the OWD , the raw water dam, ROM and the gravity separation plant and the landfill during operations and into post closure. Photo monitoring locations are P1 through to P15 inclusive.

Records of waste disposal to EPA approved repositories will be retained and reviewed monthly for appropriateness and consistency.

Monitoring locations are shown in Figure 6.6 and the co-ordinates of monitoring locations are presented in Table 31.

6.10 AIR QUALITY, ODOUR AND NOISE

Context

Environment

The Portia Deposit is located on Mulyungarie Station, about 105 km to the north west of Cockburn and Broken Hill, about 190 km by road and track to the north west of Broken Hill. The area in which the Portia Deposit occurs is sparsely populated, and devoid of sources of industrial noise and noise associated with human habitation and movement.

It is also an area of low rainfall and high evaporation, resulting in vegetation being sparse. Overgrazing by native and introduced animals has led to soils becoming exposed, resulting in the generation of large amounts of dust in periods of strong winds. There are no sources of airborne pollution on site, apart from dust and emissions from mineral exploration activities.

Stakeholders

The landholder (Mutooroo Pastoral Company) has been consulted and was not concerned with noise or dust.

Industry

The nearest industry, other than pastoral, occurs at the Honeymoon ISR site (~40 km south east) and the Oban ISR site (~40 km north east).

Applicable Legislation and Standards

Relevant legislation and standards for groundwater include:

- Mining Act,1971
- Environment Protection Act, 1993
- Natural Resource Management Act, 2004

Potential Impact Event

The potential impacts associated with noise are related to disturbance to residences at the on-site camp as well as offsite neighbours.

Site activities will produce noise from both fixed and mobile equipment. The major sources of noise associated with the operations have been identified as being:

- vehicles (including reversing alarms)

- machinery (e.g. generators, loaders, haul trucks, excavators, processing and other ancillary equipment)

Natural dust levels at the site are unknown, however levels are expected to be elevated due to the arid climate and pastoral activities.

The primary sources of dust generation from the operation are:

- clearing of vegetation for construction
- construction activities
- dumping of ore and waste material during mining and dam construction
- loading operations
- wind erosion from exposed surfaces (including stockpiles, overburden dumps and tailings dam)
- traffic from mining activity

Control and management strategies

Separation distances outlined in EPA Guidelines have been used to ensure that impacts from noise have been appropriately considered during the planning phase. The campsite will be located 1000 metres from the proposed open pit and approximately 1900 metres from the proposed ore processing operations.

For waste water treatment systems, the guideline separation distance is 100m from the nearest dwelling for waste treatment plants under 1000 person capacity. The designed waste treatment facility for the campsite will be located 100m away, thereby complying with this guideline.

The Landfill is located approximately 500 m away from the campsite and away from the prevailing wind directions.

- Vehicles and equipment will be switched off when not in use and not left idling
- Landfill facility will be managed in accordance with the Landfill Environmental Management Plan and regular capping of putrescible waste will occur in accordance with the plan,
- Waste treatment plants shall be serviced and maintained in accordance with the manufacturers recommendations,
- Monitoring energy consumption (e.g., diesel and electricity) and calculating greenhouse gas emissions,
- regular maintenance of machinery to ensure noise abatement devices are working effectively,
- minimising the amount of cleared and disturbed areas on the site,
- installing dust control devices, such as sprinklers at point sources,
- daily inspections will be carried out regarding dust emissions,
- using a water truck to control fugitive dust emissions within construction areas, pits and on roads,
- where dust suppression using water is not effective, the use of chemical dust suppressants and/or wetting agents will be considered
- limiting vehicle speed limits,
- recording and actioning of public complaints,
- monitoring noise impacts by complaint. In the event of a complaint, additional management and mitigation measures may be introduced

Likelihood and Severity of Consequences

No specific air quality data exists for the Project Area. The National Pollution Inventory (NPI) for the region indicates relatively low nitrogen and phosphorous levels associated with agricultural activities. Air quality for the project area is expected to be generally good given the lack of urban populations and industry in the region.

Emission sources are likely to include diesel combustion engines in stationary and mobile equipment. Emissions will be relatively constant for the life of the project. The emission of combustion products such as carbon monoxide (CO), sulphur dioxide (SO2), nitrogen dioxide (NO2), and particulate matter will occur and has the potential to adversely impact local air quality, with subsequent adverse impacts to human health and amenity.

Greenhouse gas also generated as a result of burning diesel fuel and LPG at the project will contribute CO_2 and N_2O emissions to the atmosphere with subsequent adverse impacts on human health on a regional scale.

Odorous emissions may occur from septic tank systems and the proposed landfill facility. These odours have the potential to adversely impact local air quality, with subsequent adverse impacts to human health and amenity.

The probability of operations negatively affecting the noise, odour and dust levels for existing users or temporary camp inhabitants is low and will be further reduced by the implementation of the control strategies stated above.

Risk Levels

The results of the risk analysis for air quality odour and noise are presented in the table below.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Respiratory irritation to the workforce	unlikely	minor	As noted above	rare	minor	Low	Yes
Respiratory irritation to members of the public	rare	minor	As noted above	rare	minor	Low	Yes
Greenhouse Gas	Almost certain	insignificant	As noted above	Almost certain	insignificant	Moderate	Yes

Justification for Risk Acceptance

There are no viable alternatives to the use of diesel engines in the context of this proposal. The likelihood of Greenhouse gas emissions to the atmosphere is therefore almost certain.

Respiratory irritation of members of the public and workforce

The nearest homestead is located 20 kilometres to the south of the project site. Impacts associated with odour and atmospheric emissions on public health and amenity will be virtually impossible and the consequences insignificant due to the distance of the MLP area to the homestead, and the general prevailing westerly wind direction negating any potential impacts giving an overall residual risk ranking of very low.

Dust generated is likely to be localised as mining activities generally produce coarse particles (greater than 10 microns (μ)). This results in the majority of dust settling within a short distance of the source (generally within 200-300 metres from the dust source). The site accommodation village is to be located 1000m from the eastern edge of the open pit and approximately 1900m from the ore processing, stockpiling areas. It is unlikely that respiratory irritation to members of the workforce will occur given the proposed control and management strategies in place and the location of infrastructure within the MLP area. If they do occur, they will be localised and have minor, short term consequences giving this impact an overall residual risk rating of low.

Greenhouse Gas

The Portia project is a small operation compared with other mining operations and its contribution to State or National greenhouse gas emissions will be negligible. The site is remote and thereby self-reliant in terms of generating on-site electricity needs using diesel generators. Estimates of greenhouse gas emissions have been calculated for the MLP area and is based on the Australian Greenhouse Office (AGO) Factors and Methods Workbook (AGO, December 2006). Calculations were completed using the AGO emissions calculator tool using the predicted annual fuel usage data for the site required to generate power and energy for mining and processing. (Refer to Chapter 3, section 3.18 of this document).

The project is estimated to liberate approximately 13,374t-eCO2 annually. State contributions to annual greenhouse emission for the 2005 year were estimated at 28.1 Mte-Co2. The Portia project will represent an increase in emissions of approximately 0.04% annually to the States greenhouse gas emissions. Emissions of greenhouse gas into the atmosphere is almost certain. The increased levels of greenhouse gas generated are considered to be insignificant when compared to current emissions on a State level thereby resulting in an overall moderate residual risk ranking for this impact.

The US EPA LandGEM model was used to estimate the likely evolution of methane from the landfill for the 10 years post-closure. The model default factors were modified in accordance with the Australian National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Municipal Solid Waste Landfills (Version 2, NPI 2010). The results of this analysis are summarised in Table 30

Table 30 Landfill methane generation by year following closure

Year	Methane generation (m^3/year)
1	424
2	400
3	377
4	356
5	336
6	317
7	299
8	282
9	266
10	251

The generation of around 1 m^3 per day of methane is considered not to represent an explosion or asphyxiation risk to human health and safety based on the short facility life and the lack of nearby

receivers post-closure, and further management and/or mitigation of the gas via gas capture and treatment would likely be cost prohibitive.

Outcome

No adverse impacts from air quality, odour and noise from project related activities.

Outcome measurement criteria

All complaints received regarding dust, odour and noise will be recorded in the complaints register and closed out through contacting complainant, identifying the source (where possible) and providing feedback on actions taken within 5 working days. All complaints and details of close out will be reported in a statutory compliance report to DSD.

Operating compliance monitoring plan

An incident register is to be kept by the Mine manager and entries made of complaints by site personnel and members of the public. It will include:

- the date and time of the complaint,
- details of the complaint,
- records of discussion with the person making the complaint,
- an assessment of the validity of the claim,
- remedial measures actioned,

The register will be reviewed monthly. The review will include the identification of possible improvement measures (i.e. procedural changes) to reduce impacts from air quality, noise and odour.

All complaints and the details of close out of these complaints will be presented in a statutory compliance report to DSD prepared by the Mine manager.

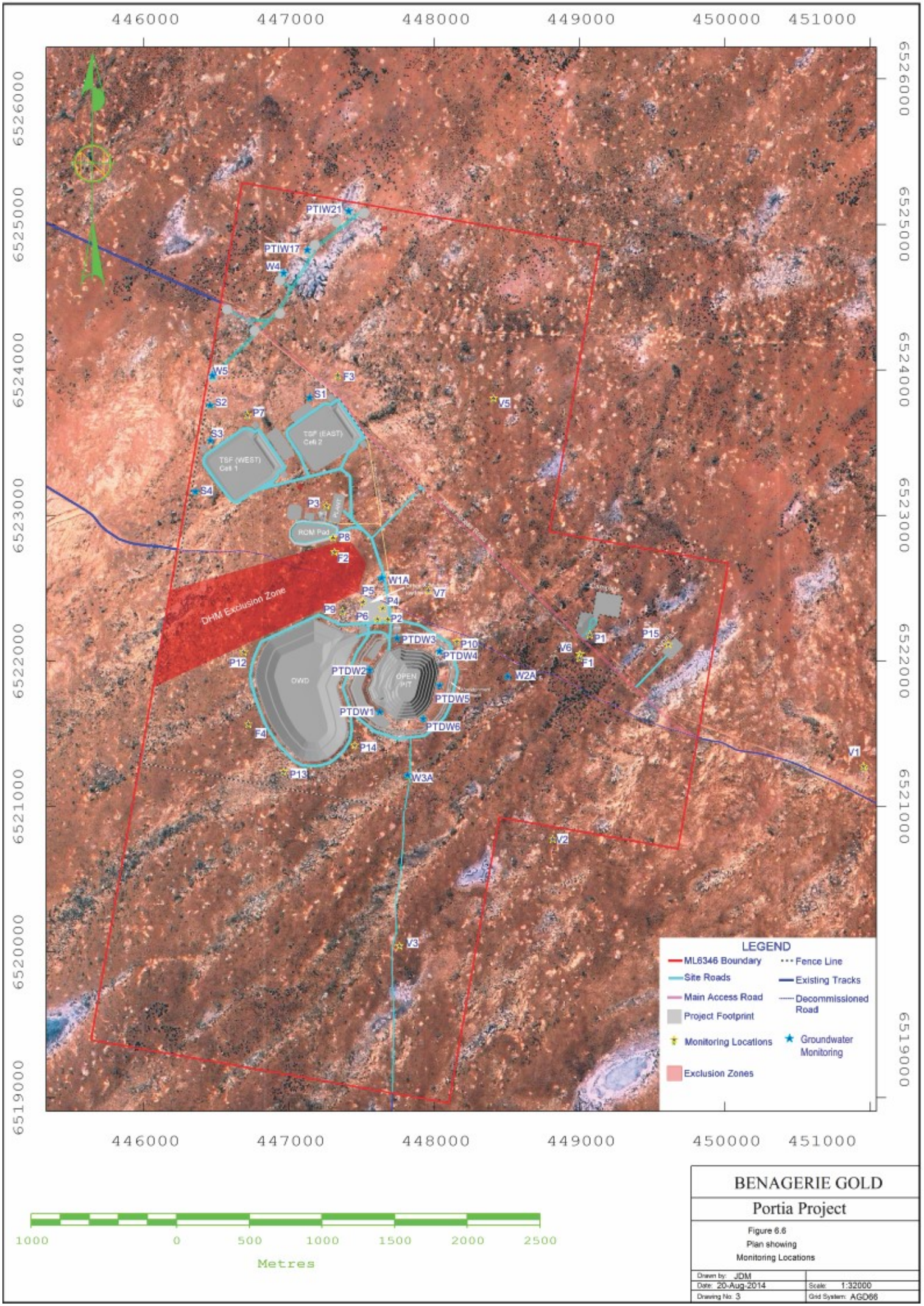
Table 31 Monitoring location summary table (in AGD coordinates)

Monitoring location ID	Location description	Easting	Northing	Monitoring element
		(m)	(m)	
P1	Camp	449057	6522174	Vegetation, waste, soils
P2	Office	447674	6522280	Vegetation, waste, soils
P3	Processing plant	447260	6523055	Vegetation, waste, soils
P4	Workshop	447646	6522359	Vegetation, waste, soils
P5	Refuelling area	447510	6522404	Vegetation, waste, soils
P6	Go bay	447605	6522278	Vegetation, waste, soils
P7	TSF	446708	6523682	Vegetation, waste, soils
P8	ROM pad	447299	6522842	Vegetation, waste, soils
P9	OWD	447362	6522331	Vegetation, waste, soils
P10	Access road	448071	6522218	Vegetation, waste, soils
P12	OWD	446684	6522057	Vegetation, waste, soils
P13	OWD	446962	6521232	Vegetation, waste, soils
P14	OWD	447447	6521424	Vegetation, waste, soils
P15	LANDFILL	449606	6522113	Vegetation, waste, soils
W1A	Drawdown	447634	6522573	Regional Groundwater Monitoring
W2A	Drawdown	448504	6521894	Regional Groundwater Monitoring
W3A	Drawdown	447813	6521202	Regional Groundwater Monitoring
PTDW1	Drawdown	447606	6521637	Groundwater Model Calibration
PTDW2	Drawdown	447550	6521918	Groundwater Model Calibration
PTDW3	Drawdown	447758	6522129	Groundwater Model Calibration
PTDW4	Drawdown	448036	6522043	Groundwater Model Calibration
PTDW5	Drawdown	448025	6521804	Groundwater Model Calibration
PTDW6	Drawdown	447918	6521583	Groundwater Model Calibration
PTIW17	Reinjection	447133	6524816	Head Impress (Eyre Sands)
PTIW21	Reinjection	447411	6525083	Head Impress (Eyre Sands)
W4	Reinjection	446963	6524656	Head Impress (Namba FM)
W5	Reinjection	446473	6523946	Head Impress (Eyre Sands)
V1	Control_site_veg	450961	6521260	Vegetation
V2	Control_site_veg	448807	6520773	Vegetation

Monitoring location ID	Location description	Easting	Northing	Monitoring element
		(m)	(m)	
V3	Control_site_veg	447764	6520037	Vegetation
V4	Control_site_veg	447726	6517624	Vegetation
V5	Control_site_veg	448408	6523794	Fauna
V6	Control_site_veg	448998	6522033	Fauna
V7	Control_site_veg	447959	6522478	Fauna
F1	Control_site_fauna	448996	6522016	Fauna
F2	Control_site_fauna	447302	6522741	Fauna
F3	Control_site_fauna	447336	6523947	Fauna
F4	Control_site_fauna	446395	6521464	Fauna
S1	TSF	447140	6523800	Seepage
S2	TSF	446461	6523747	Seepage
S3	TSF	446453	6523503	Seepage
S4	TSF	446361	6523154	Seepage

Table 32 Groundwater monitoring drawdown table

Time since commencement of operations (months)	**Well W1A drawdown** (m)	**Well W2A drawdown** (m)	**Well W3A drawdown** (m)
3	3.807	6.64	6.918
6	5.952	9.524	9.593
9	7.345	11.315	11.385
12	8.443	12.781	12.791
15	9.283	13.889	13.86
18	10.664	15.351	15.828
21	11.824	16.583	17.377
24	12.741	17.462	18.526



BENAGERIE GOLD

Portia Project

Figure 6.6
Plan showing
Monitoring Locations

Drawn by: JDM	
Date: 20-Aug-2014	Scale: 1:32000
Drawing No: 3	Grid System: AGD66

6.11 CRITERIA BREAKDOWN TABLE

Criteria breakdown tables for each potential impact event are presented in Table 33 below.

Havilah commits to reviewing measurement criteria at 6 monthly intervals with DSD from commencement of operations and providing any required updates to DSD within two weeks of the review.

Table 33 Criteria Breakdown Table

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
ADJACENT LAND USE						
No adverse impacts to adjacent land use due to the mining of the Portia Deposit.	The Mine Manager will maintain an incident register for the Portia mining lease area and access tracks, to record all incidents and complaints. It will record the date and time of the incident / complaint, a description of damage / losses, remedial actions to be taken, and the date when the action has been completed. The incident/complaints register demonstrates that, as required, all incidents or complaints are resolved or addressed to the satisfaction of the complainant or DSD within 7 days of the incident or complaint or a longer time frame agreed with DSD.	An incident register will record the date and time of the incident / complaint, a description of damage / losses, remedial actions to be taken, and the date when the action has been completed.	Portia mining lease area and access tracks.	All incidents or complaints are resolved or addressed to the satisfaction of the complainant or DSD within 7 days of the incident / complaint, or a longer time frame agreed with DSD.	As required	N/A

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
ABORIGINAL AND EUROPEAN HERITAGE						
There is to be no disturbance to or destruction of Aboriginal or European artefacts or sites of significance during construction and operation of the mine unless prior approval under the relevant legislation is obtained.	An incident register will show no unauthorised disturbance to or destruction of Aboriginal or European artefacts or sites of significance during construction and operation of the mine. Records demonstrate that work ceased in the immediate area of the discovery of Aboriginal artefacts or sites, appropriate authorities were advised, and work recommenced only after authorization under the Aboriginal Heritage Act 1998.	Disturbance to or destruction of Aboriginal or European artefacts or sites of significance. Measurement by incident register.	Portia mining lease area	No disturbance to or destruction of Aboriginal or European artefacts or sites of significance.	As required	N/A

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
NATIVE VEGETATION						
No permanent loss of abundance or diversity to native vegetation on or off the lease area through clearance, dust contaminant deposition, fire or other damage unless prior	*Leading Indicator:* A log will be maintained of native vegetation clearance during the period of operations and compared to the approved clearance plan monthly. A log (incident register) will also be kept of uncontrolled fires on or off the lease due to site operations.	Measurement by on ground survey of vegetation clearance monthly	Portia mining lease area.	Approved clearance plan monthly	Monthly	The clearance footprint shown in Figure 6.1.

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
approval is obtained under the Native Vegetation Act (1991).	An annual audit of vegetation clearance, via an on ground survey demonstrates that the area of vegetation clearance (including that by dust, contaminant, fire and other damage) does not extend beyond the clearance footprint shown in Figure 6.1 unless prior approval is obtained under the Native Vegetation Act (1991), and no clearance has occurred in the dusky hopping mouse exclusion zone.	Measurement by on ground survey of: vegetation clearance, and clearance in dusky hopping mouse exclusion zone.	Portia mining lease area.	Vegetation clearance (including that by dust, contaminant, fire and other damage) does not extend beyond the clearance footprint shown in Figure 6.1 unless prior approval is obtained under the Native Vegetation Act (1991), and no clearance has occurred in the dusky hopping mouse exclusion zone.	Annual	The clearance footprint shown in Figure 6.1.
NATIVE FAUNA						
No net adverse impacts from the site operations on native fauna abundance and diversity in the ML area and in	The mine manager shall ensure that records are kept (using an incident register) of fauna trapped by infrastructure and subsequently released during the operational period, and the recording of accidental deaths of	Measurement of fauna trappings by record keeping.	Portia Mining Lease area and access tracks	N/A	As required	N/A

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
adjacent areas as a result of constructing and operating the Project.	native fauna due to interaction with infrastructure. It will record the date, time and location of the discovery of trapped fauna, who made the discovery, the condition and fate of the animal, release location and any actions identified to preclude future entrapments from occurring. The register shall be reviewed monthly					
	A fauna survey is to be carried out prior to lease surrender. A fauna survey report is to be prepared by the fauna consultant, and the results of the survey are to be compared with the results from control sites identified from the baseline survey results. Differences in species numbers and populations are to be identified and a discussion of the significance of results documented.	Measurement of fauna abundance and diversity using the same methodology as the baseline fauna survey conducted prior to the commencement of operations. This is to be carried out at a time of year most likely to result in the maximum number	Portia Mining Lease area	Results of the survey are to be compared with the results from control sites identified from the baseline survey results. Differences in species numbers and populations are to be identified and a discussion of the significance of results documented.	Upon closure	Baseline fauna survey

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
		of fauna species to be identified.				
WEEDS AND PESTS (FERAL ANIMALS)						
No introduction of new species of weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining land, caused as a result of the mining operations.	*Leading Indicator:* A log will be maintained of observations by site personnel of feral animal visits / occurrence on site and weed germination and treatment in disturbed areas until lease surrender. These logs will be reviewed quarterly by the site manager.	Measurement by record keeping	Portia mining lease	Information from the logs will be included in the close out report for the operation.	Logs reviewed quarterly by the site manager until lease surrender.	N/A
	An annual flora survey conducted annually, consistent with the methods used in the baseline survey (Badman 2008) undertaken by a suitably qualified independent consultant finds no new weed species or increase in abundance of existing weed species when compared with control sites on or adjacent the lease as selected by the independent consultant.	New weed species and abundance of existing weeds, measurement by flora survey	Portia mining lease area and in adjacent areas.	No new weed species or increase in abundance of existing weed species when compared with control sites on or adjacent the lease as selected by the independent consultant.	Annual	Control sites as shown in Table 31

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	A fauna survey will be carried out prior to lease surrender survey shows similar abundance and diversity of pest species, in the opinion of a suitably qualified expert, as identified by surveys carried out prior to the commencement of mining.	Abundance and diversity of pest species, measurement by fauna survey prior to lease surrender	Portia mining lease area and in adjacent areas.	Similar abundance and diversity of pests, in the opinion of a suitably qualified expert, as identified by surveys carried out prior to the commencement of mining.	Prior to Lease surrender	Control sites as shown in Table 31
SOILS						
Soil affected by mining activities is suitable for return to pastoral use.	The Mine Manager ensures that all spills and leaks of contaminants are recorded in the contaminant spill register and those greater than 20 L are reported to DSD's Principal Mining Regulator by the site manager within 24 hours of occurrence, and records show that spills (if any) have been remediated to an appropriate EPA standard within 48 hours of the spill, or longer time as agreed	Spills and leaks of contaminants (measurement through spill register), spills greater than 20 L reported to DSD's Principal Mining Regulator.	Portia mining lease area.	Spills to be remediated to an appropriate EPA standard within 48 hours of the spill, or longer time as agreed with DSD's Principal Mining Regulator.	As required.	*National Environment Protection (Assessment of Site Contamination) Measure* and the EPA Guideline *Environmental Management of On-Site Remediation*.

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	with DSD's Principal Mining Regulator.					
	The Mine Manager will maintain records to demonstrate that monitoring of all topsoil stockpiles by visual assessment is being undertaken at 3 monthly intervals to assess soil stability, signs of erosion, vegetation establishment and the presence and removal of weeds as per the Topsoil Management Plan.	By visual assessment and record keeping, Stability of topsoil stockpiles and effectiveness of perimeter bunds and or drains and the presence and removal of weeds.	All topsoil storage locations within the Portia mining lease area	Viability of seed	3 monthly intervals.	Topsoil management plan (Appendix I)
	The Mine Manager shall ensure that records demonstrate that no lateral seepage is detected in piezometers S1, S2, S3, S4 during weekly inspections	Water levels monitored and recorded weekly during operation	Piezometers S1, S2, S3, S4	Field TDS readings of captured water below 4,000 ppm	Weekly during operation	4,000 ppm
GROUNDWATER AND HYDROLOGY						
No adverse impact to the quality and quantity of groundwater to existing users.	The Mine Manager shall ensure that quarterly drawdown measurements recorded by site staff, in wells W1A, W2A and W3A (shown on Figure 6.6) not	Drawdown in metres (measurement by	Monitoring wells W1A, W2A and W3A.	Drawdown not to differ by more than 1 standard deviation from the values stated in Table 32	Quarterly	Table 32 (to be verified/recalibrated after 4 months of pumping)

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
No compromise to the environmental values of the Yarramba Palaeochannel groundwater.	to differ by more than 1 standard deviation from the values stated in Table 32. Should drawdown deviate significantly from the modelled baseline thresholds these will be verified and recalibrated after 4 months of pumping.	depth to water monitoring).		(To be verified/recalibrated after 4 months of pumping)		
No compromise to the environmental values of the Shylock Palaeochannel groundwater.	The mine manager shall ensure that Head impress at location PTIW17, PTIW21, W4 and W5(shown in Figure 6.6) shall be recorded and reviewed by site personnel on a monthly basis to confirm that head impress is less than or equal to 540 kPa which is equivalent to 85% of the fracture pressure level of the overlying confining bed above the aquifer indicating that there is no failure of the aquitard (Namba Formation).	Records taken of Metres of Head or kPa pressure at the top of well casing	PTIW17, PTIW21, W4 and W5 (shown in Figure 6.6)	Less than or equal to 540 kPa of head pressure	Monthly	less than 540 kPa which is 85% of the calculated fracture pressure level of the overlying confining bed above the aquifer.
	Leading indicator 1: Should pressure at the top of well casing at monitoring well either PTIW17, PTIW21, W4 or W5 reach 540 kPa, injection	Pressure/kPa	PTIW17, PTIW21, W4, W5. (Shown in Figure 6.6).	Pressure level to remain within 85% at 540kPa measured	Monthly	N/A

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	rates will be reviewed and adjusted to remain within 85% of aquifer pressure level. Leading indicator 2: Data collected through fortnightly monitoring at investigation bores PTDW1 to PTDW6 will be used to calibrate the model volumetric flow and drawdown rates.	Volumetric flow and drawdown rates	PTDW1 to PTDW6 (Shown in Figure 6.6).	at the top of the well head Calibration and validation of the groundwater model	Fortnightly for the first 4 months, quarterly there after	N/A
	The mine manager ensures that monitoring of the water quality of the injectant (mine water) from the Pit Dewatering Dam on a monthly basis for field parameters (EC, pH, ORP) and Arsenic (As) shows As concentration of the blended injectant is below 0.5 mg/L, confirmed by Laboratory As and Major ion testing of the injectant using an approved NATA registered laboratory on a Quarterly basis.	Measurement by sampling and field analysis using calibrated instruments with laboratory analysis of As and Major ions on a Quarterly basis	Pit dewatering Dam	EPA guideline value developed for the watering of stock	Monthly: for field Arsenic Electrical conductivity/TDS, pH, ORP) Quarterly: Laboratory Arsenic and Major Ions	As 0.5 mg/L As 0.5 mg/L

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
No adverse impact to the quality of surface water	The Mine Manager shall ensure that records demonstrate that no lateral seepage is detected in piezometers S1, S2, S3, S4 during weekly inspections	Water levels monitored and recorded weekly during operation	Piezometers S1, S2, S3, S4	Field TDS readings of captured water below 4,000 ppm	Weekly during operation	4,000 ppm
	The Mine Manager shall ensure that Leachate (if any) generated by the landfill is sampled by site personnel during flow events or at three monthly intervals and found to comply with the requirements of the Environment Protection (Water Quality) Policy 2003	Sample of leachate collected and analysed by an appropriately qualified laboratory	Landfill leachate sump	None applicable (for internal purposes, leachate quality will be assessed against Schedule 2 of the Environment Protection (Water Quality) Policy 2003. Schedule 2 - Water Quality Criteria, Table 1, using Livestock limits.	During flow events or three monthly	None applicable
	The mine manager shall ensure that opportunistic sampling of surface run-off water samples shall be collected during periodic surface water flow events which are retained and captured in surface water collection sumps, bunds and drains within the Mining Lease area. Samples will be tested and assessed to ensure	Samples of surface water collected from surface water collection sumps, bunds and drains (after rain fall flow events) and analysed by an appropriately qualified	Within the Portia mining lease area at all surface water collection sumps, bunds and drains as shown in Figure 3.18.	Surface water quality will be assessed to ensure a pH of no less than 5 and TDS of no greater than 4,000 mg/L. No statistically significant difference in water	During flow events	None applicable

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	a pH of no less than 5 and TDS of no greater than 4000 mg/L. No statistically significant difference in water total suspended solids (TSS) attributable to the operation measured between upstream and downstream samples collected during opportunistic sampling of periodic surface water flow events.	laboratory for pH, TDS and Total Suspended Solids TSS		total suspended solids (TSS) attributable to the operation measured between upstream and downstream samples collected during opportunistic sampling of periodic surface water flow events.		
WASTE DISPOSAL AND HAZARDOUS SUBSTANCES						
There is to be no contamination of land and soils either on or off site, from waste products and hazardous materials used in the mine operations.	The mine manager ensures geo-referenced photos matching baseline photos taken every 3 months during the mining operations at locations shown in Figure 6.2 show no litter, and all domestic and industrial waste is securely stored (in accordance with waste management plan in Appendix J and K) in waste transfer areas.	The occurrence of litter and the storage of industrial and domestic waste; measurement by geo-referenced photos.	At locations shown in Table 31. Photo monitoring locations are P1 through to P15 inclusive.	Photos match baseline photos. All litter and industrial waste securely stored in accordance with waste management plan in waste transfer areas	3 monthly	Baseline photos, – storage in accordance with waste management plan (Appendix J and K)
	The mine manager ensures that Fortnightly checks and Records of waste disposal maintained by	The disposal of domestic and industrial wastes,	Mining lease area	EPA requirements.	Fortnightly	EPA requirements

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	the Mine Manager show that domestic and industrial wastes have been disposed of fortnightly to appropriate (licensed) repositories in accordance with EPA requirements.	measurement by record keeping.				
	The Mine Manager to ensure that Records of waste disposal to approved facilities will be maintained until lease relinquishment.	Waste disposal to approved facilities.	Mining lease area	Records kept until lease relinquishment.	As required	EPA requirements

AIR QUALITY, ODOUR and NOISE						
No significant adverse impacts to amenity or health as a result of airborne emissions or noise	All complaints received regarding dust, odour and noise will be recorded in the complaints register and closed out through contacting complainant, identifying the source (where possible) and providing feedback on actions taken within 5 working days. All complaints and details of close out will be reported in a statutory compliance report to DSD.	All complaints and details of close out will be reported in a statutory compliance report to DSD.	Location of complainants	All complaints received regarding dust, odour and noise will be recorded in the complaints register and closed out through contacting complainant, identifying the source (where possible) and providing feedback on actions taken within 5 working days	As required	None applicable

7 Mine Closure and Completion Plan

This section outlines Benagerie Gold's closure and rehabilitation plan for the project. It summarises the progressive rehabilitation process and describes the actions to be carried out to successfully rehabilitate the site. It follows the objectives and principles outlined in "Strategic framework for mine closure (2000)" developed by the Minerals Council of Australia and the former Australian and New Zealand Minerals and Energy Council (now the Ministerial Council on Mineral and Petroleum Resources) and further developed in the "Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion (2006)".

The (general) objectives for closure are to:

- enable all stakeholders to have their interests considered;
- ensure that mine closure occurs in an orderly, cost-effective and timely manner;
- ensure that the cost of rehabilitation is adequately represented in company accounts and that the community is not left with the liability;
- ensure there is clear accountability, and adequate resources for rehabilitation;
- establish a set of indicators which will demonstrate the successful completion of rehabilitation; and
- reach a point where the company has met agreed completion criteria to the satisfaction of the regulating authority.

The plan includes progressive rehabilitation (where possible) to a stable condition consistent with prior land use (i.e., pastoral) as agreed with stakeholders (including the landowner).

This closure and rehabilitation plan will ensure that the following standards are taken into account:

General economic standards

- That the community and future generations are left with no residual liability for site rehabilitation or maintenance
- That any adverse economic effects are minimized
- That provision is made for reasonable access for future mining (or reprocessing) of any remaining resource.

General social standards

- Effective ongoing community engagement
- Closure minimizes the disruption/impact on the community
- Future public health and safety are not compromised

General Environmental and Rehabilitation Standards

It is intended that rehabilitation and closure results in the return of disturbed land to "a stable, productive and self-sustaining condition, after taking into account the beneficial pastoral uses of the site and the surrounding land." This includes reference to:

- Physical, geochemical and ecological stability
- The protection of the quality of the surrounding water resources
- Risk of adverse effects to people, livestock, other fauna and the environment in general being reduced to a level acceptable to stakeholders.

It is also a goal that rehabilitation and closure leads to the site being suitable for a sustainable post mining land use, which at Portia will be pastoral.

Monitoring and reporting criteria for successful final rehabilitation have also been developed, including (where appropriate) reference to:

- appropriate mechanisms for formal "sign-off" of rehabilitation as completed,
- Australian Standards as they apply at the time the rehabilitation is "signed-off",
- comparative measures (for example reference photographs),
- agreed times for the proving of rehabilitation actions, and
- requirements under other legislation e.g., the Environmental Protection Act 1993 (SA) and the Natural Resources Management Act 2004 (SA).

7.1 CONTEXT

The Portia Deposit is located in the north east pastoral zone of South Australia and is to be developed as a green field site, i.e., with no prior mining in the areas now occupied by or proposed for the operation. The only activities carried out at this site have been stock grazing and mineral exploration.

The area has been described as being in fair rather than good condition, due to the impacts of heavy grazing by native animals and livestock. Public amenity is low and there are no unusual habitats, sites of significance or other items that are likely to make the area suitable for conservation. Agricultural productivity is described as very low, supporting only 12 sheep per square kilometre. The climate is hot and arid, with low rainfall and high evaporation. Surface topography is subdued, consisting of low sand dunes separated by clayey interdune corridors (flats). Vegetation is sparse; it consists of low shrublands of *Maireana astrotricha* (Low Bluebush) on the flats, with *Atriplex vesicaria* (Bladder Saltbush) and *Maireana astrotricha* on low dunes. There are some isolated stands of *Casuarina pauper* (Black Oak) low woodlands.

With regard to fauna, the Portia site and surrounds are species-poor, with the exception being reptiles, which have proven to be the group best adapted to the conditions. However, many of the populations of arid zone mammal and bird species have been and are threatened by anthropogenic influences, especially the impacts of pest plants and animals. A few of the larger species, such as kangaroo, euro and emu, and some of the bird species have benefited by the introduction of permanent watering points. Dusky hopping mice have been observed within the ML and a zone to protect this species has been set aside to ensure that it is protected.

There are no established water courses within 10 kilometres of the Portia Deposit and no significant drainage channels occur in the ML area, with primary drainages lying well to the north, south and east. At Portia, surface water is present only after significant and intense rainfall events.

Groundwater resources at Portia are poor, with supplies of groundwater occurring in the underlying basement rocks. Well yields are low at <5 L/s/well. Further, the water is highly saline, with a total dissolved solids concentration (TDS) of in excess of 12,000 ppm, making it unsuitable for potable supply, irrigation and livestock use.

7.2 STAKEHOLDER INVOLVEMENT AND ISSUES

Stakeholder consultation carried out during exploration and development leading to this PEPR included one-on-one consultation with the landholder on a number of occasions, liaison with government agencies (DSD, EPA, DEH), and discussions with and information distribution to the residents of Cockburn.

Key issues by government agencies (EPA and DSD) in relation to environmental safeguards for the Project include:

- That the TSF structures are safe and stable and fit to the natural environment with a clearly defined closure timeframe. To this end, the TSF has been designed so as to provide a clear and defined closure timeframe.

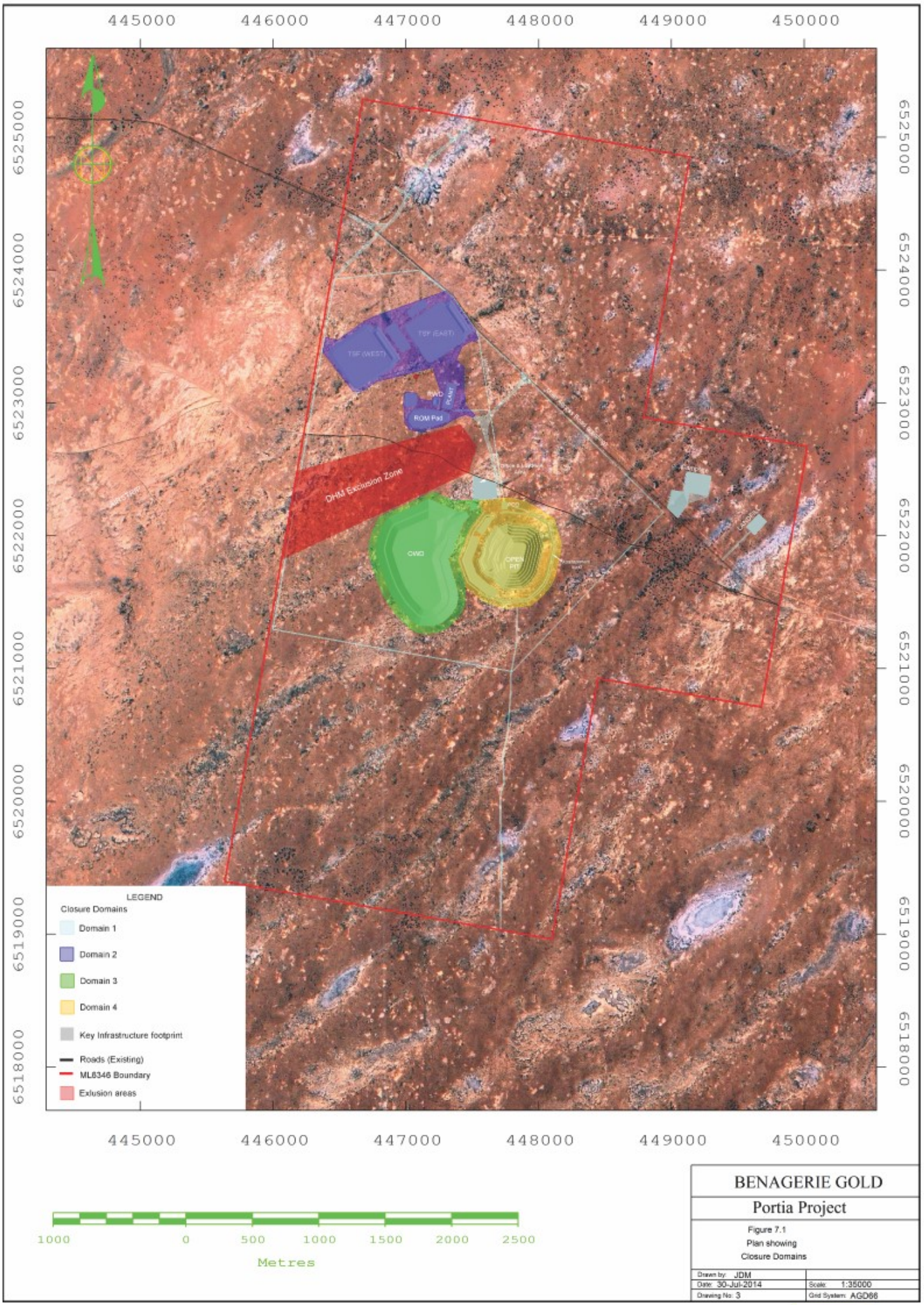
  That salinization effects to soil have been suitably considered within the projects closure plan by the company. To this end, a definitive seepage analysis study was completed by Golder associates on the TSF facility to demonstrate the efficacy of the design and quantify the risk to salinization of soils by seepage during and after operation as being low. The site water holding dams shall all be lined using HDPE liners during operation in order to prevent seepage into the surrounding environment from these structures, and a clear closure and rehabilitation strategy for all site roads has been developed.
- Due to the remote location, low rainfall, uniformity of landscape, and significant distance from population centres, land use on completion of operations will revert to pastoral as agreed with the current leaseholders of Benagerie Station.

7.3 SCOPE AND DESCRIPTION OF CLOSURE DOMAINS

The Portia site has been divided into the following domains:

- domain 1 - infrastructure areas
- domain 2 – TSF, Plant and Infrastructure including ROM Pad Infrastructure
- domain 3 - overburden waste dump
- domain 4 - open pit mine void

These domains are shown in Figure 7.1 and are described in more detail over.



BENAGERIE GOLD

Portia Project

Figure 7.1
Plan showing
Closure Domains

Drawn by: JDM	
Date: 30-Jul-2014	Scale: 1:35000
Drawing No: 3	Grid System: AGD66

Domain 1 – Infrastructure areas. This domain includes the campsite, landfill, re-injection well field, all monitoring wells, pipeline corridors, office and workshop areas, refuelling area, hardstand and laydown areas, haul roads, site and camp roads (excluding roads defined within other domains and the main existing access track), fence lines and sewage and wastewater treatment plants (at camp and mine office).

In these areas, the main change to the land surface will be the stripping and stockpiling of topsoil, the placement of sheeting, the placement of buildings, the installation of tanks (e.g., fuel and septic), the construction of the landfill facility, the stockpiling of gravel, the construction of drains and runoff retention structures and the installation of wells and placement of pipes and cabling (e.g., power).

The total area of disturbance requiring rehabilitation in this domain is approximately 36.4 ha.

Domain 2 – Processing plant and storages. This includes the TSF and internal road network around the TSF, the haul road to the ROM pad and processing plant, the raw water dam and related surface water collection and retention systems, the capping surcharge stockpiles and the topsoil stockpiles contained within this domain. Alterations to the land surface include topsoil stripping and stockpiling, the construction of the tailings TSF cells, the excavation of the raw water dam and the pit dewatering dam, the placement of road and pad sheeting, the placement of capping surcharge material adjacent to the TSF cells, the erection of processing plant infrastructure and pipelines to and around the TSF and the construction of drains and water retention structures.

The total area of disturbance to vegetation in Domain 2 is approximately 47 ha.

Domain 3 - Overburden Waste Dump. The OWD will be constructed of overburden won from the stripping of the top section of the pit and other non-economic intervals deeper down and it will be covered with topsoil prior to revegetation. The perimeter access road, drainage collection systems and retention storages to manage runoff from the OWD are also included in this domain, as are topsoil stockpiles formed by clearance prior to OWD construction within the boundary of this domain.

The total area of disturbance to vegetation within this domain is 61 ha.

Domain 4 - Open Pit. This domain includes the pit, the abandonment bund, the perimeter access track around the abandonment bund location, the pit dewatering dam and pit dewatering infrastructure, including, wells, pipelines and cable and temporary surface stockpiles including the topsoil stockpiles within the boundary of this domain. The pit void will cover an area of around 21 ha (including safety bund and pit dewatering perimeter access road during operations, but could ultimately occupy an area of 50 ha on closure, allowing for the decommissioning of the dewatering wells and construction of the abandonment bund.

The footprints stated above for each domain include areas for stormwater runoff collection and retention structures. The total area of site disturbance requiring rehabilitation for closure is 194 ha.

As a precursor to rehabilitation, topsoil will be stockpiled from all planned areas of disturbance at the commencement of mining and then re-spread over areas that are to be rehabilitated upon mine closure. In most locations, about 150 mm of top soil will be removed, which will be sufficient to adequately cover the disturbed area, with a little extra available for additional rehabilitation if and when required. Approximately 30,000 cubic metres of topsoil will be generated from the open pit area, which will be available for any other rehabilitated areas where a deficit of topsoil exists.

7.4 POTENTIAL ENVIRONMENTAL, ECONOMIC AND SOCIAL IMPACTS OF MINE CLOSURE

Potential environmental, economic and social impacts of mining operations that could remain after mine closure include:

- unacceptable visual amenity,
- risks to health and safety of the public and fauna,
- ecosystem function and landscape function is not resilient and self-sustaining,
- the site is not physically stable,
- compromised quality and quantity of groundwater to existing users and compromise to the environmental values of the Yarramba palaeochannel,
- mine waste materials left on site are not chemically and physically stable, and
- pre-mining land use not being re-established.

These risks are assessed below.

7.5 VISUAL AMENITY

Potential Impact Event: The external visual amenity of the site does not meet acceptance by the Director of Mines.

This relates to domains 1, 2, 3 and 4.

Control and management strategies:

- The removal of all plant and equipment from the site.
- The drying out, backfilling and covering of the TSF cells with topsoil followed by successful revegetation with locally derived seedstock.
- The backfilling of the pit dewatering dam, raw water dam, topsoil placement and establishment of vegetation.
- The placement of topsoil on the OWD plus the establishment of vegetation.
- The infilling of all surface drainage infrastructure.
- The removal of the camp and septic wastewater system, topsoil placement and revegetation.
- The capping of the landfill pit with 60mm of clay and subsequent cover with 100mm of topsoil followed by the establishment of vegetation.
- The abandonment of dewatering wells.
- The spraying and removal of pest plant and weed species prior to lease surrender.

Likelihood and severity of consequences:

It is possible that external visual amenity of the site may not meet approval. Control measures will be used to improve visual amenity.

Risk Levels

Risk levels for visual amenity are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
External visual amenity of the site may not meet approval	likely	minor	control measures as outlined	unlikely	minor	low	yes

Justification for risk acceptance

From the above risk analysis, it would appear that risks to visual amenity will be low.

Outcome/Objective

The external visual amenity of the site is acceptable as determined by the Director of Mines in consultation with relevant interested parties.

Completion criteria:

The Mine Manager ensures photo monitoring at locations P1 through to P15, inclusive, as shown in Figure 6.6 and in Table 31 at lease surrender shows visual amenity that is acceptable to the Director of Mines and that all buildings, plant, temporary stockpiles and equipment are removed from the site.

7.6 RISKS TO HEALTH AND SAFETY

Potential Impact Event: risks to the health and safety of the public and fauna remain after closure.

This risk event relates to all domains.

Control and management strategies

- Completing the construction of the abandonment bund around the pit to preclude vehicular access
- Backfilling the pit dewatering and raw water dam
- Removing the site (perimeter) fence unless otherwise requested by the landholder
- Placing a block (overburden or rock) across the haul road entrance
- Erecting signage warning of danger (pit)
- Following the deposition methodology as described in Section 3.6.2, will ensure good drying and consolidation of the tailings in the TSF's allowing them to be trafficable within 3 months (Golder, 2013). This will be followed by the infilling of any remaining void, grading back the sides, placing topsoil and establishing vegetation.
- The remediation of chemical spill sites in accordance with EPA requirements

Likelihood and severity of consequences:

It is possible that risks to the health and safety of the public and fauna could remain after closure; however, the control measures stated above will reduce these risks.

Risk Levels

Risk levels for health and safety of the public and fauna are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
risks to the health and safety of the public and fauna remain after closure	unlikely	major	control measures as outlined	unlikely	minor	low	yes

Justification for risk acceptance:

From the above risk analysis, it would appear that risks to the health and safety of the public and fauna will be low.

Outcome/Objective

The risks to the health and safety of the public and fauna are as low as reasonably practical.

Completion Criteria

Audit carried out by a suitably qualified and experienced independent expert, prior to lease surrender to ensure the long term risks to the health and safety of the public and fauna remain as low as reasonably practical, verifies that:

- Construction of the tailings storage facility in accordance with construction design as summarised in Section 3.6.2 and Appendix O has occurred.
- The TSF cells are appropriately dried out sufficiently to undertake pastoral activity and have been capped and rehabilitated as shown in Figure 7.8 and Figure 7.9 and described in Section 7.11
- The pit dewatering and raw water dams are backfilled and capped with topsoil.

An independent geotechnical expert certifies prior to lease surrender that the pit abandonment bund (including a barrier across the entrance to the pit) has been located at least 10 m outside the long term stable pit wall collapse area, is 14m wide (at the base) and 3 m high (at the crest), with side slopes of 1V:2H and a crest width of 2.0 m and that is has been constructed with a core of locally won clay and a covering of imported rock 300mm to 500 mm thick.

A site audit report to the satisfaction of DSD by an independent expert immediately prior to lease surrender shows that:

- Warning signage is in place every 400 m along the abandonment bund adequately secured to posts,
- All fencing has been removed, unless a written agreement to accept ongoing liability for maintenance is received from the pastoralist.
- The long term risks to the health and safety of the public and fauna on closure remains as low as reasonably practical through the siting and construction of a safe, stable abandonment bund

outside of the identified zone of potential instability of the pit as described in Section 3.11.1 and which has been verified by an independent geotechnical expert prior to lease surrender.

7.7 ECOSYSTEM AND LANDSCAPE FUNCTION

Potential Impact Event: Ecosystem function and landscape function is not resilient and self-sustaining.

This relates to domains 1, 2 and 3.

Control and management strategies:

- Topsoil profiles within the mining lease are thin as evidenced in test pit logs (see Golders tailings design report, 2013 – Appendix O). The topsoils are usually less than 100mm with subsoils up to another 300mm thick. The disturbed areas of the Portia site (with exception of the pit) will rehabilitated with a layer of growth medium 150mm thick, with additional nutrients and seed base added to encourage growth. The rationale' is to establish and analogue to the surrounding landscapes with the desired outcome being equal to or an improvement over local environment if possible.
- With regard to the tailings cells, the amelioration cover layer will comprise a subsoil made up a 350mm layer of surface Quaternary sandy clays with growth medium of 150mm of topsoil. This layer is therefore analogous (albeit slightly thicker) to the typical soil profile as noted above in the test pit logs.
- Management of soil resources, especially the placement of topsoil on disturbed areas
- Completion of suitable earthworks to assist both active and passive revegetation
- The successful revegetation of disturbed areas (except the pit) with locally derived seed stock
- The removal of all putrescible and non-recyclable wastes and disposal in an EPA approved facility on site.
- Capping of the landfill facility and subsequent rehabilitation in accordance with the Landfill Environmental Management Plan and as described in Section 3.6.5
- The spraying or removal of weeds and pest plants if persisting prior to site surrender
- Eradication of feral animals on and in the vicinity of the site (if practicable) prior to lease surrender
- Potential control of over-abundant large native herbivores (if adversely affecting revegetation success)
- Monitoring of environmental conditions, vegetation, flora and fauna and environmentally sensitive sites
- Monitoring of rehabilitation success.

Likelihood and severity of consequences:

It is possible that ecosystem function and landscape function is not resilient and self-sustaining. Control measures will be used to improve the ecosystem and landscape functions.

Risk Levels

Risk levels for ecosystem function and landscape function are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Ecosystem function and landscape function is not resilient and self-sustaining after site closure	likely	minor	control measures as outlined	unlikely	minor	low	yes

Justification for risk acceptance:

From the above risk analysis, it would appear that risks to ecosystem and landscape function will be low.

Outcome

Ecosystem function and landscape function is resilient and self-sustaining at site closure.

Completion criteria:

An ecosystem function analysis undertaken by a suitably qualified independent consultant for each of Domains 1, 2 and 3 prior to lease surrender, shows that the condition and diversity of vegetation species is no worse at the date of surrender than for adjacent control sites (shown in Figure 6.6) for the respective functional group, or is similar to that prior to the commencement of operations (refer to baseline data in Sections 2.11 and 2.12), and that revegetation is resilient and trending towards sustainability. Target values for indicator EFA criteria, such as landscape stability, water and nutrient infiltration and nutrient recycling for each of the vegetation associations in Domains 1, 2 and 3 will be determined by a suitably qualified independent expert, based on landscape, soil type and vegetation community and species to demonstrate that disturbance sites are being suitably rehabilitated and, therefore, that management of the site is sustainable.

7.8 PHYSICAL STABILITY

Potential Impact Event: the site is not physically stable

This relates to all domains.

Control and management strategies:

- The placement of topsoil on disturbed areas,
- The revegetation of disturbed areas (except the pit) with locally derived seed stock to act as competition against weeds,
- Enclosing the site with stock fencing to reduce grazing pressure during Stage 1 rehabilitation activities,
- The construction of the pit abandonment bund at a distance from the pit crest that precludes it from collapsing into the pit if the pit walls collapse (i.e. outside the pit wall collapse radius). Section 3.11.1 contains details of the bund,

- operation of the TSF in accordance with Section 3.6.2 and in accordance with the Benagerie Gold Operations and Surveillance Manual, (refer to Appendix N),
- With regard to the TSF cells, the structures will be built to design as per the guidelines (ANCOLD, 2012) that will mitigate the risk of failure from post closure overtopping, seismic risks or storm erosion.

Likelihood and severity of consequences:

It is possible that the site or parts of it may remain physically unstable. Control measures will be used to improve stability and manage risk.

Risk Levels

Risk levels for physical stability of the site are presented in the following table

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
the site is not physically stable	likely	minor	control measures as outlined	unlikely	minor	low	yes

Justification for risk acceptance:

From the above risk analysis, it would appear that risks to physical stability will be low.

Outcome/Objective

The site is physically stable.

Completion criteria

Monthly monitoring of the central decant pond of the Tailings Storage Facility during operation shows that the decant pond does not exceed 10,000m^2 to allow adequate time for drying and consolidation for a trafficable tailings beach and appropriate rehabilitation.

An audit by a suitably qualified and experienced independent expert, prior to lease surrender, shows that the OWD and TSF have been constructed as per sections 3.6.1 (OWD), 3.6.2 (TSF), and also in accordance with Figure 7.14 – Figure 7.17 (OWD), and Figure 7.8 and Figure 7.9 (TSF).

An additional audit, by a suitably qualified and experienced independent expert (prior to lease surrender), shows that all domains have been revegetated in accordance with the sustainable closure strategies defined in Section 7.12.

7.9 GROUNDWATER

Potential Impact Event: compromise in quality and quantity of groundwater to existing users

This does not relate to domains on site, but to potential off site impacts.

Control and management strategies

The nearest known groundwater use sites (Honeymoon mine and Zacs Bore) are situated to the south, outside the modelled area and as shown by the drawdown contours in Figure 3.5, the cone of depression remains a significant distance from the model boundaries when drawdown is at its greatest. Hence, drawdown at Honeymoon and Zacs Bore due to dewatering at Portia during operation and on closure is modelled to be zero.

Seepage assessments conducted on the TSF by Golder Associates demonstrate that no impact is predicted to occur to the groundwater piezometric surface as a result of vertical seepage flows through the TSF. (Refer to Appendix O).

At the reinjection well field, there are no existing users which target the palaeochannel which could be impacted by the proposed reinjection scheme. Groundwater quality in the palaeochannel is poor, with salinity ranging from 18,800 to 23,500 mg/L. This is above the ANZECC guideline value for stock (~10,000 mg/L – upper limit for sheep) and as such there are no existing users which source groundwater from this aquifer system. Major ion chemistry of the pit disposal water and the groundwater obtained from the Shylock Palaeochannel shows that both samples belong to the same water type (see Figure 3.24), with the pit water being of lower salinity (14,000 mg/L) than the groundwater within the Shylock Palaeochannel. Hydrochemical analysis of the pit disposal water and the groundwater obtained from the Shylock Palaeochannel (refer to Table 20, page 99) shows that with the exception of Arsenic, all other dissolved metals were at concentrations in the Pit groundwater to be lower than the palaeochannel aquifer. Although the arsenic concentrations are higher at the pit than the receiving aquifer, the composite average concentration of the blended injectant is expected to be consistently below the EPA guideline limit of 0.5 mg/L. (Refer Appendix P and Table 5, page 19).

On closure of Domain 4, the pit will remain as a groundwater sink in the long term with water in the pit predicted to return to a post mining water level of approximately 23 m AHD, given pre-mining water levels of approximately 41 m AHD. Portia Pit groundwater levels were predicted through modelling to return to within 68% of pre mining water level within 10 years (19.9 m AHD), with full recovery to 23m AHD taking approximately 990 years as shown in the graph in Figure 3.6. As demonstrated in the predicted hydrographs, (Figure 6.4 and Figure 6.5) no drawdown response within 10 km of the mine site was shown to occur and the above operations will not be affected by the proposed dewatering and reinjection scenario.

No potentially acid forming (PAF) material is known to occur within the walls of the open pit and no PAF material is planned to be mined within the pit. Furthermore, the filling of the pit void with water replicates the naturally occurring conditions by re-creating anaerobic conditions with approximately 40 metres of water above the base of pit that will prevent oxidation of any sulphidic minerals that may be inadvertently exposed on the pit floor. This will ensure acid forming conditions do not exist upon pit closure. The likelihood of acid generation occurring within the pit on closure would be very rare given the context described.

Although not modelled, in-pit salinity will increase due to evaporative effects. Given ambient salinities (basement aquifer) are ~14,000 mg/L, an additional increase will not change the environmental value of the groundwater resource currently classed as industrial, (AGT,2014)

Likelihood and Severity of Consequences

The probability of operations negatively affecting the quality and quantity of groundwater, for existing users and environmental values of the Shylock and Yarramba Palaeochannel, after mining has ceased is very low.

Risk Levels

The results of the risk analysis for groundwater are presented in the table over.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
The reduction in the quality and quantity of groundwater for existing pastoral users	rare	minor	control measures as outlined above	virtually impossible	minor	low	yes
Impacts to environmental values of the Yarramba and Shylock Palaeochannel	rare	minor	control measures as outlined above	virtually impossible	minor	low	yes
TSF seepage impacting off-site receptors	Rare	minor	control measures as outlined above	virtually impossible	minor	low	yes

Justification for Risk Acceptance

From the above risk analysis and control and management strategies presented through modelling results, it would appear that risks to the quality and quantity of water available for existing pastoral users and possible impacts to environmental values of the Yarramba Palaeochannel are very low.

Outcome

- No compromise in the quality and quantity of groundwater to existing users.
- No compromise to the environmental values of the Yarramba Palaeochannel groundwater.
- No compromise to the environmental values of the Shylock Palaeochannel groundwater.

Completion Criteria

The mine manager shall ensure that operational drawdowns, monitored by site staff at 3 monthly intervals during operations, in wells W1A, W2A and W3A (shown in Figure 6.6) do not differ by more than 1 standard deviation from pre-mining drawdown predictions (as reviewed 4 months post dewatering start-up) presented in Table 32. Should operational drawdowns differ by more than 1 standard deviation from pre-mining predictions (as reviewed 4 months post dewatering start-up), the numerical groundwater model will be updated to confirm the time for full recovery to predicted post-mining groundwater levels.

The mine manager shall ensure that records demonstrate that monitoring of the water quality of the injectant (mine water) from the Pit Dewatering Dam during operation for Arsenic (As) shows As concentration of the injectant is consistently below 0.5 mg/L.

The Exploration Manager provides an audit on closure demonstrating that each exploration drill hole on the Mining Lease has been rehabilitated in accordance with Information Sheet M21, "Mineral exploration drillholes - General specifications for construction and backfilling" within 6 months of being drilled.

7.10 MINE WASTE MATERIALS

Potential Impact Event: mine waste materials left on site are not chemically and physically stable

This relates to domain 1 (infrastructure areas) domain 2 (tailings dam) and domain 3 (OWD).

Processing is by gravity separation only, with wastes from the processing plant being directed to the TSF. No chemicals will be added. Overburden and unmineralised materials are to be used in the construction of the abandonment bund, with the remainder being trucked to the overburden waste dump (OWD). Any potentially acid forming (PAF) materials will be encapsulated within the OWD and then covered by topsoil.

All disturbed areas will be covered with available topsoil and revegetated to prevent erosion.

Control and management strategies:

- Encapsulating PAF materials within the OWD (note: no PAF materials are planned to be mined)
- Drying tailings materials then backfilling the tailings dam
- Covering disturbed areas with topsoil and revegetating with locally derived seedstock
- Remediating chemical spill sites of spills greater than 20L to meet EPA standards

Outcome/Objective

All mine waste materials left on site are chemically and physically stable.

Completion Criteria

This outcome will be measured by the physical stability criteria.

The mine manager will ensure that a contaminant spill register demonstrates all chemical spill sites of spills greater than 20L have been rehabilitated to meet EPA standard within 48 hours of the spill, or longer time as agreed with DSD's Principal Mining Regulator

7.11 CLOSURE CRITERIA BREAKDOWN TABLE

Criteria breakdown tables for each potential impact event are presented in Table 34 below.

Havilah commits to reviewing measurement criteria at 6 monthly intervals with DSD from commencement of closure and providing any required updates to DMTIRE within two weeks of the review.

Table 34 Closure Criteria Breakdown Table

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
VISUAL AMENITY						
The external visual amenity of the site is acceptable as determined by the Director of Mines in consultation with relevant interested parties.	The Mine Manager ensures photo monitoring at locations P1 through to P15, inclusive, as shown in Figure 6.6 and listed in Table 31 at lease surrender shows visual amenity that is acceptable to the Director of Mines and that all buildings, plant, temporary stockpiles and equipment are removed from the site.	Visual Amenity	P1 through to P15, inclusive, as shown in Figure 6.6 and in Table 31	Visual amenity that is acceptable to the Director of Mines and that all buildings, plant, temporary stockpiles and equipment are removed from the site.	Lease surrender	N/A
RISKS TO HEALTH AND SAFETY						
The risks to the health and safety of the public and fauna	Audit carried out by a suitably qualified and experienced independent expert, prior to lease surrender verifies that:	Verification by reporting and				

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
are as low as reasonably practical.	• Construction of the tailings storage facility has occurred in accordance with construction design as summarised in Section 3.6.2 and Appendix O.	inspection during construction of the TSF cells.	TSF Cells	N/A	As required	N/A
	• The TSF cells are appropriately dried out sufficiently to undertake pastoral activity and have been capped and rehabilitated as shown in Figure 7.8 and Figure 7.9 and described in Section 7.11	Verification by inspection and reporting prior to and on completion of capping and rehabilitating the TSF cells.	TSF Cells	N/A	As required	N/A
	• The pit dewatering and raw water dams are backfilled and capped with topsoil.	Verification by reporting on completion of backfilling and rehabilitation	Raw water dam and Pit dewatering dam Pit Abandonment Bund	N/A	As required	N/A
	An independent geotechnical expert certifies prior to lease surrender that the pit abandonment bund (including a barrier across the entrance to the pit) has been located at least 10 m outside the long term stable pit wall collapse area, is 14m wide (at the base) and 3 m high (at the crest), with side slopes of 1V:2H	A site audit report to the satisfaction of DSD by an independent expert immediately prior to lease surrender shows that: • Warning signage is in place every 400 m along the		N/A	Immediately prior to lease surrender	N/A

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	and a crest width of 2.0 m and that is has been constructed with a core of locally won clay and a covering of imported rock 300mm to 500 mm thick. A site audit report to the satisfaction of DSD by an independent expert immediately prior to lease surrender shows that: • Warning signage is in place every 400 m along the abandonment bund adequately secured to posts, • All fencing has been removed, unless a written agreement to accept ongoing liability for maintenance is received from the pastoralist. • The long term risks to the health and safety of the public and fauna on closure remains as low as reasonably practical through the siting and construction of a safe, stable abandonment bund outside of the identified zone of potential instability of the pit	abandonment bund adequately secured to posts, • All fencing has been removed, unless a written agreement to accept ongoing liability for maintenance is received from the pastoralist. • The long term risks to the health and safety of the public and fauna on closure remains as low as reasonably practical through the siting and construction of a safe, stable abandonment bund outside of the identified zone of potential instability of the				

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	as described in Section 3.11.1 and which has been verified by an independent geotechnical expert prior to lease surrender.	pit as described in Section 3.11.1 and which has been verified by an independent geotechnical expert prior to lease surrender.				
ECOSYSTEM AND LANDSCAPE FUNCTION						
Ecosystem function and landscape function is resilient and self-sustaining at site closure.	An ecosystem function analysis undertaken by a suitably qualified independent consultant for each of Domains 1, 2 and 3 prior to lease surrender, shows that the condition and diversity of vegetation species is no worse at the date of surrender than for adjacent control sites (shown in Figure 6.6) for the respective functional group, or is similar to that prior to the commencement of operations (refer to baseline data in Sections 2.11 and 2.12), and that revegetation is resilient and trending towards sustainability. Target values for	Condition and diversity of vegetation species is no worse at the date of surrender than for adjacent control sites for the respective functional group, or is similar to that prior to the commencement of operations using an Ecosystem Functional Analysis	Domains 1, 2 and 3 within the Portia Mining Lease area	Target values for indicator EFA criteria, such as landscape stability, water and nutrient infiltration and nutrient recycling for each of the vegetation associations in Domains 1, 2 and 3 will be determined by a suitably qualified independent expert, based on landscape, soil type and vegetation community and	Prior to lease surrender	Baseline Data as described in Sections 2.11 and 2.12 or adjacent control sites for the respective functional group (shown in Figure 6.6)

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	indicator EFA criteria, such as landscape stability, water and nutrient infiltration and nutrient recycling for each of the vegetation associations in Domains 1, 2 and 3 will be determined by a suitably qualified independent expert, based on landscape, soil type and vegetation community and species to demonstrate that disturbance sites are being suitably rehabilitated and, therefore, that management of the site is sustainable.			species to demonstrate that disturbance sites are being suitably rehabilitated and, therefore, that management of the site is sustainable.		

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
PHYSICAL STABILITY						
The site is physically stable.	An audit by a suitably qualified and experienced independent expert, prior to lease surrender, shows that the OWD and TSF have been constructed as per sections 3.6.1 (OWD), 3.6.2 (TSF), and also in accordance with Figure 7.14 - Figure 7.17(OWD), and Figures Figure 7.8 and Figure 7.9 (TSF). An additional audit, by a suitably qualified and experienced independent expert (prior to lease surrender), shows that all domains have been revegetated in accordance with the sustainable closure strategies defined in Section 7.12.	Technical report demonstrates that the OWD and TSF have been constructed as per sections 3.6.1 (OWD), 3.6.2 (TSF) and also in accordance with Figure 7.14–Figure 7.17 (OWD), and Figures Figure 7.8 and Figure 7.9 (TSF). Technical report demonstrates that all domains have been revegetated.	OWD and TSF All domain areas within the Portia Mining Lease area	N/A N/A	Immediately prior to Lease surrender Immediately prior to Lease surrender	N/A N/A

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	Monthly monitoring of the central decant pond of the Tailings Storage Facility during operation shows that the decant pond does not exceed 10,000m^2 to allow adequate time for drying and consolidation for a trafficable tailings beach and appropriate rehabilitation.	Decant Pond Area	TSF Decant Ponds	10,000m^2	Monthly	N/A
GROUNDWATER						
No compromise in the quality and quantity of groundwater to existing users and no compromise to the environmental values of the Yarramba Palaeochannel groundwater	The mine manager shall ensure that operational drawdowns, monitored by site staff at 3 monthly intervals during operations, in wells W1A, W2A and W3A (shown in Figure 6.6) do not differ by more than 1 standard deviation from pre-mining drawdown predictions (as reviewed 4 months post dewatering start-up) presented in Table 32. Should operational drawdowns differ by more than 1 standard deviation from pre-mining predictions (as reviewed 4 months post dewatering start-up), the numerical groundwater	Field verification using Drawdown in metres (measurement by depth to water monitoring) and hydrogeological modelling to verify calibration and long term recovery scenario.	Monitoring wells W1A, W2A and W3A.	During operation, drawdown not to differ by more than 1 standard deviation of the values stated in Table 32. Should operational drawdowns differ by more than 1 standard deviation from pre-mining predictions (as reviewed 4 months post dewatering start-up), the numerical groundwater model	Quarterly during operation.	Table 32 (to be recalibrated within 4 months of operation)

Outcome	Outcome Measurement Criteria	What will be measured and form (method) of measurement	Locations	Target Value	Frequency	Control or baseline data
	model will be updated to confirm the time for full recovery to predicted post-mining groundwater levels.			will be updated to confirm the time for full recovery to predicted post-mining groundwater levels.		
	The Exploration Manager provides an audit on closure demonstrating that each exploration drill hole on the Mining Lease has been rehabilitated in accordance with Information Sheet M21, "Mineral exploration drillholes - General specifications for construction and backfilling" within 6 months of being drilled.	The rehabilitation of each drill hole, measurement by audit	Portia Mining Lease area	N/A	Prior to lease surrender	Information sheet M21
No compromise to the environmental values for the Shylock Palaeochannel system	The mine manager shall ensure that monitoring of the water quality of the injectant (mine water) from the Pit Dewatering Dam during operation for Arsenic (As) shows As concentration of the injectant is below 0.5 mg/L.	Measurement by sampling and analysis using an appropriately qualified laboratory for As	PDD	EPA guideline value developed for the watering of stock	Monthly during the first 3 months of operation and then at three monthly intervals thereafter	As 0.5 mg/L

MINE WASTE MATERIALS						
All mine waste materials left on site are chemically and physically stable.	**This outcome will be measured by the physical stability criteria**	Refer to Physical stability criteria	Refer to Physical stability criteria.	Refer to Physical stability criteria	Refer to Physical stability criteria	Refer to Physical stability criteria
	The mine manager will ensure that a contaminant spill register demonstrates all chemical spill sites of spills greater than 20L have been rehabilitated to meet EPA standard within 48 hours of the spill, or longer time as agreed with DSD's Principal Mining Regulator.	(measurement through spill register), spills greater than 20 L	Portia mining lease area.	Spills to be remediated to an appropriate EPA standard within 48 hours of the spill, or longer time as agreed with DSD's Principal Mining Regulator.	As required.	EPA Guideline *Environmental Management of On-Site Remediation*.

7.12 SUSTAINABLE CLOSURE STRATEGIES (CONTROL MEASURES)

The following closure strategies (control measures) are proposed for each domain:

Domain 1: Supporting site infrastructure

- remove all buildings (including camp and office), power supply lines, tanks, chemicals, waste water treatment systems, waste materials (in accordance with the site waste management plan), disconnect and terminate all services, fuel tanks and non-permanent bunding (e.g., fuel tank bunding) and fencing
- remove pumps, pipelines and power supply lines (to re-injection well field)
- cap and abandon all wells in accordance with DFW requirements
- break up and remove any concrete footings and dispose to the open pit
- remove landfill surface infrastructure, including fences, gates and unused stockpiles
- cap the landfill and compact the capping layer
- rip all hardstand and trafficked areas, including roads (but excluding the existing main access road)
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- grade windrows back over tracks or cleared areas
- place topsoil over all disturbed areas
- reshape or profile individual areas if necessary to blend in with surrounding areas and reduce erosion potential
- fill in related stormwater drains and retention structures
- seed all disturbed areas with local native grasses and shrubs

Domain 2: TSF and Plant and Infrastructure including ROM Pad Infrastructure

- dry tailings by exposure through thin layer deposition to enhance evaporation and consolidation.
- Remove pipework within Domain 2 and dispose of off site
- break up and remove any concrete footings and dispose to the open pit
- fill in TSF by pushing in the walls above the height of the tails and placing the stored capping material on to the dry tailings surface
- remove any remaining material stockpiled on the ROM pad to the Open Pit
- rip all hardstand and trafficked areas, including haulage roads and the internal road network contained within Domain 2
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- grade windrows back over tracks or cleared areas
- empty raw water dam and cut HDPE liner and bury
- infill the raw water dam using quaternary material and reshape/profile the footprint areas to existing topography
- fill in related stormwater drains and retention structures
- place topsoil on dam tops and sides, and on all other disturbed areas which have been stripped of top soil
- seed all disturbed areas with local native grasses and shrubs

Domain 3: OWD

- smooth / trim sides and top surfaces of the OWD
- rip along the contour of the OWD
- fill in related stormwater drains and retention structures to the OWD
- rip all hardstand and trafficked areas, including haulage roads and the internal road network contained within Domain 3
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- grade windrows back over tracks or cleared areas
- place topsoil on top and sides of the OWD and on other disturbed surfaces which have been stripped of topsoil contained within Domain 3
- seed all disturbed areas with local native grasses and shrubs

Domain 4: Pit

- remove any remaining stockpiles of gravel and construction materials and dispose of within the open pit
- rip all hardstand and trafficked areas, including haulage roads and the internal road network contained within Domain 4
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- remove pumps, discharge lines and power supply lines
- abandon all wells in accordance with DFW requirements
- empty pit dewatering dam and cut HDPE liner and bury
- infill the pit dewatering dam using quaternary material and reshape/profile the footprint areas to existing topography
- fill in related stormwater drains and retention structures
- allow pit walls to collapse to post mining angle of repose
- ensure abandonment bund has not been breached
- complete the abandonment bund
- place a barrier of waste rock across haul road entrance to the pit
- grade windrows back over tracks or cleared areas
- place topsoil on disturbed surfaces which have been stripped of topsoil contained within Domain 4, except the open pit
- seed all disturbed areas with local native grasses and shrubs except the pit
- install warning signage
- construct stock fencing outside the abandonment bund

Rehabilitation is to occur in 2 stages.

Stage 1 rehabilitation activities for Domain 1 are to include:

- remove all buildings, excluding the camp, office associated power supply lines and infrastructure and the landfill
- remove pumps, pipelines and power supply lines (to re-injection well field)
- cap and abandon all wells in accordance with DFW requirements
- break up and remove any concrete footings and dispose to the open pit

- rip all hardstand and trafficked areas, including roads (but excluding the existing main access road)
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- grade windrows back over tracks or cleared areas no longer in use
- place topsoil over disturbed areas no longer in use
- reshape or profile individual areas if necessary to blend in with surrounding areas and reduce erosion potential
- fill in related stormwater drains and retention structures
- seed all no longer used disturbed areas with local native grasses and shrubs

Stage 1 rehabilitation activities for Domain 2 will include:

- dry tailings by exposure through thin layer deposition to enhance evaporation and consolidation.
- Remove pipework within Domain 2 and dispose of off site
- fill in TSF by pushing in the walls above the height of the tails and placing the stored capping material on to the dry tailings surface
- remove any remaining material stockpiled on the ROM pad to the Open Pit
- break up and remove any concrete footings and dispose to the open pit
- rip all hardstand and trafficked areas, including haulage roads and the internal road network contained within Domain 2
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- grade windrows back over tracks or cleared areas
- empty raw water dam and cut HDPE liner and bury
- infill the raw water dam using quaternary material and reshape/profile the footprint areas to existing topography
- fill in related stormwater drains and retention structures
- place topsoil on dam tops and sides, and on all other disturbed areas which have been stripped of top soil
- seed all disturbed areas with local native grasses and shrubs

Stage 1 rehabilitation activities for Domain 3 will include:

- smooth / trim sides and top surfaces of the OWD
- rip along the contour of the OWD
- fill in related stormwater drains and retention structures to the OWD
- rip all hardstand and trafficked areas, including haulage roads and the internal road network contained within Domain 3
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- grade windrows back over tracks or cleared areas
- place topsoil on top and sides of the OWD and on other disturbed surfaces which have been stripped of topsoil contained within Domain 3
- seed all disturbed areas with local native grasses and shrubs

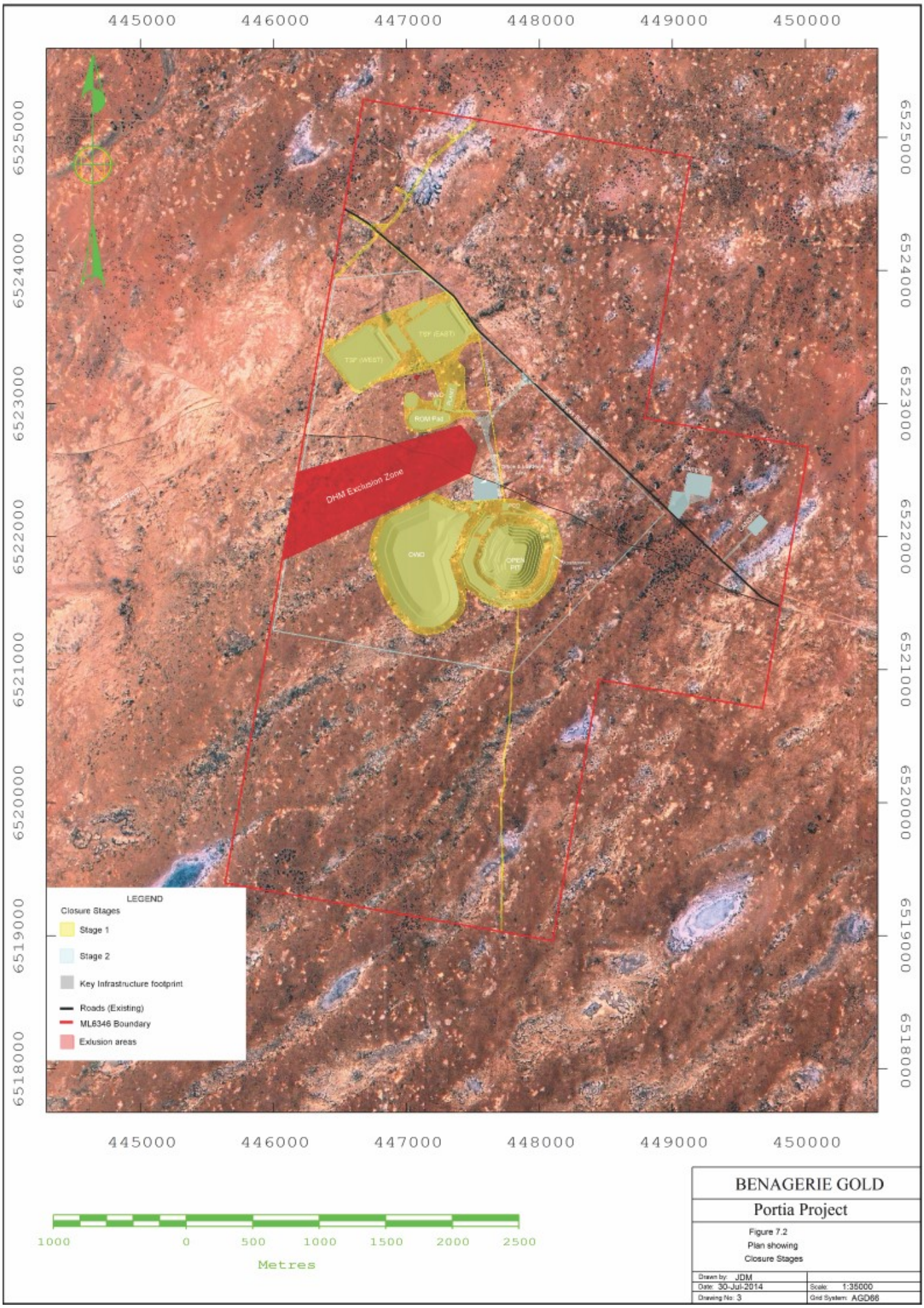
Stage 1 rehabilitation activities for Domain 4 will include:

- remove any remaining stockpiles of gravel and construction materials and dispose of within the open pit
- rip all hardstand and trafficked areas, including haulage roads and the internal road network contained within Domain 4
- scrape off any visual salt crust build up on trafficked areas, including roads and dispose to the open pit
- remove pumps, discharge lines and power supply lines
- abandon all wells in accordance with DFW requirements
- empty pit dewatering dam and cut HDPE liner and bury
- infill the pit dewatering dam using quaternary material and reshape/profile the footprint areas to existing topography
- fill in related stormwater drains and retention structures
- allow pit walls to collapse to post mining angle of repose
- ensure abandonment bund has not been breached
- complete the abandonment bund
- place a barrier of waste rock across haul road entrance to the pit
- grade windrows back over tracks or cleared areas
- place topsoil on disturbed surfaces which have been stripped of topsoil contained within Domain 4, except the open pit
- seed all disturbed areas with local native grasses and shrubs except the pit
- install warning signage
- construct stock fencing outside the abandonment bund

Stage 2 rehabilitation activities are to include:

- remove all buildings (e.g., camp, office), pipework, power supply lines, septic tanks, fuel tanks, fencing , and non-permanent bunding (e.g., fuel tank)
- remove landfill surface infrastructure, including fences, gates and unused stockpiles
- cap the landfill and compact the capping layer
- fill in any related and remaining stormwater drains and retention structures (e.g., office, camp, landfill)
- rip remaining trafficked hardstand and trafficked areas
- grade remaining windrows back over existing tracks or cleared areas
- place topsoil over all remaining disturbed areas
- seed all remaining disturbed areas with local native grasses and shrubs

Stage 2 rehabilitation will also include ongoing maintenance and restoration of areas rehabilitated in Stage 1 as required. These stages are visually described in Figure 7.2



BENAGERIE GOLD

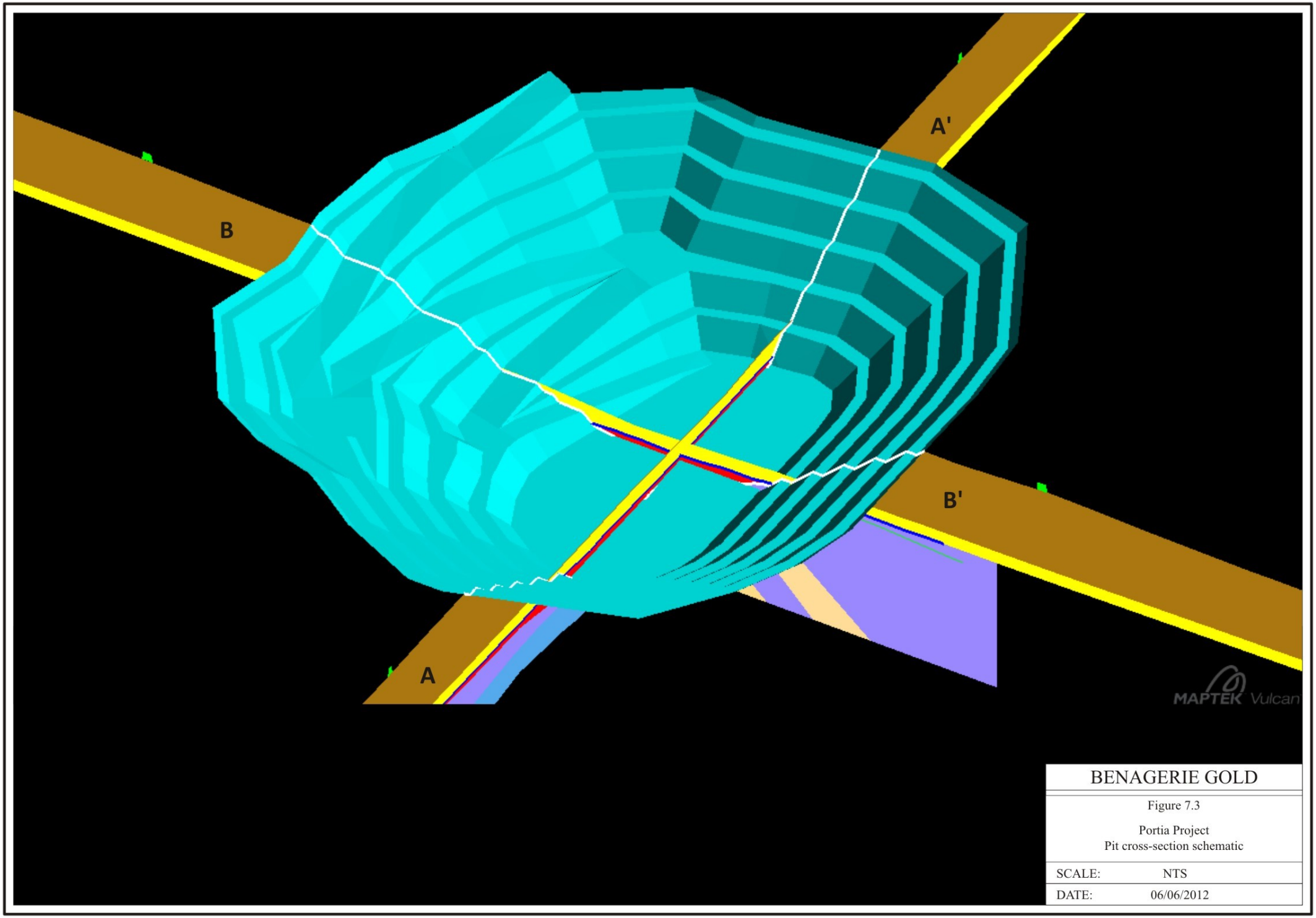
Portia Project

Figure 7.2
Plan showing
Closure Stages

Drawn by: JDM	
Date: 30-Jul-2014	Scale: 1:35000
Drawing No: 3	Grid System: AGD66

7.13 CLOSURE PLAN MAPS AND SECTIONS

Plans and Sections depicting the site layout on completion of Mining and Processing and on completion of Closure rehabilitation, have been included to show the intended final landforms resulting from mining and rehabilitation at Portia. These plans and sections are shown from Figure 7.3 through to Figure 7.17 inclusive.

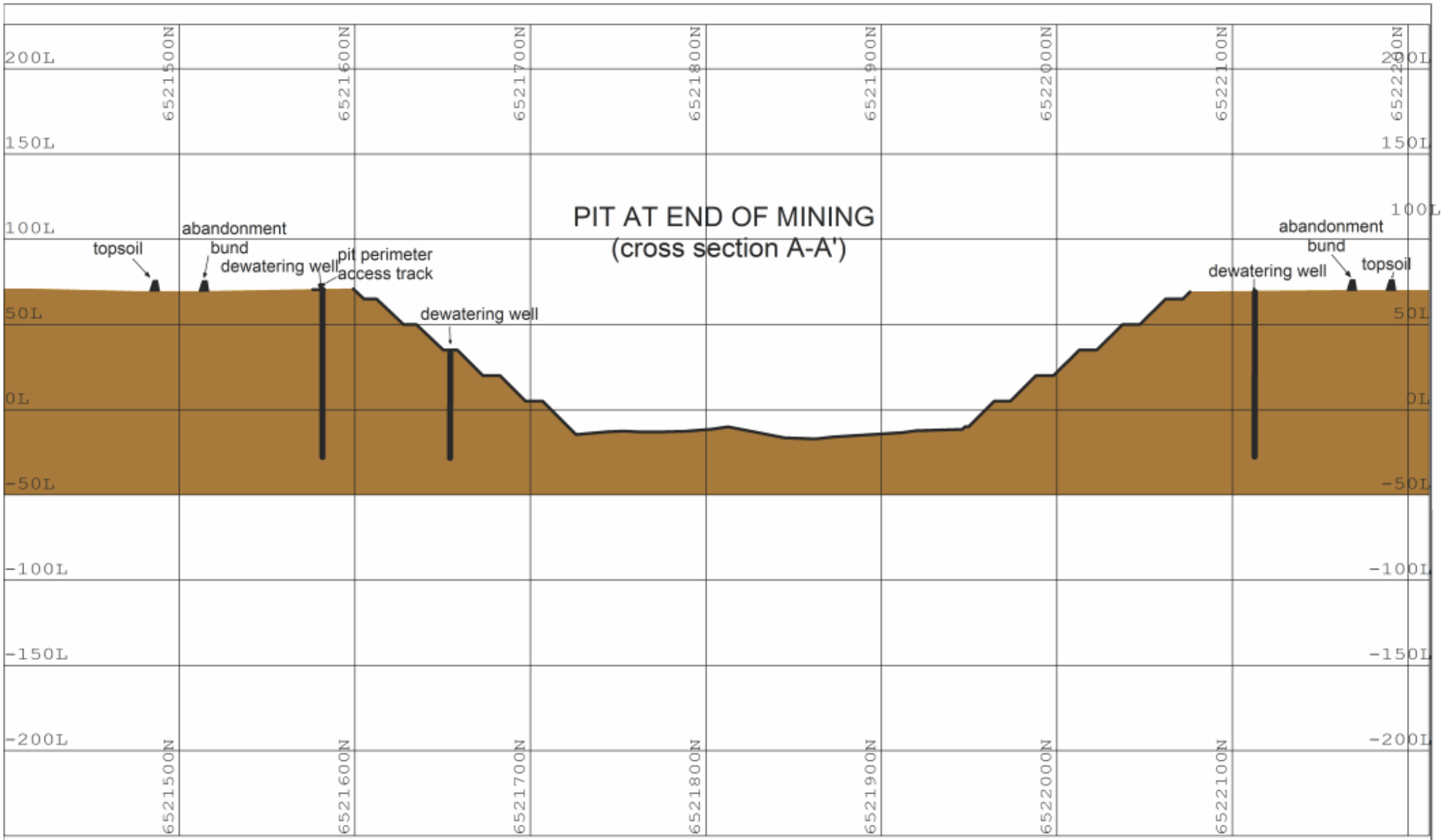


BENAGERIE GOLD

Figure 7.3

Portia Project
Pit cross-section schematic

SCALE:	NTS
DATE:	06/06/2012



Revision	Date
Rev 2	17/12/19

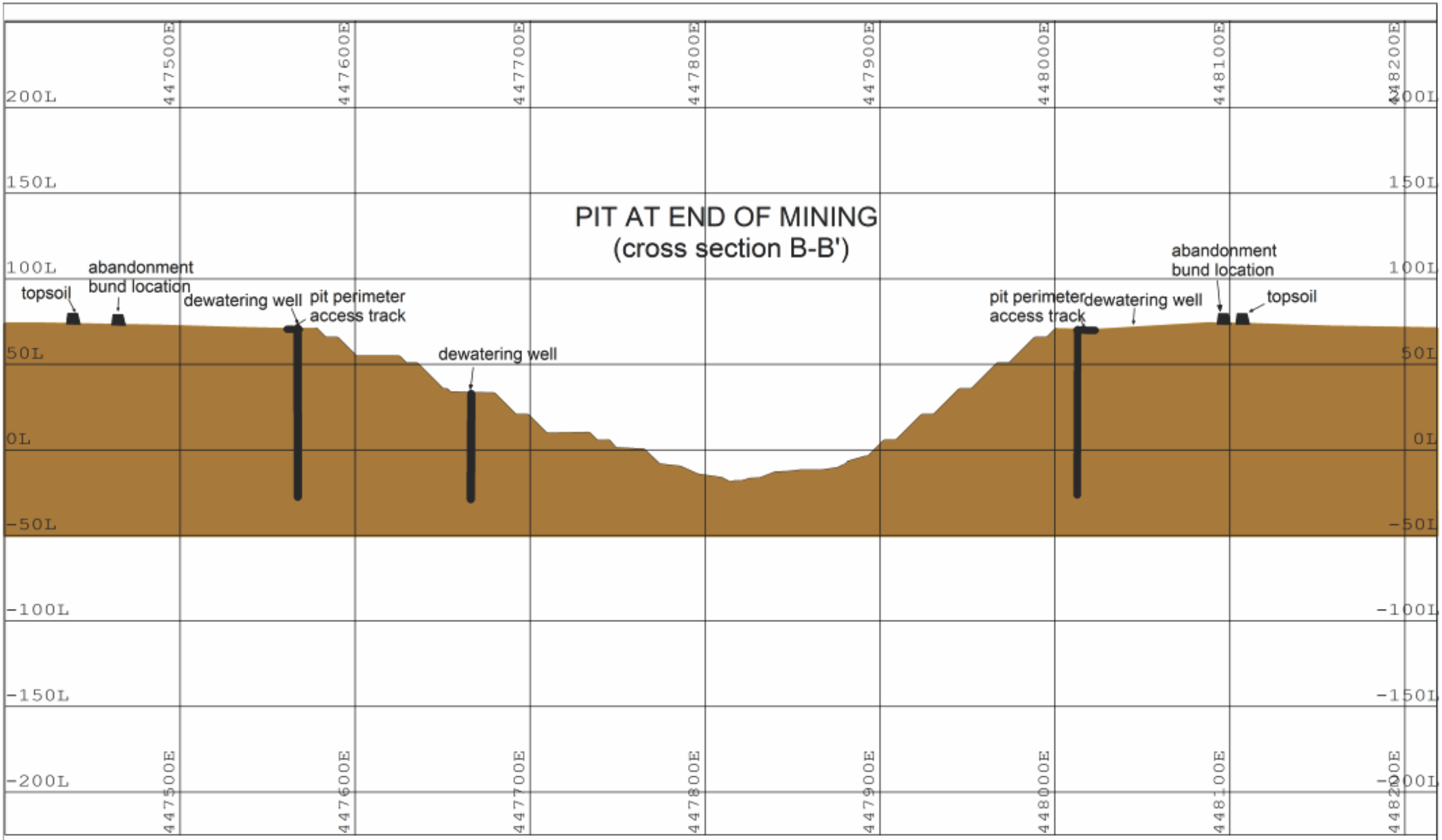
BENAGERIE GOLD

Portia Project

Figure 7.4
Cross-section A-A' of pit on closure

Grid system AGD 66

Scale 1:3000



40 0 20 40 60 80 100

Metres

Revision	Date
Rev 2	17/12/13

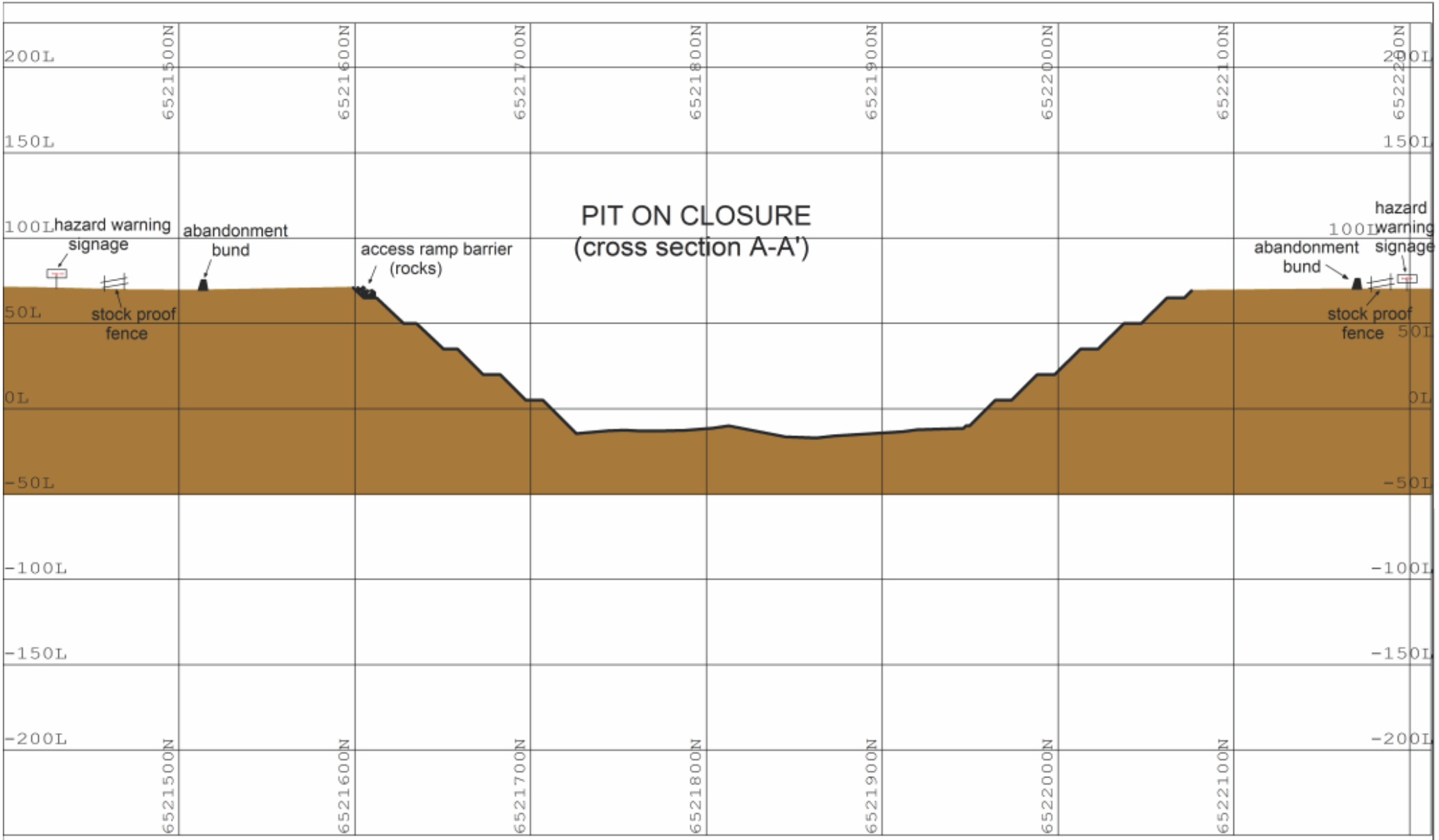
BENAGERIE GOLD

Portia Project

Figure 7.5
Cross-section B-B' of pit at end of mining

Grid system AGD 66

Scale 1:3000



40 0 20 40 60 80 100

Metres

Revision	Date
Rev 2	17/12/19

BENAGERIE GOLD

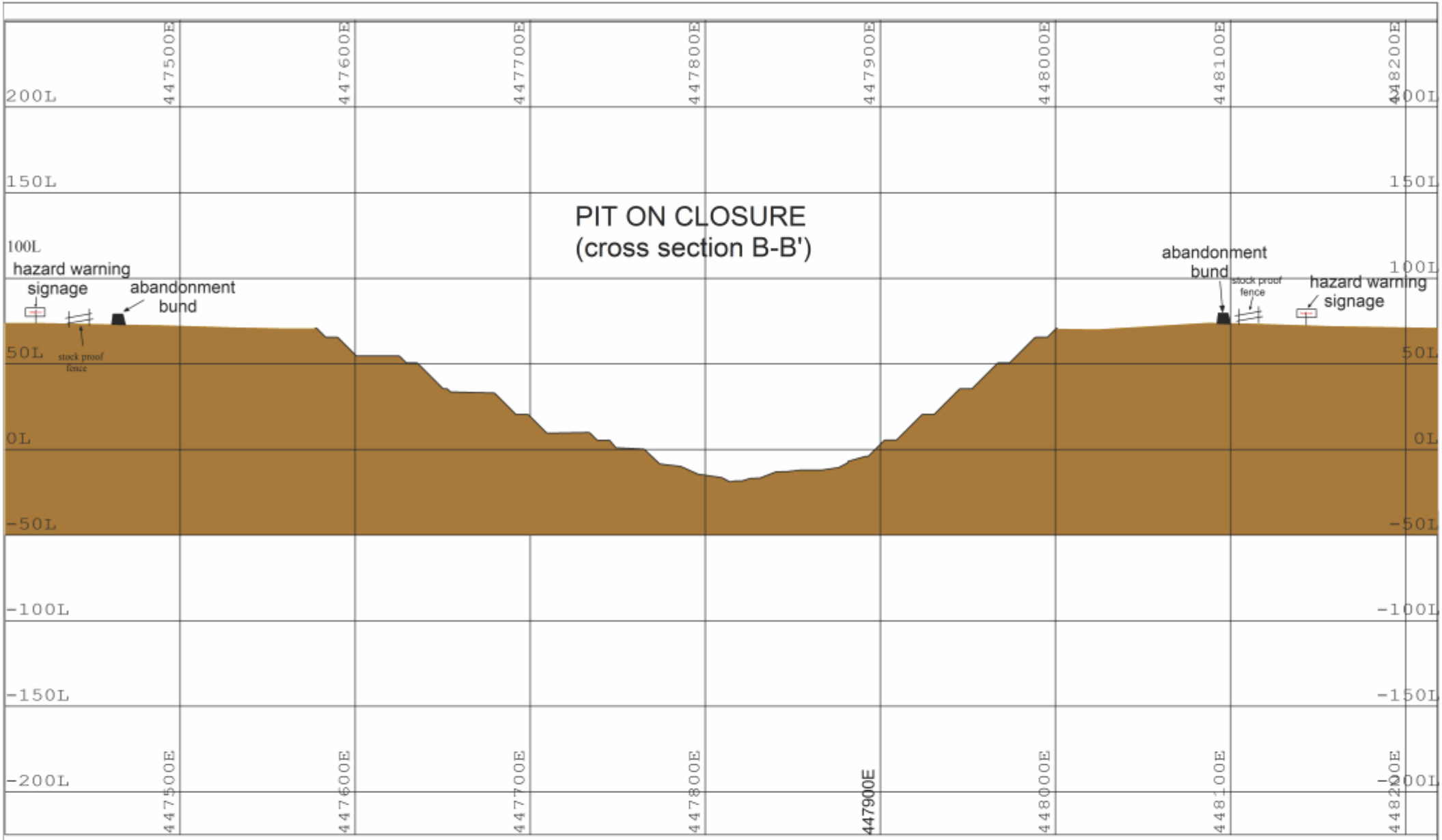
Portia Project

Figure 7.6
Cross-section A-A' of pit on Closure

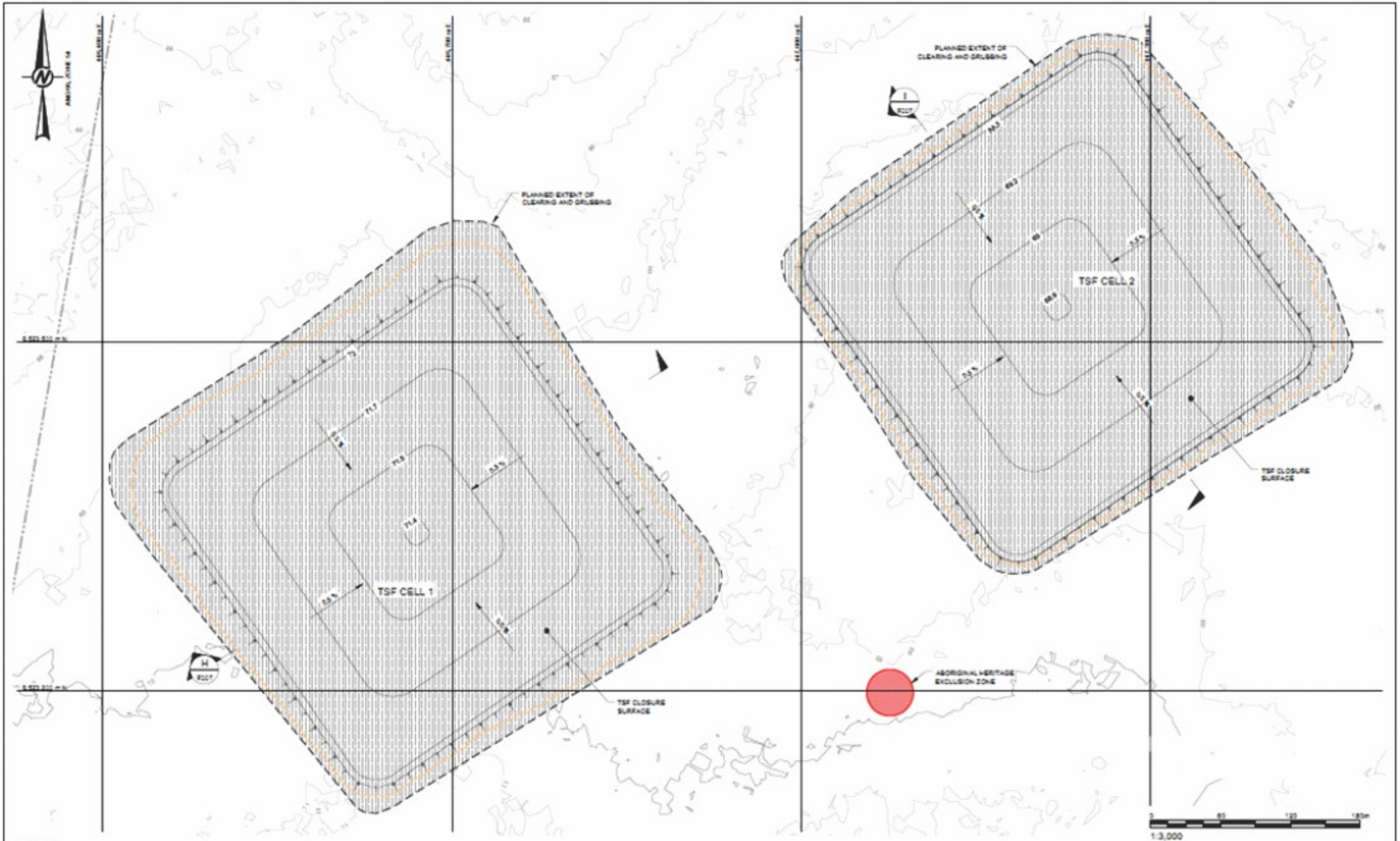
Grid system AGD 66

Scale 1:3000

MAPTEK Vulcan



BENAGERIE GOLD	
Portia Project	
Figure 7.7 Cross-section B-B' of pit on closure	
Grid system AGD 66	Scale 1:3000



LEGEND

PLANNED EXTENT OF CLEARING AND GRUBBING

MINING LEASE BOUNDARY

TOPOGRAPHICAL CONTOUR AND ELEVATION (AHD)

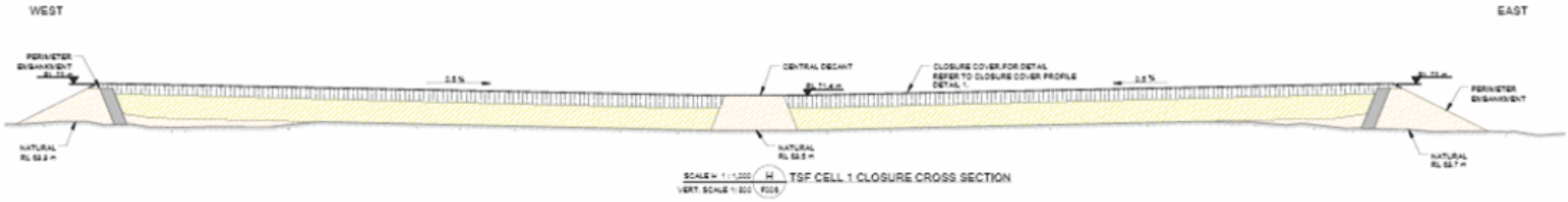
CLOSURE SURFACE

DRAWING TAKEN FROM HAVILAH RESOURCES, golder dtf.dwg DATED 08.01.2013
SITE_LAYOUT.dwg DATED 07.05.2013 AND NATURAL SURFACE surve_dtf.dtf DATED08.01.2013

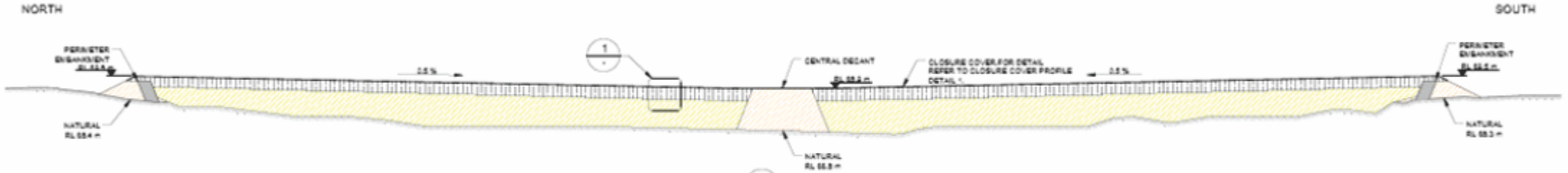
Golder Associates

www.golder.com
GOLDER ASSOCIATES PTY. LTD.

CLIENT: HAVILAH RESOURCES NL		PROJECT: PORTIA TAILINGS STORAGE FACILITY						
DRAWN BY: M. CALDAROLA	DATE: 09.05.2013	DRAWING TITLE: CLOSURE PLAN						
CHECKED BY: P. CHAPMAN	DATE: 09.05.2013							
SCALE: 1 : 3,000	SHEET SIZE: A3	PROJECT No: 137665006	DOC No: 002	DOC TYPE: R	PHASE No: F006	REV No: 1	FIGURE 6	



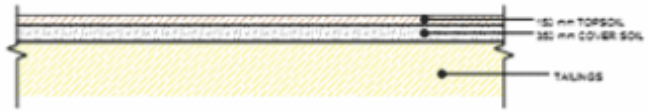
H TSF CELL 1 CLOSURE CROSS SECTION



I TSF CELL 2 CLOSURE CROSS SECTION

NOTES:

1. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD).
2. ALL CO-ORDINATES ARE IN METRES TO AUSTRALIA MAP GRID (AMG 66).
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.



1 CLOSURE COVER DETAIL

1:100

1:200

1:1,000

LAYOUT PROVIDED BY HAVILAH RESOURCES, golder dxf.dwg DATED 09.01.2013
SITE_LAYOUT.dwg DATED 27.05.2013 AND NATURAL SURFACE sorte_grid.dxf DATED08.01.2013

Golder Associates

CLIENT: HAVILAH RESOURCES NL
PROJECT: PORTIA TAILINGS STORAGE FACILITY
DRAWN BY: M. CALDAROLA — DATE: 09.05.2013
CHECKED BY: P. ClearRican — DATE: 09.05.2013
DRAWING TITLE: FIGURE 7.9 CLOSURE CROSS SECTIONS
SCALE: AS SHOWN
SHEET SIZE: A3
PROJECT No: 137665008
DOC No: 002
DOC TYPE: R
FILE No: F007
REV No: 1
FIGURE 7

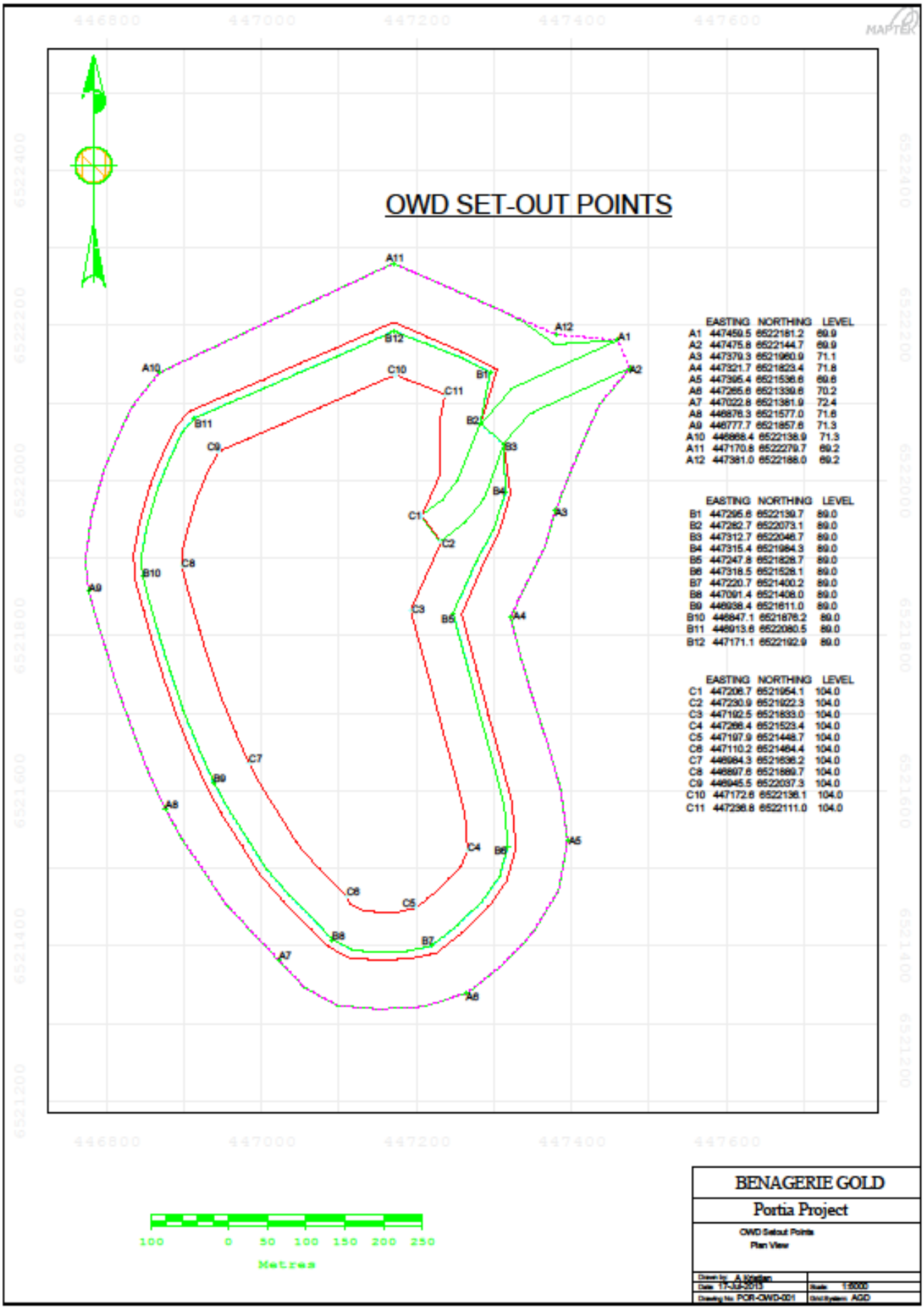


Figure 7.10 OWD Construction set-out points

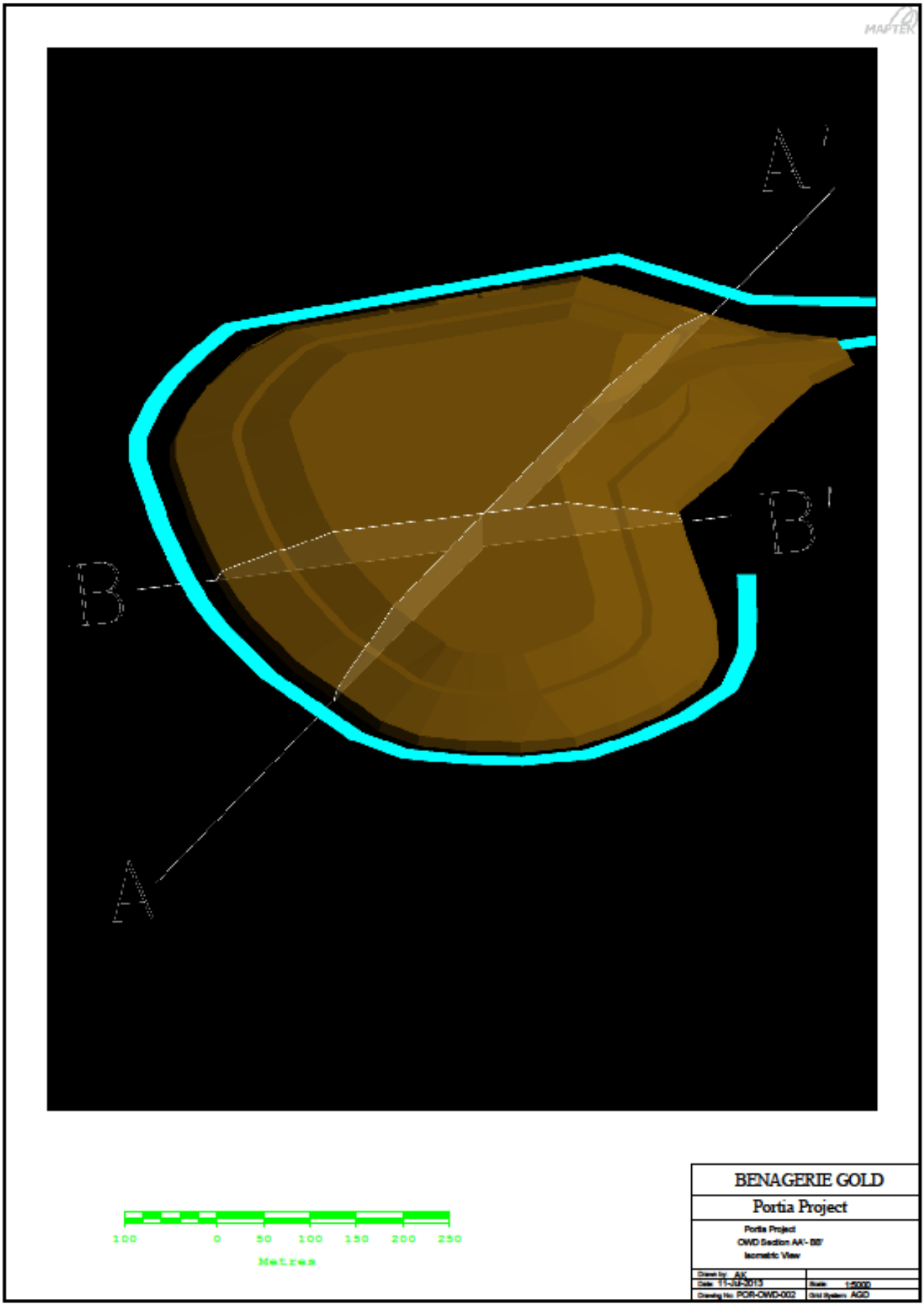
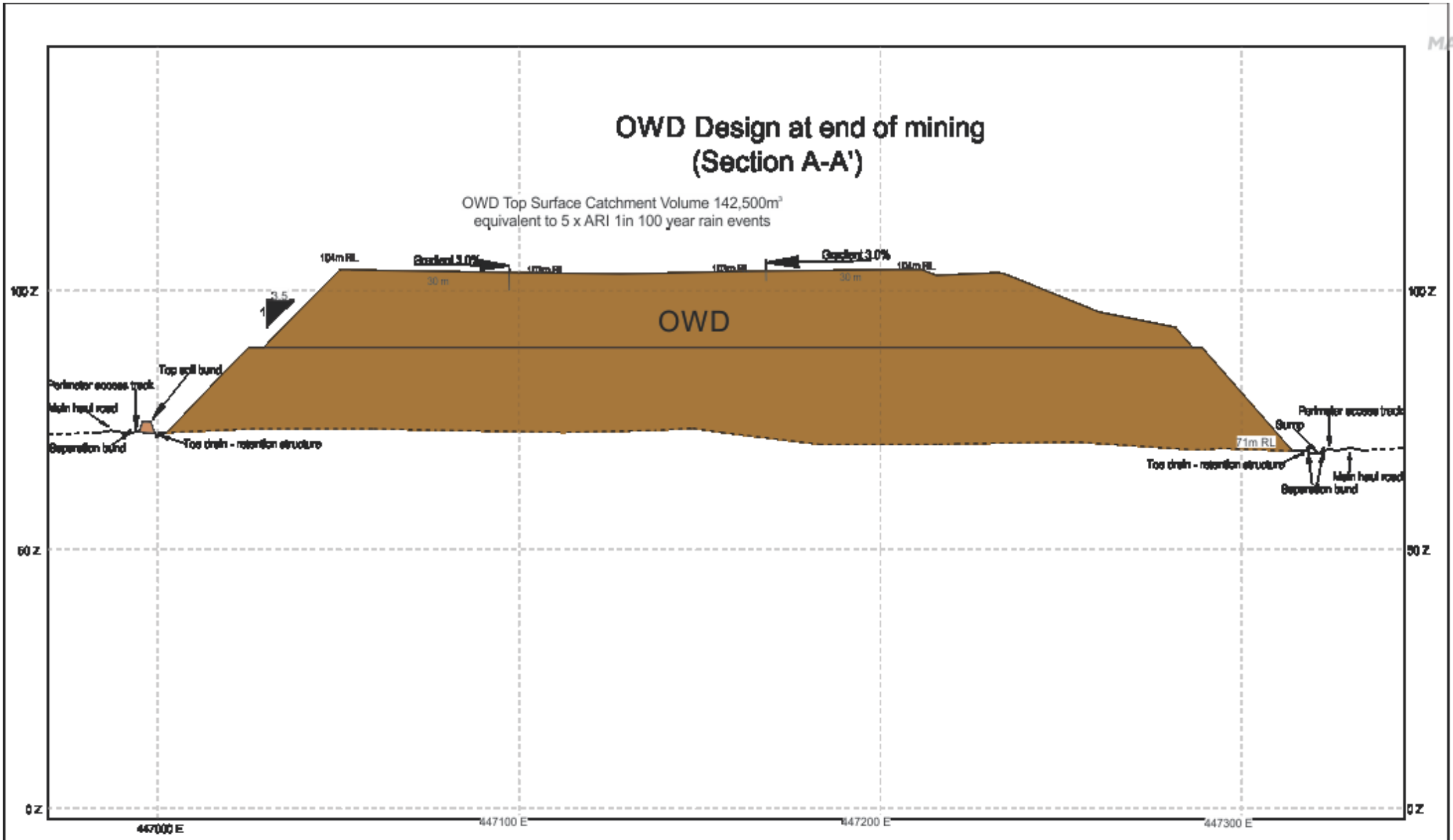


Figure 7.11 OWD Schematic showing cross section locations



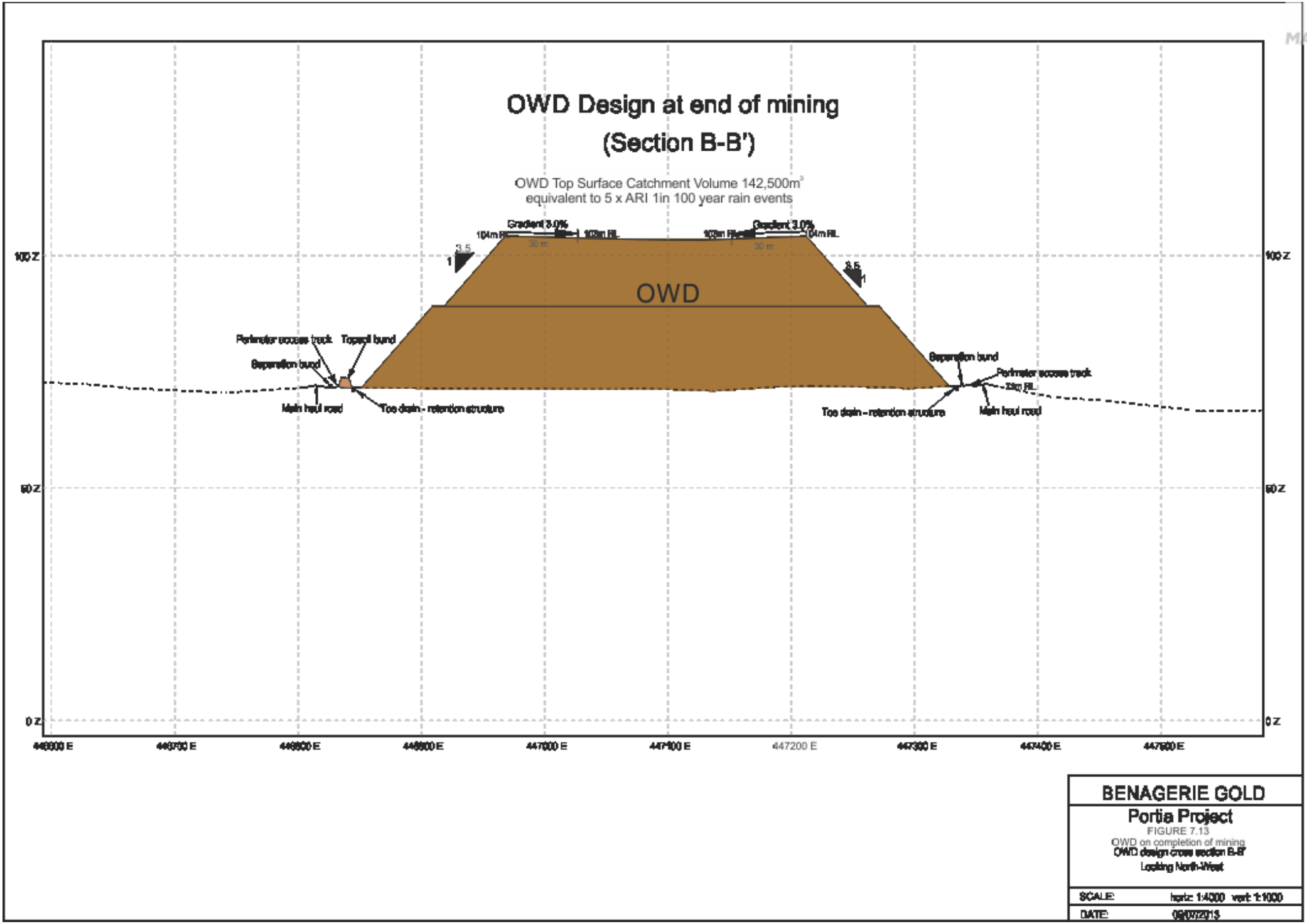
BENAGERIE GOLD

Perlia Project

FIGURE 7.12
OWD on completion of mining

OWD design cross section A-A'
Looking North-West

SCALE:	horiz 1:4000 vert 1:1000
DATE:	09/07/2015



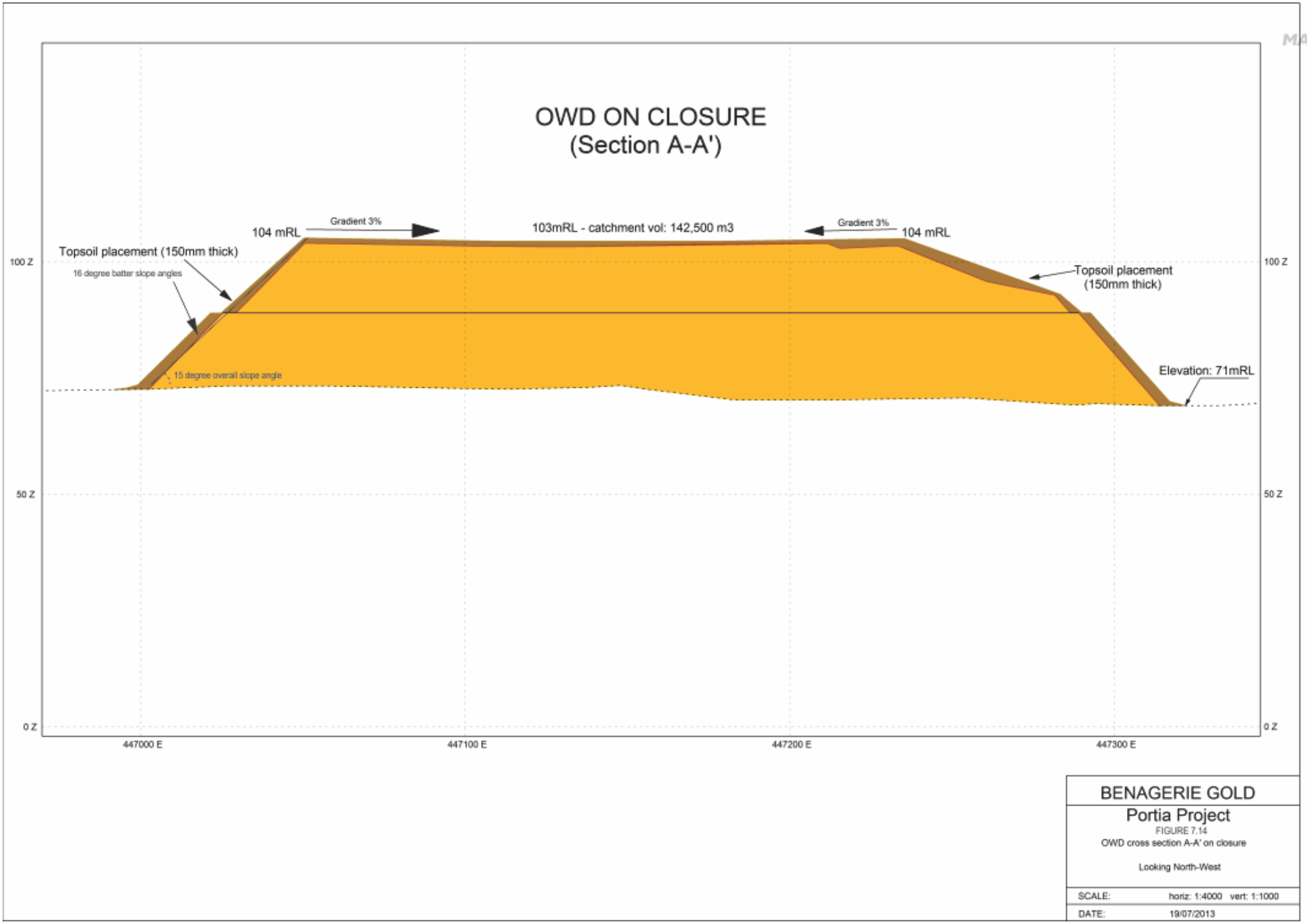
BENAGERIE GOLD

Portia Project

FIGURE 7.13

OWD on completion of mining
OWD design cross section B-B'
Looking North-West

SCALE:	horiz 1:4000 vert 1:1000
DATE:	09/07/2015



BENAGERIE GOLD

Portia Project

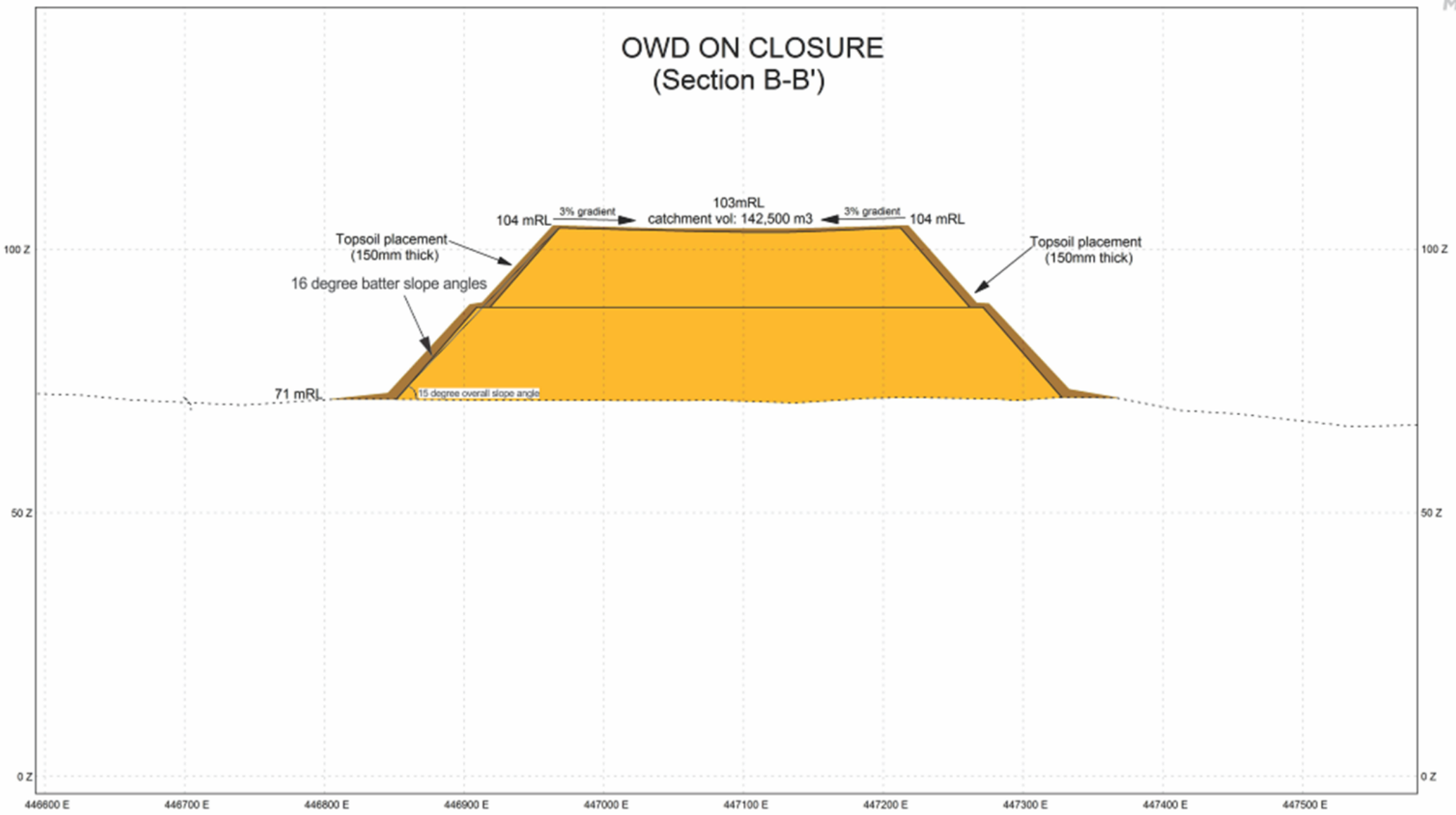
FIGURE 7.14

OWD cross section A-A' on closure

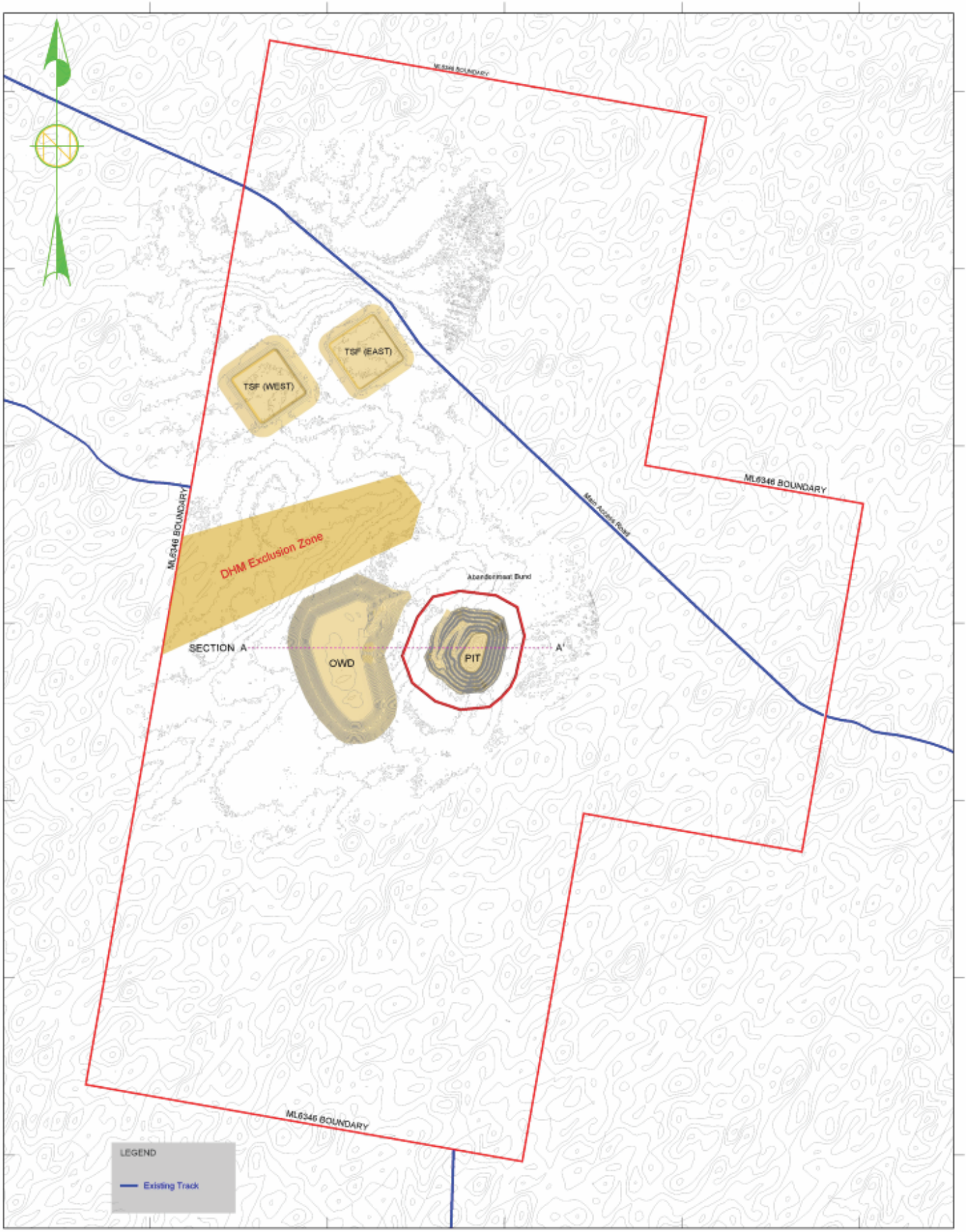
Looking North-West

SCALE:	horiz: 1:4000 vert: 1:1000
DATE:	19/07/2013

OWD ON CLOSURE
(Section B-B')



BENAGERIE GOLD	
Portia Project	
FIGURE 7.15	
OWD cross section B-B' on closure	
Looking North-West	
SCALE:	horiz: 1:4000 vert: 1:1000
DATE:	19/07/2013

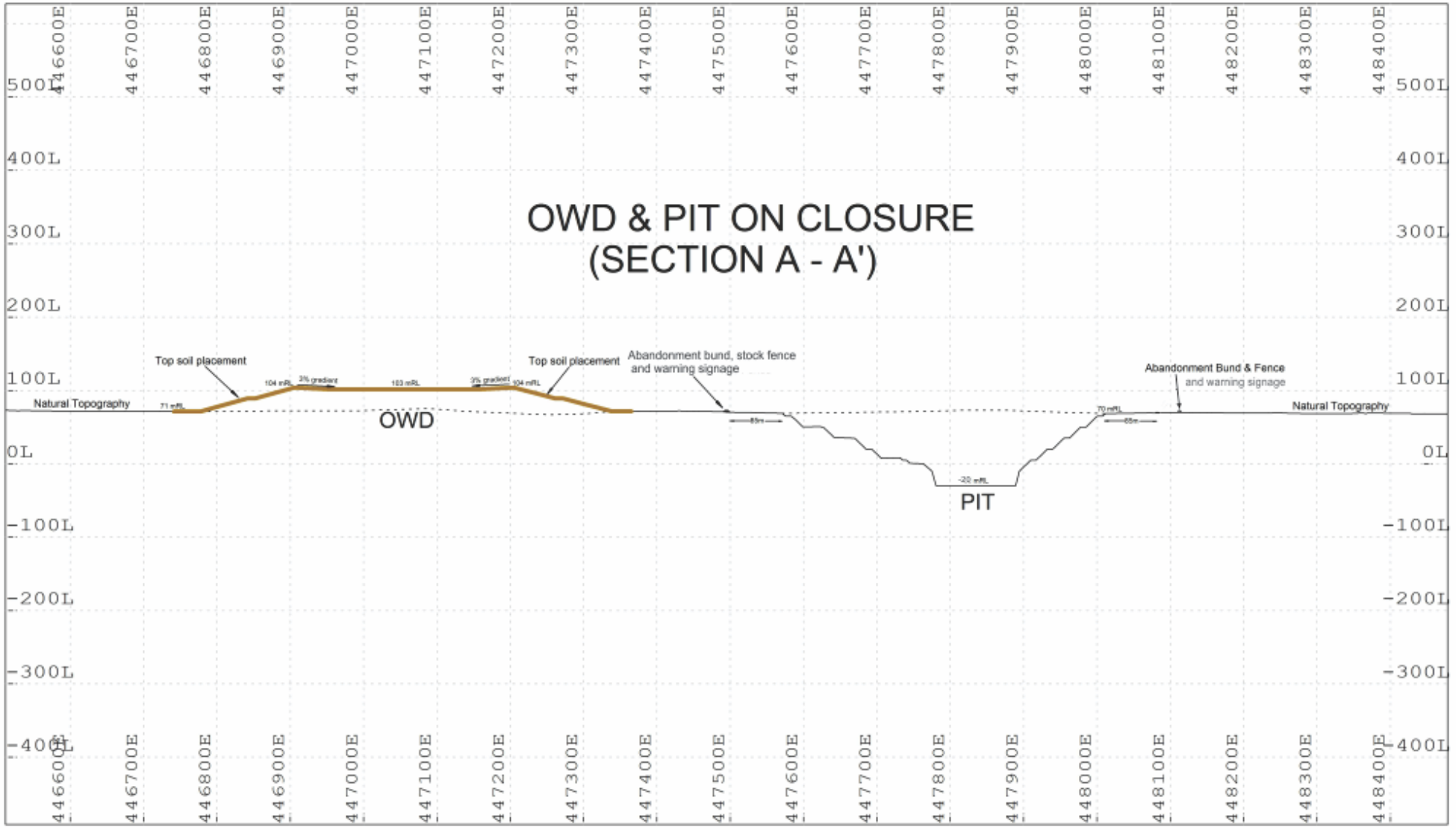


BENAGERIE GOLD

Portia Project

FIGURE 7.19
SITE CLOSURE CONTOUR PLAN
A4

Drawn by: A Kristian	
Date: 24-Oct-2013	Scale: 1:30000
Drawing No: POR-PEPR-10	Grid System: AGD



200 0 100 200 300 400 500

Metres

BENAGERIE GOLD

Portia Project

FIGURE 7.17
SECTION A-A' LOOKING NORTH
SHOWING OWD, PIT AND
ABANDONMENT BUND

Drawn by: A KRISTIAN	SCALE:
Date: 23-Oct-2013	horiz: 1:6000 vert: 1:2000
Drawing No: POR-OWD-07	Grid System: AGD

7.14 COMPLETION RISK ASSESSMENT

Closure risks may include:

- sudden closure of the mine due to unforeseen market changes,
- unsuccessful rehabilitation, and
- climatic impacts.

Risk assessments for each are presented below.

Potential Impact Event: the mine is closed due to unforseen market changes.

Control and management strategies:

- The bond payment will cover all anticipated rehabilitation costs in the event of premature mine closure and company insolvency.

Likelihood and severity of consequences

It is possible that mining operations could cease before mining has been completed due to changes in market (i.e., the gold price). Risks to closure will, however be reduced by the control measure stated above.

Risk Levels

Risk levels for closure of the mine due to market changes are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Closure of the mine due to market changes	unlikely	major	control measures as outlined above	unlikely	minor	low	yes

Justification for risk acceptance

From the risk analysis above, market changes will not affect the effective outcome of closure, as the bond will cover all anticipated closure costs.

Potential Impact Event: unsuccessful rehabilitation activities

Control and management strategies:

- Best practice procedures will be employed in the rehabilitation work to prevent this possibility. In addition, as Havilah is working in the area on its other projects, it will continue to monitor the site and take such remedial action as may be required to produce acceptable outcomes.
- A contingency sum will be allocated to cover for additional remedial activities.

Likelihood and severity of consequences

It is possible that rehabilitation activities may not achieve the required closure outcomes. Risks to closure will, however be reduced by the control measure stated above.

Risk Levels

Risk levels for closure of the mine due to poor management of rehabilitation are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
poor management of rehabilitation	unlikely	minor	control measures as outlined above	unlikely	minor	low	yes

Justification for risk acceptance

From the risk analysis above, poor management of rehabilitation will not affect closure, as a contingency is budgeted to cover ongoing monitoring and any additional remedial activities.

Potential Impact Event: Climatic impacts

Control and management strategies:

- Successive dry seasons or droughts will delay the revegetation process. Havilah's ongoing monitoring will determine what remedial actions are required. Costs will be provided for in the contingency budget.

Likelihood and severity of consequences

It is possible that negative climatic impacts could impact rehabilitation of the site, both through drought and flood. Risks to closure will, however be reduced by the control measure stated above.

Risk Levels

Risk levels for closure of the mine due to climatic impacts are presented in the following table.

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measures	Residual Risk After Implementation of Controls		Level of Risk	ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Climatic impacts	possible	minor	control measures as outlined above	rare	minor	low	yes

Justification for risk acceptance

From the risk analysis above, climate impacts will not affect the closure outcome, as the contingency budget will be used to cover costs associated with all required remedial works.

7.15 CLOSURE COST ESTIMATE

The cost estimate for rehabilitation of the Portia site has been prepared using the Victorian Department of Primary Industries Rehabilitation Cost Calculation Tool. The cost estimate is based on the assumption that a third party undertakes the rehabilitation and decommissioning works at the end of mine life and that there is no revenue from resaleable items.

The estimated rehabilitation cost is $1,833,000.00. The costing spreadsheet is presented as Appendix L.

Provision will be made in company accounts for funding of the closure of the site.

Public liability insurance is currently in place for mineral exploration at Portia. This cover will continue (with modifications as appropriate) to cover the operations until lease surrender.

7.16 MINE CLOSURE SCHEDULE

The mine closure activity schedule for site closure based upon completion of rehabilitation in accordance with the closure strategy plan outlined in Section 7.12, is illustrated in Table 35 over.

It assumes completion of all stage one rehabilitation activities shall be completed within 2 years of cessation of operation. The rehabilitation schedule critical path lies on the closure of Domain 2 which contains the TSF. The design and operation methodology of the TSF will enable closure works of this facility to be commenced within the first year of the rehabilitation schedule and completed within the second year of rehabilitation.

Closure and rehabilitation will be coordinated by Benagerie Gold, using in-house staff, staff from affiliated companies and contractors/consultants as required. The General Manager (Benagerie Gold) will be responsible for the successful implementation of the closure strategy. It is acknowledged that vegetation may take a number of years to successfully re-establish. Monitoring and maintenance will be carried out by Benagerie Gold personnel on an as-required basis until lease surrender.

Table 35 Mine closure activity schedule

Closure Activity Schedule	Month (Year 1)												Subsequent years			
	1	2	3	4	5	6	7	8	9	10	11	12	2	3	4	5
Stage 1																
Domain 1 - Supporting Site Infrastructure																
Domain 2 - TSF and Process Plant Infrastructure																
Domain 3 - OWD																
Domain 4 - Pit and Pit dewatering infrastructure																
Stage 2																
Domain 1 - Supporting Site Infrastructure																
Domain 2 - TSF and Process Plant Infrastructure																
Domain 3 - OWD																
Domain 4 - Pit and Pit dewatering infrastructure																
Ongoing maintenance and Monitoring																
Lease relinquishment																

8 Management Systems and Capability

This section outlines Benagerie Gold's management systems and capability relevant to the Portia operations.

8.1 COMMITMENT AND LEADERSHIP

Benagerie Gold has established corporate principles and a number of policies that define how its operations should be conducted. The Health Safety and Environment (HSE) Management procedures are built on the environment and safety policies and a set of guiding principles described below.

A centrepiece of Benagerie Gold's management approach is leadership. As new staff and contractors are engaged for the proposed operations, they will be required to include workplace HSE in role descriptions and to develop individual safety plans to improve the company's HSE performance.

The Benagerie Gold management team is actively involved in project work and regularly conducts site inspections and safety interactions.

A General Manager has been appointed for the Portia project. He will be supported by staff responsible for HSE management under the direction of the Board. The General Manager will be responsible for ensuring that core company values are maintained by all staff (including contractors).

8.2 POLICIES AND OBJECTIVES

Benagerie Gold has established corporate principles and a number of policies that define how its operations should be conducted. The Health Safety and Environment (HSE) Management procedures are built on the environment and safety policies and a set of guiding principles described below.

The Havilah Resources (parent company) Employee handbook, HSE manual and induction booklet are presented in Appendix M in the digital version of this document. They are too lengthy to include in the hardcopy, but have previously been provided in hard copy with the Mining Lease Proposal document.

Environment Policy

Benagerie Gold balances its economic and environmental values and builds systems to identify, assess and manage environmental risk at each stage of exploration, development, operation and closure. Thus to ensure the standards of environmental performance to which it is committed, Benagerie Gold:

- conducts operations, as a minimum, in compliance with all relevant environmental regulations, licences and legislation;
- identifies, monitors and manages environmental risks arising from its operations;
- seeks continuous performance improvement in environmental management, production processes, waste management and the use of resources;
- sets and periodically reviews objectives and targets which relate to environmental management;
- provides appropriate training and awareness for all employees on environmental issues;

- communicates regularly with employees about its aim and about the responsibilities of individuals; and
- communicates with shareholders and the community about its environmental performance and contributes to the development of laws and regulations which may affect its business.

An environmentally responsible culture is promoted at all locations and Benagerie Gold's environmental team works closely with employees and stakeholders to ensure environmental matters are considered in all aspects of the company's work. Benagerie Gold believes in the principles that:

- all environmental incidents are preventable, and
- environmental performance can always improve.

Benagerie Gold's Environmental Policy document presented below.

ENVIRONMENTAL POLICY - BENAGERIE GOLD

Benagerie Gold is committed to conducting all its operations in an environmentally responsible manner.

The Company plans and manages its activities in a manner that will minimize disturbance to the environments in which it operates.

To fulfill the above objectives the company uses its best endeavors to:

- Accept, establish and maintain, environmental standards consistent with developments in technology, industry codes of practice and all relevant statutory requirements.
- Co-operate with government authorities, environmental groups, landowners and any other stakeholders in the formulation and application of rational and practical environmental guidelines and legislation.
- Protect native flora and fauna in all spheres of its operations.
- Avoid the pollution of land, water and air.
- In the absence of specific requirements adopt the most practical means of preventing harmful environmental effects.
- Avoid disturbance to known sites of archaeological, historical, natural and scientific significance.
- Manage operations so that the area is open to multiple legitimate land users.
- Maintain an active rehabilitation program to restore areas to a condition which is compatible with the prior land use.
- Inform all employees and contractors of this policy and of their responsibilities in ensuring the company environmental objectives are met.

The aim of the Environmental Policy is to provide realistic and achievable guidelines for all personnel involved in the company's activities.

Chris Giles

Technical Director

March 2011

Safety Policy

The health, safety and wellbeing of Benagerie Gold's people, contractors, suppliers, visitors and host communities are key values for the company. Benagerie Gold is committed to ensuring the highest standards of occupational health and safety management at its operations.

Benagerie Gold follows a multi-layered approach to health, safety and environmental management. This involves:

- visible leadership,
- safety management controls,
- behaviour and awareness, and
- emergency response.

Benagerie Gold's philosophy is that all personnel share the responsibility for a safe workplace. Benagerie Gold personnel ensure that a healthy and safe workplace is maintained and that their activities are carried out in the manner required by the appropriate legislation and company standards. This is achieved by:

- ongoing training and supervision,
- ongoing accident prevention awareness and hazard control,
- safe operating procedures,
- wearing protective clothing and equipment, and
- maintaining facilities for immediate care of employees.

Benagerie Gold's fitness for work policy is designed to further promote wellbeing and a safe workplace by addressing drug, alcohol and fatigue related issues.

HSE Objectives

The Health, Safety and Environment Management objectives are:

- zero fatalities and injuries,
- zero cases of occupational illness, and
- zero infringements.

HSE Guiding Principles

The Health Safety and Environmental guiding principles are:

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

HSE and Risk Management Systems

Havilah Resource's group-wide HSE program provides a solid framework for all aspects of safety and environmental management at Portia (ref Appendix M).

This system works on a continuous improvement model and focuses on risk management and is closely monitored by Management. The Portia project will be required to report monthly on its HSE performance, compliance and on any incidents that require investigation. It is also required to report on safety meetings, workplace inspections and internal audits or reviews.

As noted earlier, the environmental risks for the Portia operation have been identified and assessed as low risk with mitigation measures prescribed.

Behaviour and Awareness

Benagerie Gold is acutely aware of the impact of behaviour and attitude of employees to HSE aspects of exploration and mining developments. It will endeavour to instil in its workforce a code of behaviour which optimises HSE outcomes.

Emergency Response

Benagerie Gold has developed emergency response programs that include information system recovery, emergency response management, and call centre requirements.

In line with industry requirements and best practices, Benagerie Gold has developed an Emergency Response Plan which includes a General Contacts Directory for the Portia operations (refer Appendix M). This plan draws on existing emergency response capabilities at Broken Hill (e.g., Flying Doctor) and within the Havilah Group.

8.3 ORGANISATION, RESOURCES AND DOCUMENTATION

The following resources will be made available to ensure that the compliance system operates effectively:

- The General Manager, reporting to the Board, will be accountable for ensuring compliance with lease conditions, management plans and environmental policies and objectives
- The Site Manager, reporting to the General Manager, will be directly responsible for the HSE performance of operations and ensuring that compliance requirements are effectively implemented
- Environmental Manager. The Environmental Manager will coordinate all environmental management and reporting activities for the Portia operation
- Environmental staff will assist the environmental manager in conducting environmental management and monitoring activities.

The nominated organization structure for mining at Portia is presented in Figure 8.1.

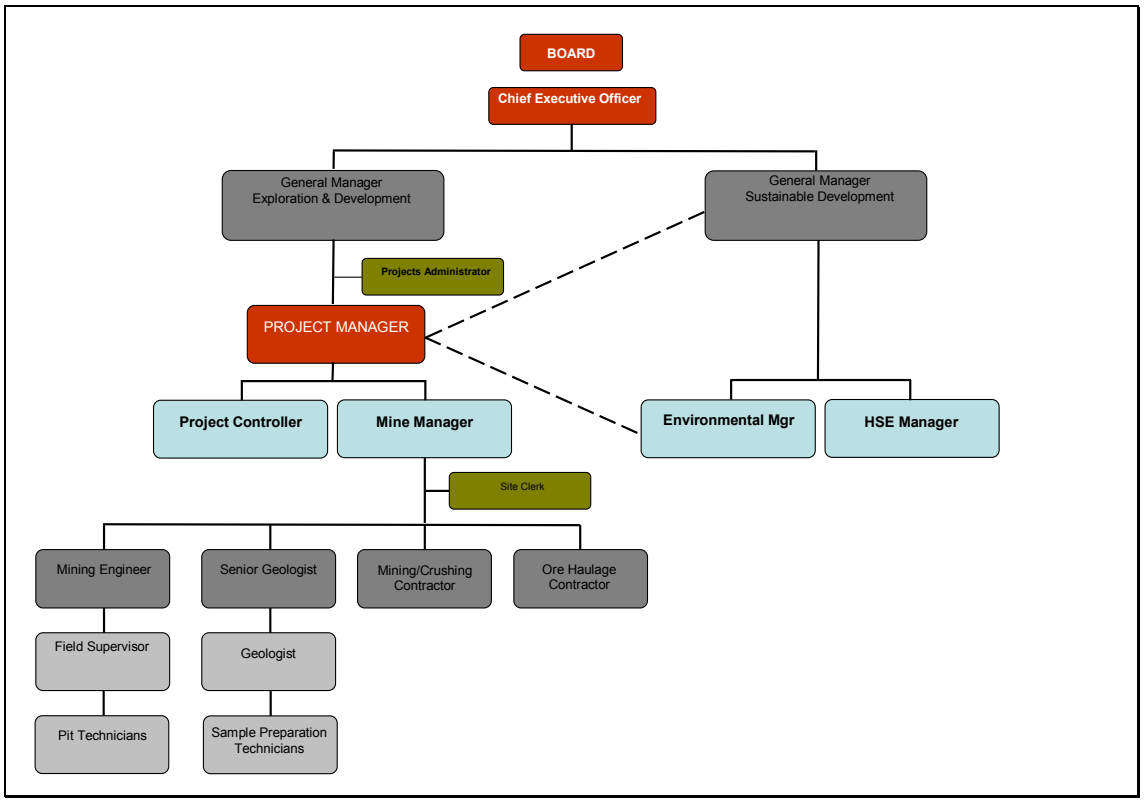


Figure 8.1 Management chart - Portia operations

Environmental officers will be responsible for the actioning of all monitoring and compliance activities. The environmental manager will coordinate, mentor and quality assure environmental officers and monitoring / compliance outcomes.

The Environmental Manager will work with the Site Manager to ensure that all activities carried out comply with lease conditions and licensing requirements. Corrective actions will be instigated by the Environmental Manager.

Environmental officers will be presented with the site environmental management plan; a copy of the PEPR will be kept on site for reference. Reporting will be coordinated by the Environmental Manager and presented to the Site Manager and the General Manager to satisfy company reporting requirements. Statutory environmental reporting (e.g., MARCR) will also be coordinated by the Environmental Manager.

8.4 RISK EVALUATION AND MANAGEMENT

Benagerie Gold's policies are designed to ensure that risks are identified, assessed and managed. In particular, the following will be implemented at Portia:

- Preliminary hazard analyses to identify risks.
- Documentation of risks in a register.
- Action or continuous improvement plans that identify:
  - controls to be implemented,
  - the person responsible for the control of the risk,
  - the due date for control measures to be completed, and
  - a schedule to review and assess effectiveness of the risk control measures.
- Training of employees in risk management techniques

In addition, Havilah Resource's group-wide HSE program provides a solid framework for all aspects of safety and environmental management at Portia.

This system works on a continuous improvement model; it focuses on risk management and is closely monitored by Management. The Portia project will be required to report monthly on its HSE performance, compliance and on any incidents that require investigation. It is also required to report on safety meetings, workplace inspections and internal audits or reviews.

8.5 PLANNING

Benagerie Gold, through its parent company Havilah Resources, has developed a set of manuals and guidelines that define procedures to be adopted to ensure compliance with lease conditions and the outcomes stated in the PEPR.

These include:

- Native vegetation management plan
- Hydrocarbon spill management plan
- HSE manual
- Employee handbook
- Site induction booklet

These documents are presented in Appendix M.

8.6 IMPLEMENTATION, RECORDING AND MONITORING

Mining at Portia will require adherence to internal environmental management protocols, agency guidelines and legislative requirements. To achieve compliance, Benagerie Gold will follow a set of environmental management procedures for the operation based on; operating experience at other open cut mines, the requirements of South Australian legislation and the requirements stated in this PEPR. This includes reference to the Mining Act, 1971, the Natural Resources Management Act, the Environment Protection Act and licence conditions (outcomes) provided for the site.

Procedures to be adopted include monitoring protocols, data storage and management processes, quality assurance programs (to provide confidence in the integrity of collected data including internal audit review of the data obtained), and the development and implementation of environmental improvement measures arising from the review of monitoring data.

Reporting and disclosure to agencies will be in accord with relevant acts and guidance documentation (including the PEPR).

Compliance will be monitored by the General Manager and will be reported regularly to the Board.

8.7 AUDIT AND REVIEW

Benagerie Gold has developed monitoring programs that will enable changes or trends to be identified. Risks will be compared with the outcomes stated in the lease offer and actions taken if and when appropriate. Data will be reviewed monthly and internal reports will be prepared at the same frequency (monthly) with respect to HSE performance, compliance and on any incidents that require investigation.

The need for corrective action will be considered in light of inspections and audits or in the unlikely event that impacts reach an unacceptable level. Alternatively the monitoring programs may indicate that certain risks are not significant, and resources may be channelled to other areas.

Benagerie Gold will report on performance against all commitments made in the PEPR as required by DSD.

8.8 PREVIOUS EXPERIENCE OF THE OPERATOR

Benagerie Gold is a wholly owned subsidiary of Havilah Resources NL. Havilah has been an active explorer since 1996 and has successfully conducted exploration programs at Portia, Kalkaroo, Mutooroo, Maldorky, and Lilydale.

Short-listed mining contractors are all experienced with similar size operations in South Australia and are aware of the environmental and health and safety requirements pertaining to open pit mining operations in South Australia (e.g., Lucas Total Contract Solutions).

Dr Chris Giles is Benagerie Gold's Technical Director and he has more than 35 years of experience in exploration geology and management including supervising grade control and mining operations at several small scale open pit gold operations in the Eastern Goldfields of Western Australia. Similarly, Benagerie Gold's Chairman, Dr Bob Johnson, has operated a small private open pit gold mining operation in Victoria for many years and is very familiar with all aspects of successfully operating such mines.

Benagerie Gold has already employed a suitably experienced mining engineer, Jared Murray, to manage the day to day mining operations and site activities. Mr Murray has over 20 years of relevant experience as a mining engineer having been associated with projects ranging in size from White Dam to Olympic Dam.

8.9 LEASE CONDITIONS

The outcomes specified in the Second Schedule of the lease offer have been addressed in this PEPR. The following table (Table 36) provides a checklist of the sections of the PEPR that addresses each outcome.

Table 36 Checklist

Outcome (Second Schedule)	PEPR Section
Adjacent land use	6.2
Aboriginal and European heritage	6.3
Native fauna	6.4
Native vegetation	6.5
Weeds and pests (feral animals)	6.6
Soil	6.7
Groundwater and hydrology	6.8
Waste disposal and hazardous substances	6.9
Mine closure	7.1 – 7.16
Landholder liaison	6.2
Additional leading indicator criteria (Yarramba palaeochannel)	6.8, 7.9

9 References

Anthropological report commissioned by Geoscience Australia and PIRSA in 2005

Animal and Plant Control Commission (APCC), 2004: Listing of Proclaimed Plants in SA. www.dwlbc.sa.gov.au/

Australian Ground Water Technologies, (2013). Portia Dewatering Assessment. AGT reference 1226-13-HAD.

Australian Ground Water Technologies, (2013A). Portia Gold MAR Investigations. AGT Reference 1259-13-HAD.

Australian Ground Water Technologies, (2014). Portia Gold Project – Extraction and re-injection trial and numerical model update, Letter Report to Havilah Resources.

Australian Standard 1940:2004 (2004): The storage and handling of flammable and combustible liquids

Badman Environmental (2008): Vegetation survey of the Portia Gold Prospect October 2007

Badman Environmental (2008): Fauna of the Portia Gold Prospect Area

Barker, W.R., Barker, R.M., Jessop, J.P. and Vonow, H.P. (Eds.) (2005): Census of South Australian Vascular Plants. 5th Edition. Journal of Adelaide Botanic Gardens, Supplement 1. Botanic Gardens of Adelaide and State Herbarium: Adelaide.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R, and Poulter, R. (2003): The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Hawthorne East, Victoria.

Blakers, M., Davies, S.J.J.F. and Reilly, P. (1984): The Atlas of Australian Birds. Melbourne University Press, Melbourne

Bom.gov.au (n.d.) *Welcome to the IFD Program*. [online] Available at:

http://www.bom.gov.au/hydro/has/cdirswebx/cdirswebx.shtml [Accessed: 8th April 2013].

Cupper, J. and Cupper, L. (1980): Nesting of the Grey Falcon Falco hypoleucos. Australian Bird Watcher. 8: 212-219.

Debus, S.J.S, Lollback, G., Oliver, D.L., and Cairns, S.C. (2006): The birds of Bulgunnia and Mulyungarie stations in the pastoral zone of South Australia. South Australian Ornithologist 35, pp. 27-37.

Environment Protection Authority South Australia (2007): Guideline for Bunding and Spill Management - EPA reference 080/07

Golder Associates. (2013): Portia Gold Project. Design Studies to support a program for Environmental Protection and Rehabilitation for Tailings Storage. Golders reference 137665008-002R-Rev1

Hollands, D. (1984): Eagles, hawks and falcons of Australia. Thomas Nelson Australia, Melbourne.

KBR (2011): Havilah Flora and Fauna Assessments - Benagerie Gold Pty Ltd Flora and Fauna Assessment.

Lang, P.J. and Kraehenbuehl, D.N. (2006): Plants of Particular Conservation Significance in South Australia. January 2006 update of unpublished database (Department for Environment and Heritage).

Laut, P. (1977). Environments of South Australia. CSIRO. Division of Land Use Research.

Love, D. (1996). Seismic Hazards and Microzonation of the Adelaide Metropolitan Area, Report Book 96/27, Department of Mines and Energy.

Minerals Council of Australia and the former Australian and New Zealand Minerals and Energy Council (now the Ministerial Council on Mineral and Petroleum Resources) (2000): Strategic framework for mine closure.

Ministerial Council on Mineral and Petroleum Resources (2006): Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion.

National Environment Protection (Assessment of Site Contamination) Measure (1999) Schedule B (1): Guideline on the Investigation Levels for Soil and Groundwater.

Native title application made by the Adnyamathanha people (SC99/1).

Neagle, N. (2003): An Inventory of Biological Resources of the Rangelands of South Australia. Department for Environment and Heritage, South Australia.

Olsen, P.D. (1995): Australian birds of prey. University of New South Wales Press: Sydney and Johns Hopkins: Baltimore.

Playfair, R.M. and Robinson, A.C. (1997): A Vegetation Survey of the North Olary Plains South Australia 1995-1997. A report prepared by the Biological Survey and Research Group, Natural Resources Group of the Department of Environment and Natural Resources, South Australia

Primary Industries Resources South Australia (PIRSA): Guidelines for the Preparation of a Mining and Rehabilitation Program (MARP) Version 4.8, 2007.

Primary Industries Resources South Australia (PIRSA): Guidelines for the Preparation of a Mining and Rehabilitation Program (MARP) Version 4.11, January 2011.

Primary Industries Resources South Australia (PIRSA): Statement of Environmental Objectives & Guidelines for Mineral Exploration Activities in SA (Form M33-June 2004).

Primary Industries Resources South Australia (PIRSA): General Specifications for the Construction and Abandonment of Mineral Exploration Drillholes (Information Sheet M21).

Read and Badman (1999) Read, J.L. and Badman, F.J. (1999): The Birds of the Lake Eyre South Region. In: W.J.H. Slaytor (Ed.) The Lake Eyre South Monograph Series Volume 3. Royal Geographical Society of South Australian Incorporated, Adelaide.

Report on investigations into the presence of archaeological relics undertaken in the area by the Aboriginal Heritage Unit of the South Australian Department for the Environment.

Rocktest Consulting (2012): Portia Abandonment Bund (report to Havilah Resources).

Rocktest Consulting (2012): Portia Overburden Dump Design (report to Havilah Resources).

Rocktest Consulting (2012): Portia Pit Walls Geotechnical Assessment (report to Havilah Resources).

SA Department of Environment and Heritage (SADEH) (2008): 'The Biological Data Base of South Australia (BDBSA)'

SADEH (2007). Species Profiles and Threats (SPRAT) sheets. Department for Environment and Heritage, Plant Biodiversity Centre, Adelaide.

WA Department of Industry and Resources Document No. ZMA048HA 'Safety Bund Walls Around Abandoned Open Pit Mines' (1997).

Appendix A	**Badman Environmental Reports**
Appendix B	**KBR Flora Fauna Survey**
Appendix C	**Rocktest Pit Geotechnical Design Report**
Appendix D	**Rocktest OWD Geotechnical Design Report**
Appendix E	**AGT Portia Dewatering Assessment_rev3**
Appendix F	**AGT Portia Shylock MAR rev 2**
Appendix G	**Rocktest Abandonment Bund design**
Appendix H	**Native Vegetation Management Plan**
Appendix I	**Topsoil Management Plan**
Appendix J	**Waste Management Plan**
Appendix K	**Portia LEMP_Final**
Appendix L	**Bond calculation spreadsheet**
Appendix M	**HSE Handbook, Manuals, Procedures** **Portia HSE & Induction Booklet** **Environment Policy & Guide** **Portia MARP Management Systems**
Appendix N	**BTM Solutions TSF Operations and Surveillance Manual**
Appendix O	**Golder Associate TSF Design and Seepage Report**
Appendix P	**Portia Gold Project – Extraction and re-injection trial and numerical model update**
Appendix Q	**Benagerie Gold - Portia Gold Project Groundwater Management Plan**