GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

EPA REFERRAL FORM PROPONENT

Referral of a Proposal by the Proponent to the Environmental Protection Authority under Section 38(1) of the *Environmental Protection Act 1986*.

PURPOSE OF THIS FORM

Section 38(1) of the *Environmental Protection Act 1986* (EP Act) provides that where a development proposal is likely to have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the EP Act. This form sets out the information requirements for the referral of a proposal by a proponent.

Proponents are encouraged to familiarise themselves with the EPA's *General Guide on Referral of Proposals* [see Environmental Impact Assessment/Referral of Proposals and Schemes] before completing this form.

A referral under section 38(1) of the EP Act by a proponent to the EPA must be made on this form. A request to the EPA for a declaration under section 39B (derived proposal) must be made on this form. This form will be treated as a referral provided all information required by Part A has been included and all information requested by Part B has been provided to the extent that it is pertinent to the proposal being referred. Referral documents are to be submitted in two formats – hard copy and electronic copy. The electronic copy of the referral will be provided for public comment for a period of 7 days, prior to the EPA making its decision on whether or not to assess the proposal.

CHECKLIST

Before you submit this form, please check that you have:

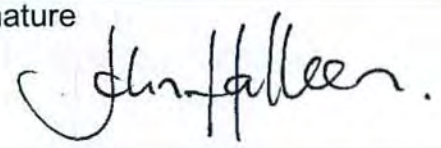
	Yes	No
Completed all the questions in Part A (essential).	x	
Completed all applicable questions in Part B.	x	
Included Attachment 1 – location maps.	x	
Included Attachment 2 – additional document(s) the proponent wishes to provide (if applicable).	x	
Included Attachment 3 – confidential information (if applicable).		x
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping but excluding confidential information.	x	

Following a review of the information presented in this form, please consider the following question (a response is optional).

Do you consider the proposal requires formal environmental impact assessment?		
☒ Yes	☐ No	☐ Not sure
If yes, what level of assessment?		
☒ Assessment on Proponent Information	☐ Public Environmental Review	

PROPONENT DECLARATION (to be completed by the proponent)

I, John Halleen declare that I am authorised on behalf of Vern Newton (being the person responsible for the proposal) to submit this form and further declare that the information contained in this form is true and not misleading.

Signature 	Name: John Halleen
Position: Technical Director	Company: RPS (on behalf of Rocla Quarry Products)
Date 20/02/2014	

PART A - PROPONENT AND PROPOSAL INFORMATION

(All fields of Part A must be completed for this document to be treated as a referral)

1 PROPONENT AND PROPOSAL INFORMATION

1.1 Proponent

Name	Vern Newton (Rocla Quarry Products)
Joint Venture parties (if applicable)	N/A
Australian Company Number (if applicable)	N/A
Postal Address (where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)	130 Fauntleroy Ave, Redcliffe WA 6104
Key proponent contact for the proposal: • name • address • phone • email	• Vern Newton • 130 Fauntleroy Ave, Redcliffe WA 6104 • 9475 2555 • Vern.Newton@rocla.com.au
Consultant for the proposal (if applicable): • name • address • phone • email	• John Halleen • Level 3 38 Station St, Subiaco WA 6008 • 92111111 • john.halleen@rpsgroup.com.au

1.2 Proposal

Title	McKinley Road Neerabup Sand Extraction
Description	Sand quarries within the Gnangara Pine Plantation
Extent (area) of proposed ground disturbance.	Approximately 2,000 ha
Timeframe in which the activity or development is proposed to occur (including start and finish dates where applicable).	Immediate start with a 50+ year quarry life
Details of any staging of the proposal.	Mining will be undertaken in stages within McKinley Road site.
Is the proposal a strategic proposal?	No
Is the proponent requesting a declaration that the proposal is a derived proposal? If so, provide the following information on the strategic assessment within which the referred proposal was identified: • title of the strategic assessment; and • Ministerial Statement number.	No
Please indicate whether, and in what way, the proposal is related to other proposals in the region.	The proposal is related to Rocla's Gaskell Avenue Operations – sand quarries

Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?	The proponent has mining tenements (M70/1316) across the McKinley Road site.
What is the current land use on the property, and the extent (area in hectares) of the property?	Forest Products Commission managed Pine Plantation. The proposed excavation areas across all tenements M70/1316 which is 1,979 ha

1.3 Location

Name of the Shire in which the proposal is located.	City of Wanneroo
For urban areas: • street address; • lot number; • suburb; and • nearest road intersection.	-
For remote localities: • nearest town; and • distance and direction from that town to the proposal site.	Refer to Figure 1 within attached report. Approximately 10km east of Joondalup
Electronic copy of spatial data - GIS or CAD, geo-referenced and conforming to the following parameters: • GIS: polygons representing all activities and named; • CAD: simple closed polygons representing all activities and named; • datum: GDA94; • projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA); • format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD.	Enclosed?: Yes

1.4 Confidential Information

Does the proponent wish to request the EPA to allow any part of the referral information to be treated as confidential?	No
If yes, is confidential information attached as a separate document in hard copy?	N/A

1.5 Government Approvals

Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	No

Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal? If yes, please complete the table below.		Yes	
Agency/Authority	Approval required	Application lodged Yes / No	Agency/Local Authority contact(s) for proposal
DoW	Water Licence	No	N/A
DER	Works Approval	No	N/A

PART B - ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT

2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, by answering the questions contained in Sections 2.1-2.11:

2.1 flora and vegetation;

2.2 fauna;

2.3 rivers, creeks, wetlands and estuaries;

2.4 significant areas and/ or land features;

2.5 coastal zone areas;

2.6 marine areas and biota;

2.7 water supply and drainage catchments;

2.8 pollution;

2.9 greenhouse gas emissions;

2.10 contamination; and

2.11 social surroundings.

These features should be shown on the site plan, where appropriate.

For all information, please indicate:

(a) the source of the information; and

(b) the currency of the information.

2.1 Flora and Vegetation

2.1.1 Do you propose to clear any native flora and vegetation as a part of this proposal?

[A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act (Environmental Protection (Clearing of Native Vegetation) Regulations 2004)]. Please contact the Department of Environment and Conservation (DEC) for more information.

(please tick) ✔ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section

Rocla Quarry Products will not clear any existing vegetation as part of this proposal. The Forestry Products Commission (FPC) will clear the pine plantation and Rocla will commence work on cleared land. Rocla will need to clear any regrowth that occurs within areas of pine plantation cleared by the FPC.

2.1.2 How much vegetation are you proposing to clear (in hectares)?

The extent of any required vegetation clearing is not yet known.

2.1.3 Have you submitted an application to clear native vegetation to the DEC (unless you are exempt from such a requirement)?

☐ Yes ✔ No **If yes**, on what date and to which office was the application submitted of the DEC?

2.1.4 Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?

☐ Yes ✔ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

2.1.5 Has a search of DEC records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site?

✔ Yes ☐ No If you are proposing to clear native vegetation for any part of your proposal, a search of DEC records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact DEC for more information.

Rocla proposed to excavate sand from cleared pine plantation areas. Rocla will commence work on cleared land.

Therefore it is not anticipated the sand excavation will impact upon any priority flora or TEC.

However, Rocla will need to clear any regrowth that occurs within areas of pine plantation cleared by the FPC.

2.1.6 Are there any known occurrences of rare or priority flora or threatened ecological communities on the site?

☐ Yes ✔ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

2.1.7 If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)

✔ Yes ☐ No **If yes**, please indicate which Bush Forever Site is affected (site number and name of site where appropriate).

12 Bush Forever sites (1, 95, 136, 137, 139, 140, 425, 444, 446, 451, 455 and 457). In addition, eight Bush Forever sites (0, 135, 290, 293, 380, 410, 411 and 428) are intersected along the boundaries of the site

A 50 m buffer from all Bush Forever sites adjacent to the proposed sand excavation stages is proposed.

2.1.8 What is the condition of the vegetation at the site?

Rocla proposed to excavate sand from cleared pine plantation areas. Rocla will commence work on cleared land.

2.2 Fauna

2.2.1 Do you expect that any fauna or fauna habitat will be impacted by the proposal?

(please tick) ✔ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

Rocla will not clear existing vegetation (FPC will clear pine plantation); therefore no impact on fauna habitat is expected to arise from this proposal.

2.2.2 Describe the nature and extent of the expected impact.

Loss of fauna may, however, arise from re-colonisation of habitat created through vegetation regrowth. That is regrowth that occurs between vegetation being cleared by the FPC and Rocla commencing excavation within that area. If regrowth of vegetation occurs, it will be necessary for Rocla to clear the regrowth (and any associated habitat) prior to the commencement of excavation within that area.

2.2.3 Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?

☐ Yes ✔ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

2.2.4 Has a search of DEC records for known occurrences of Specially Protected (threatened) fauna been conducted for the site?

☐ Yes ✔ No (please tick)

2.2.5 Are there any known occurrences of Specially Protected (threatened) fauna on the site?

✔ Yes ☐ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

The existing pine plantation is known to provide Carnaby's Black Cockatoos with foraging habitat. However the pines will be removed by the FPC prior to Rocla excavating any sand.

2.3 Rivers, Creeks, Wetlands and Estuaries

2.3.1 Will the development occur within 200 metres of a river, creek, wetland or estuary?

(please tick) ✔ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.3.2 Will the development result in the clearing of vegetation within the 200 metre zone?

☐ Yes ✔ No **If yes**, please describe the extent of the expected impact.

All vegetation will be cleared by FPC prior to the commencement of Rocla's proposed mining activities. No activities will be undertaken within 50m of a mapped wetland.

2.3.3 Will the development result in the filling or excavation of a river, creek, wetland or estuary?

☐ Yes ✔ No **If yes**, please describe the extent of the expected impact.

2.3.4 Will the development result in the impoundment of a river, creek, wetland or estuary?

☐ Yes ✔ No **If yes**, please describe the extent of the expected impact.

2.3.5 Will the development result in draining to a river, creek, wetland or estuary?

☐ Yes ✔ No **If yes**, please describe the extent of the expected impact.

2.3.6 Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)

Conservation Category Wetland	☐ Yes	✔ No	☐ Unsure
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	☐ Yes	✔ No	☐ Unsure
Perth's Bush Forever site	☐ Yes	✔ No	☐ Unsure
Environmental Protection (Swan & Canning Rivers) Policy 1998	☐ Yes	✔ No	☐ Unsure
The management area as defined in s4(1) of the *Swan River Trust Act 1988*	☐ Yes	✔ No	☐ Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA)	☐ Yes	✔ No	☐ Unsure

2.4 Significant Areas and/ or Land Features

2.4.1 Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?

✔ Yes ☐ No **If yes**, please provide details.

Please refer to Section 2.4.3 of the attached report.

The McKinley Road mining tenement is within the Gnangara-Moore River State Forest.

2.4.2 Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?

☐ Yes ✔ No **If yes**, please provide details.

2.4.3 Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?

☐ Yes ✔ No **If yes**, please provide details.

2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

2.5.1 Will the development occur within 300metres of a coastal area?

(please tick) ☐ Yes **If yes**, complete the rest of this section.

✔ No **If no**, go to the next section.

2.5.2 What is the expected setback of the development from the high tide level and from the primary dune?

2.5.3 Will the development impact on coastal areas with significant landforms including beach ridge plain, cuspate headland, coastal dunes or karst?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.5.4 Is the development likely to impact on mangroves?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.6 Marine Areas and Biota

2.6.1 Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?

☐ Yes ✔ No **If yes**, please describe the extent of the expected impact.

2.6.2 Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in *A Representative Marine Reserve System for Western Australia*, CALM, 1994)?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.6.3 Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

2.7 Water Supply and Drainage Catchments

2.7.1 Are you in a proclaimed or proposed groundwater or surface water protection area?

(You may need to contact the Department of Water (DoW) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

✔ Yes ☐ No **If yes**, please describe what category of area.

The majority of the tenements lie within a Priority 1 Public Drinking Water Source Area.

2.7.2 Are you in an existing or proposed Underground Water Supply and Pollution Control area?

(You may need to contact the DoW for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

✔ Yes ☐ No **If yes**, please describe what category of area.

The tenement fall within the Gnangara Underground Water Pollution Control Area and one tenement is partially within the Perth Coastal Underground Water Pollution Control Area.

2.7.3 Are you in a Public Drinking Water Supply Area (PDWSA)?

(You may need to contact the DoW for more information or refer to the DoW website. A proposal to clear vegetation within a PDWSA requires approval from DoW.)

✔ Yes ☐ No **If yes**, please describe what category of area.

The tenement lies within a Priority 1 Public Drinking Water Source Area.

2.7.4 Is there sufficient water available for the proposal?

(Please consult with the DoW as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the DoW)

☐ Yes ✔ No (please tick)

A 500,000 kL water licence will be applied for to allow for the washing of sand to meet market requirements, if required. Alternatively the existing wash plant at Rocla's Gaskell Avenue quarry will be utilised.

2.7.5 Will the proposal require drainage of the land?

☐ Yes ✔ No **If yes**, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

2.7.6 Is there a water requirement for the construction and/ or operation of this proposal?

(please tick) ✔ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.7.7 What is the water requirement for the construction and operation of this proposal, in kilolitres per year?

Water will be required during the operations of the sand quarry for dust suppression and for use in a screening and washing plant (following the application to DER for a works approval). The exact water requirement has yet to be determined.

2.7.8 What is the proposed source of water for the proposal? (e.g. dam, bore, surface water etc.)

The water used on site will be sourced from groundwater.

2.8 Pollution

2.8.1 Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?

(please tick) ✔ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.8.2 Is the proposal a prescribed premise, under the Environmental Protection Regulations 1987?

(Refer to the EPA's *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

☐ Yes ✔ No **If yes**, please describe what category of prescribed premise.

2.8.3 Will the proposal result in gaseous emissions to air?

☐ Yes ✔ No **If yes**, please briefly describe.

2.8.4 Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?

☐ Yes ✔ No **If yes**, please briefly describe.

2.8.5 Will the proposal result in liquid effluent discharge?

✔ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and receiving environment.

Pending an application and approval for a washing and screening plant on site, there may be a liquid effluent discharge (wash water). This water would be discharged into a bund and the proponent shall ensure that it is not discharged to any wetland or watercourse.

2.8.6 If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?

☐ Yes ✔ No **If yes**, please describe.

2.8.7 Will the proposal produce or result in solid wastes?

☐ Yes ✔ No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

2.8.8 Will the proposal result in significant off-site noise emissions?

☐ Yes ✔ No **If yes**, please briefly describe.

2.8.9 Will the development be subject to the Environmental Protection (Noise) Regulations 1997?

✔ Yes ☐ No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

Please attach the analysis.

The proposal shall comply with *the Environmental Protection* (Noise) *Regulations 1997* at all times. No analysis has been undertaken, however residential areas are far removed from the proposed excavation areas and residents are not likely to be affected by noise pollution.

2.8.10 Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other "sensitive premises" such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?

☐ Yes ✔ No **If yes**, please describe and provide the distance to residences and other "sensitive premises".

2.8.11 If the proposal has a residential component or involves "sensitive premises", is it located near a land use that may discharge a pollutant?

☐ Yes ✔ No ☐ Not Applicable

If yes, please describe and provide the distance to the potential pollution source

2.9 Greenhouse Gas Emissions

2.9.1 Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?

☐ Yes ✔ No **If yes**, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.

2.9.2 Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.

2.10 Contamination

2.10.1 Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?

☐ Yes ✔ No ☐ Unsure **If yes**, please describe.

2.10.2 Has any assessment been done for soil or groundwater contamination on the site?

☐ Yes ✔ No **If yes**, please describe.

2.10.3 Has the site been registered as a contaminated site under the *Contaminated Sites Act 2003*? (on finalisation of the CS Regulations and proclamation of the CS Act)

☐ Yes ✔ No **If yes**, please describe.

2.11 Social Surroundings

2.11.1 Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?

☐ Yes ✔ No ☐ Unsure **If yes**, please describe.

No Heritage sites (or their buffers) will be disturbed in any way by this proposal.

2.11.2 Is the proposal on a property which contains or is near a site of high public interest (e.g. a major recreation area or natural scenic feature)?

☐ Yes ✔ No **If yes**, please describe.

2.11.3 Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?

✔ Yes ☐ No **If yes**, please describe.

Transportation of material off site to supply to market will be required, however, service trucks will remain on a designated route including major highways and direct access roads. It is not anticipated that the amenity of the local area will be impacted by this transportation.

3. PROPOSED MANAGEMENT

3.1 Principles of Environmental Protection

3.1.1 Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA website)

1. The precautionary principle.	✔ Yes	☐ No
2. The principle of intergenerational equity.	✔ Yes	☐ No
3. The principle of the conservation of biological diversity and ecological integrity.	✔ Yes	☐ No
4. Principles relating to improved valuation, pricing and incentive mechanisms.	✔ Yes	☐ No
5. The principle of waste minimisation.	✔ Yes	☐ No

3.1.2 Is the proposal consistent with the EPA's Environmental Protection Bulletins/Position Statements and Environmental Assessment Guidelines/Guidance Statements (available on the EPA website)?

✔ Yes ☐ No

3.2 Consultation

3.2.1 Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?

✔ Yes ☐ No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

Please refer to Table E of the attached report for a summary of all consultation undertaken to date.

ENVIRONMENTAL ASSESSMENT

McKinley Road Neerabup Sand Extraction Project

Prepared by:

RPS

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Report No: L11438:2
Version/Date: Rev 0, March 2014

Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Draft A	Draft for Client Review	SamDel	JohHal	19.02.14	DC 19.02.14		
Rev 0	Final for Issue	JohHal	JohHal	05.03.14	SN 05.03.14	J. Halleen	06.03.14

Disclaimer

SUMMARY

Rocla Quarry Products (Rocla) is seeking approval to establish a sand quarry within the McKinley Road Neerabup Project Area (tenement M70/1316). The Project Area (M70/1316) was derived from Rocla's exploration drilling and assessment within a broader exploration tenement area E70/3276.

An overview of the McKinley Road Project Area (tenement M70/1316) and the exploration tenement area E70/3276 along with the sand excavation stages (i.e. Stage 1, Stage 2, and the future excavation areas) is shown in Figure A and in detail in Figure 3B.

The McKinley Road Project Area is located in the Gnangara Pine Plantation which is Department of Parks and Wildlife (DPaW) managed land. The Project Area is in Neerabup which is within the City of Wanneroo municipal boundary.

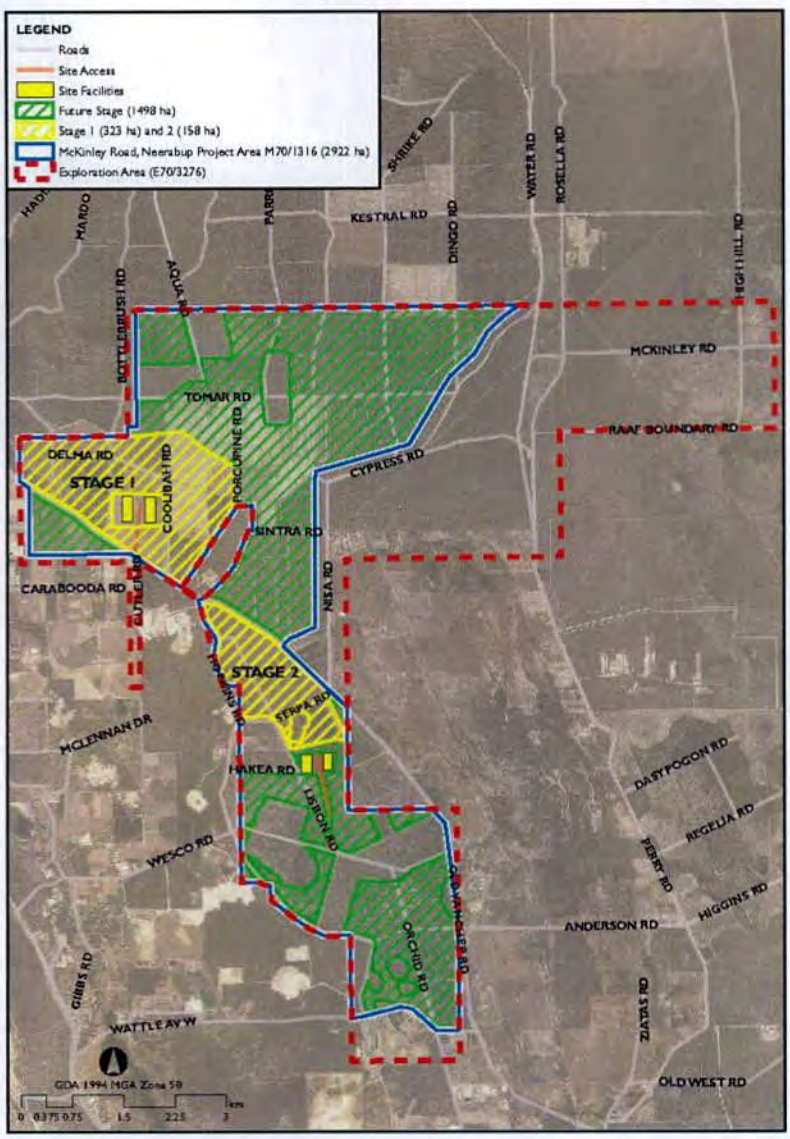

Figure A: McKinley Road Project Overview

Currently there is a shortage of basic raw materials (sand), required for development in the Perth Metropolitan region. The key strategic sites outlined in this report will provide an important resource in the region for the next 50–60 years. Silica sand is utilised for use in domestic trade and international export.

It is proposed that within the Project Area (tenement M70/1316), sand will be excavated in a series of stages determined in accordance with the exploration drilling undertaken. Namely, Stage 1, Stage 2 and the future excavation areas. The location of clearing associated with proposed Stage 1, Stage 2 and the future excavation areas, and the buffers from Bush Forever sites and wetland areas are identified in detail in Figures 3A and 3B.

Prior to any excavation works, the existing pine plantation will be cleared by the Forest Products Commission (FPC) before Rocla commences operations. As a result of this, Rocla's environmental impacts will not include those associated with clearing native vegetation.

The key environmental issues for the McKinley Road Project Area include addressing the interface to:

- Bush Forever sites
- Conservation category wetlands (CCWs) and resource enhancement wetlands (REWs).

Rocla proposes to maintain buffers from Bush Forever sites and wetlands areas at all times during construction and quarry operations.

Extraction of construction sand will be market driven and historically approximately 10 million tonne of material is required annually by the northern Perth market. The sand will be screened on site and then transported off site to customers. Sand extraction is proposed to commence as soon as approval is issued and as required by market conditions.

Table A and Table B outline the key characteristics and management commitments of the project.

Table A: Project Key Characteristics

Project Component	McKinley Road Neerabup Project Area (M70/1316)
Excavation	
Quarry life	50 + years
Total estimated material excavated	25 million + metres^3
Estimated total excavation area (quarry stages)	1,979 ha (proposed excavation area)
Estimated excavation rate	1000–2000 tonnes per day
Maximum pit depth	Initially, 5 m above the estimated future water table
Screening plant	A screening plant will be used at each site to screen oversized rock and organic material.

Project Component	McKinley Road Neerabup Project Area (M70/1316)
Quarry Site Infrastructure	
Machinery	
Water Cart	18 kL capacity, used for dust suppression of haul road, pit floor and stockpiles.
Front end loaders	Three Volvo 150E or similar
Semi-trailers	Variable. From 10 m^3 to 40 m^3 capacity. Will be provided by customers. Vehicles used will be classified by Main Roads Western Australia
Grader	One Cat 140G or similar. For maintaining roads, as required
Service truck	Truck with 5000 L fuel capacity and tanks for separate lubricants, including a waste oil tank and evacuation pump.
Light vehicles	Two for site operators.
Diesel generators	One suitably-sized diesel generator
Mobile screening plant	A washing and screening plant will be used to sort sand material after excavation
Transport	
Truck movements and hours	Approximately 50 to 100 return truck movements per day of operation (depending on truck sizes).
Workforce	
Operation	3–5 personnel during operation
Hours of Operation	0600 to 1900 daily

Table B: Summary of Commitments for the McKinley Road Neerabup Project Area

Environmental Factor	Summary	Management Commitment
Flora and Vegetation	The proposed excavation areas in the McKinley Road project area are comprised solely of pine plantation and no existing native vegetation will be cleared as part of the proposal.	▪ The potential spread of weeds and Dieback, if present, during operations will be prevented. ▪ Dust will be managed during the quarrying operations to protect surrounding native vegetation. ▪ The extent of vegetation clearing will be consistent with FPC clearing program with the remaining pine tree stumps will be cleared in stages. ▪ Adequate buffers will be maintained between excavation areas and adjacent native vegetation and Bush Forever sites. ▪ Vehicles will be restricted to designated roads. ▪ At the completion of operations, FPC will replant pine.
Dieback	▪ The sites are considered un-interpretable, due to the absence of any indicator species. ▪ Hygiene guidelines will be implemented on site entry and exit. This policy will apply to all mobile excavation equipment as they have a high risk of carrying soil.	▪ All vehicles will be free of soil and plant material before entering the site. If any dirt or plant material has been picked up, the vehicle must be brushed down. ▪ Training programs and inductions will be conducted for site personnel. ▪ Area will be quarantined ahead of excavation. ▪ All surface water will be contained on site. Run-off from the quarry pit, stockpiles, cleaning down and haul roads will be contained, and not released into areas of native vegetation. ▪ Light vehicles and machinery will be restricted to access roads, tracks and the excavation area. ▪ No soil or vegetation will be brought on site. ▪ The site will be fenced to prevent uncontrolled access.

Environmental Factor	Summary	Management Commitment
Fauna	A variety of threatened fauna species may occur within and adjacent to the proposed sites. The quarry footprints are pine plantation so it is unlikely that suitable habitat for significant species will be directly disturbed by the project.	▪ No existing native vegetation will be cleared. ▪ Management measures will be implemented to reduce indirect disturbance of surrounding fauna habitat. ▪ Staged removal of pine stumps to allow for acclimatisation for any remaining fauna in the area. ▪ The control and monitoring of dust, noise and smoke. ▪ Induction of machinery operators involved in the operations and stump removal process. Operators will be advised to be alert for fauna, and to take steps to avoid impacts, where practical. ▪ Speed limits will apply on site to limit fauna fatalities. ▪ Non-native fauna will be prohibited from site.
Groundwater Resources	Groundwater abstraction is likely to occur from groundwater bores to be installed on each site, however pit dewatering will not be required as the maximum pit depth will remain above the water table.	▪ Quarry operations will not excavate to within 5 m (initially) of the estimated future maximum groundwater level (finished floor level). ▪ Monitoring bores will be installed across the site to assess water level, water quality. ▪ Bore data will be used to assess the finished floor level. ▪ Waste management to ensure all wastes are disposed of appropriately, minimising the risk of groundwater contamination. ▪ Surface water management will minimise the risk of contamination to groundwater via infiltration.
Acid Sulfate Soils	The proposed excavation areas do not include any areas of high ASS risk.	▪ An adequate buffer will be maintained to high to moderate ASS risk area at all times during operations. ▪ Excavation will not intersect the water table at any time during operations, minimising the risk of exposing potential ASS.
Noise	▪ There are no residential dwellings within close proximity of the proposed excavation areas. ▪ Rocla do not expect significant noise issues to arise for the duration of operations.	To protect the amenity of the receiving environments from noise impacts, the following key management measures will be implemented during the construction and operation phase: ▪ Limiting construction work; operating 6.00 am to 7.00 pm, daily. ▪ Design the mine excavation areas to provide enhanced landform and constructed noise screening (i.e. bunds), when within 500 m of a residence. ▪ Maintain noise suppression devices in good condition on all operational machinery. ▪ Shut down equipment when not in use. ▪ Operate machinery only within the designated hours of operation. ▪ Schedule activities to minimise the likelihood of noise nuisance. ▪ Use the dedicated transport route. Record any complaints received regarding noise disturbance and instigate follow-up action instigated immediately to minimise the cause, to the greatest possible extent.

Environmental Factor	Summary	Management Commitment
Air Quality	There are no residential dwellings within close proximity to the proposed excavation areas. Local residents may be affected by the transportation of material along transport routes. Dust monitoring will only be required in the event of a legitimate complaint.	To prevent or minimise dust generation during quarry operations, the following dust management measures will be implemented during the construction and operation phase: ▪ The excavation will occur in stages. A key objective is to minimise the disturbance or open area at any one time, as far as practicable. ▪ Maintain haul road surface in a good condition and with suitable grades. ▪ Restrict vehicle movements to defined roads. ▪ All vehicles leaving the site are required to have covered loads. ▪ Use water as appropriate to wet down roads and trafficked areas (a water licence will be obtained). ▪ Use dust suppressants where appropriate (either mixed with water to enhance dust suppression and vegetation cover, or applied periodically to specific areas). ▪ Limit the speed of vehicles on the site. ▪ Apply surface treatments (e.g. mulch, ground cover) to stabilise any bare areas which might be prone to wind erosion. ▪ Define buffer areas within the site to avoid any unnecessary disturbance of stabilised surfaces or vehicle traffic. ▪ Limit the quantity of machinery / vehicles in operation. ▪ Inducting all contractors working within the sites. Record any complaints received and instigate follow-up action instigated immediately to minimise the cause, to the greatest possible extent.
Hydrocarbons and Waste	Hydrocarbons will be stored on site in a self-bunded fuel tank and transported around the site in a mobile fuel tank. The following wastes may be produced by the proposed project: ▪ hydrocarbon and chemical contaminated waste ▪ general waste (e.g. kitchen waste, paper, cardboard) ▪ sewage and domestic wastewater.	▪ Procedures will be implemented for the correct handling, storage, spill management and clean up. ▪ Contaminated material will be removed and bio-remediated (if biodegradable) or disposed of at a licensed facility. ▪ Spill response equipment will be located in the vicinity of work areas, with site personnel trained in spill response management. ▪ The proposed fuel storage tanks to service the machinery will be required to comply fully with the *Australian Standard 1940:2004 The Storage and Handling of Flammable and Combustible Liquids*. This standard specifies requirements for security, bunding, signage, fire protection and handling.
Visual Amenity	It is not expected that the project will have a significant effect on the visual amenity of the nearest neighbours.	▪ The pit design will be such that natural topography and sand bunds will be utilised to shield the view of the mine from surrounding land uses. ▪ Ensure barrier fences and gates are compatible with the semi-rural style of the surround land areas and natural landscape. ▪ Ensure orderly storage and removal of disused equipment or waste.

Environmental Factor	Summary	Management Commitment
Aboriginal Heritage	There are no registered Aboriginal heritage sites within the McKinley Road Project Area.	▪ Any significant sites identified during construction will not be removed, damaged or altered without approval under Section 18 of the *Aboriginal Heritage Act 1972*. ▪ Training will be provided to all construction workers detailing the importance of avoiding heritage sites and reporting of any suspected heritage sites. Exclusion zones will also be identified and clearly communicated to project personnel in the event of a heritage site being uncovered.

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APPENDICES

1.0 INTRODUCTION

1.1 Background

Rocla extracts, processes and distributes sands for pre-mixed concrete and concrete products for industrial uses, landscaping and other building and construction applications. In Western Australia, Rocla manage and operate a number of mine sites in the metropolitan area and surrounds, including the excavation areas proposed in the Gnangara region of Perth (Figure 1).

1.1.1 Overview

Rocla is seeking approval to establish a sand quarry within the 2922 hectare (ha) McKinley Road Neerabup Project Area (tenement M70/1316). As outlined in Table A, the estimated total excavation area (quarry stages) is 1,979 ha (proposed excavation area). The Project Area (M70/1316) was derived from Rocla's exploration drilling and assessment within a broader exploration tenement area E70/3276.

Within the Project Area Rocla has defined the proposed sand excavation Stage 1, Stage 2, and the future excavation areas based on the exploration drilling undertaken. An overview of the McKinley Road Project Area (tenement M70/1316) and the exploration tenement area E70/3276 along with the sand excavation stages is shown in Figure A and in detail in Figure 3B.

The McKinley Road Project Area is located within the Banksia woodland belt of the Swan Coastal Plain (SCP). The native vegetation was cleared approximately 85 years ago to establish the Gnangara Pine Plantation. There are 22,000 ha of pine plantations within the Gnangara system, 5,000 ha of which has been harvested to date, as part of the Gnangara Sustainability Strategy (GSS), which is a joint project between the Department of Water (DoW), Department of Agriculture, Department of Parks and Wildlife (DPaW), Department of Planning, Forest Products Commission, Water Corporation and the CSIRO (GSS 2009). The GSS is a state government initiative which aims to provide a framework for a whole of government approach to address land use and water planning issues associated with the Gnangara groundwater system. Three pine plantations have been targeted for harvesting by the Forest Product Commission (FPC) by 2028, with no new plantations to be established. Some of this area has been identified to be restored to native woodlands.

The McKinley Road Project Area described in this assessment has not been previously mined or excavated.

It is proposed the McKinley Road Project Area excavation stages will be cleared first by the FPC prior to Rocla commencing operations. As a result of this, Rocla's environmental impacts will not include those associated with the clearing of existing pine plantations within the Gnangara-Moore State Forest.

1.2 Project Description

The objective of the McKinley Road Project is to extract sand from within the "proposed stages areas" within the tenement M70/1316 (Figures A and 3). Some excavation of limestone may occur if encountered within the extraction area. If this occurs the limestone will be extracted and track crushed (or similar) to make the product suitable for market.

The Project Area will be mined in several stages. Sand excavation Stage 1 and Stage 2, and future excavation areas have been identified in Figures 3A and 3B.

Each sand excavation stage will be characterised by an open quarry area of approximately 30 ha at any one time over the 50+ year quarry life of the McKinley Road Project. External to the sand excavation stages, approximately 5 ha within the McKinley Road Project Area will be used for site infrastructure, including, but not limited to:

- sand screening and washing plant
- fuel tanks
- weighbridge
- wash down facility
- site office.

Extraction of construction sand will be market driven and historically approximately 10 million tonne of material is required annually by Perth market for uses including: concrete, plastering, bricklaying, fill sand and specialised sands for foundries, glass, grouts and other specialised uses.

The sand will be screened within the Project Area stage boundaries and then transported off site. Sand excavation is proposed to commence within the Project Area (M70/1316) as soon as approval is issued and as required by market conditions.

1.3 Market Demand for Product

Currently, there is a shortage of basic raw materials, particularly fill required for development in the south-west. The key strategic sites outlined in this report will provide a key resource for the next 50–60 years. Historically, approximately 10 million tonne of material is required annually by the northern Perth market.

1.4 Location

The McKinley Road Project Area is located in the suburb of Neerabup, approximately 10 km north-east of Quinns Rock and covers an area of 2,922 ha. The estimated total excavation area (quarry stages) is 1,979 ha (proposed excavation area). The site is located wholly within the City of Wanneroo. Figure 1 shows the location of the Project Area.

1.5 Relevant State Legislation

The Environmental Protection Authority (EPA) undertakes the environmental impact assessment (EIA) of proposals and schemes referred to it under Part IV of the *Environmental Protection Act 1986*.

Rocla is seeking approval under Section 38(a) of the *Environmental Protection Act 1986* for the McKinley Road, Neerabup sand excavation project.

1.6 Purpose of this Report

This report has been prepared to accompany a Section 38(a) referral to the EPA.

1.7 Environmental Policy

Rocla is committed to the protection of the environment and continuous improvement of production and environmental practices. In protecting the environment, Rocla will:

- meet all statutory requirements
- minimise waste
- take demonstrable action to ensure maintenance of effective minimum levels of environmental control
- give consideration to the use of recycled material
- assess the environmental impact of the operations, handling, storage and disposal of sand products
- undertake regular monitoring and risk assessment, wherever there is potential for adverse impact on the environment, employees or the community
- provide employee training programs in implementing the Environmental Policy.

(Rocla 2002)

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2.0 EXISTING ENVIRONMENT

2.1 Regional Setting

The following discusses the overall region, including the McKinley Road Project Area (M70/1316).

The Interim Biogeographic Regionalisation for Australia (IBRA) classification system divides Australia into 85 bioregions and 403 subregions. The bioregions and subregions are the reporting unit for assessing the status of native ecosystems, their protection in the national reserve system and for use in the monitoring and evaluation framework in the Australian Government's current Natural Resource Management initiatives (DSEWPC 2012a).

The McKinley Road Project Area is located within the Swan Coastal Plain 2 (SWA2) subregion, which lies within the Swan Coastal Plain Bioregion.

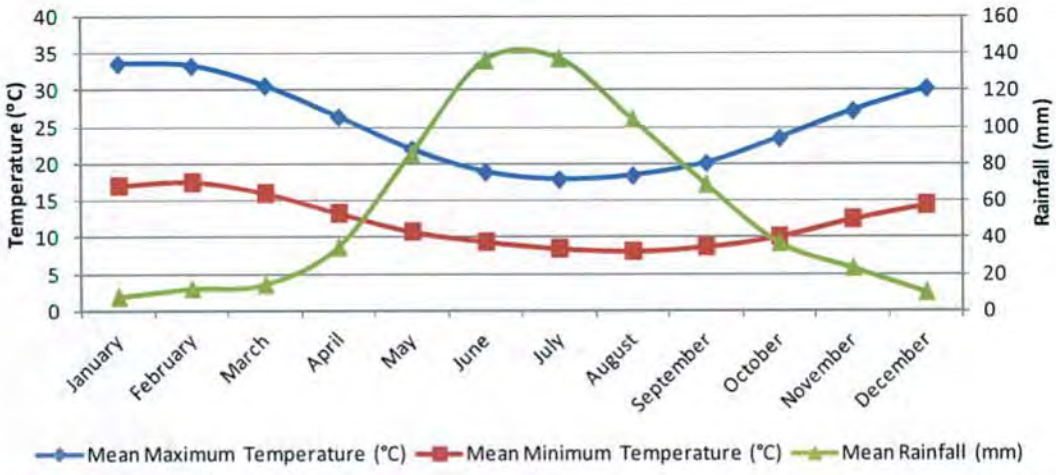
The Swan Coastal Plain (SCP) is a low-lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to discrusted Mesozoic sediments dominated by jarrah woodland. The climate is warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *C. obesa*–marri woodlands and *Melaleuca* shrublands, are extensive only in the south. (Mitchell et al. 2002)

The Perth subregion is composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone. Heath and/or tuart woodlands are present on the limestone, Banksia and jarrah – Banksia woodlands on Quaternary marine dunes of various ages, and marri on colluvial and alluvials. The region includes a complex series of seasonal wetlands and also includes Rottnest, Carnac and Garden Islands. Rainfall ranges between 600 and 1000 mm annually. The subregional area is 1,333,901 ha. (Mitchell et al. 2002)

2.2 Climate

The McKinley Road Project Area is located just north of the Perth metropolitan area. The climate is classified as Mediterranean. The closest open climate station is located at the Pearce Royal Australian Air Force (RAAF) base.

Graph A below displays the average annual climate data for RAAF Pearce Station No. 09053 (BOM 2012).



(BOM 2012)

Graph A: Climatic Means from RAAF Pearce Station from 1940 to 2012Physical Environment

2.2.1 Geology and Soils

Regional geology mapping indicates that the McKinley Road Project Area is predominantly S7 sand (pale and olive yellow, medium to coarse-grained, sub-angular quartz with a trace of feldspar, moderately sorted, of residual origin) and S8 sand (very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin), with small portions of LS1 limestone (light yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin) distributed throughout. The north-east portion of the site is underlain with S9 sand (yellowish brown, medium to coarse-grained, angular to sub-rounded quartz, some fine-grained pisolitic laterite, little fines, of lacustrine origin). A small portion on the eastern side of the site is S10 sand over pebbly silt (sand as per S8 overlying Mgs 1 gravelly silt) (Figure 4).

2.2.2 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing iron sulfides, most commonly pyrite. When ASS are exposed to air the iron sulfides in the soil react with oxygen and water to produce a variety of iron compounds and sulfuric acid. The resulting acid can release other substances, including heavy metals, from the soil and into the surrounding environment. These materials are characterised by bright yellow or straw coloured mottles of the mineral jarosite and often contain dark reddish coloured streaks. Actual ASS have a soil pH of 4 or less. (DoE 2003)

The western portion of the McKinley Road Project Area is at no risk of ASS. There is a small portion along the eastern boundary of "high to moderate risk of ASS within 3 m of the natural soil surface (or deeper)" and the entire north-east of the site is considered to be "moderate to low risk of Acid Sulfate Soil (ASS) within 3 m of the natural soil surface (or deeper)" (Figure 5).

2.2.3 Contaminated Sites

A search of the Department of Environmental Regulation Contaminated Sites database (DER 2012) did not identify any registered contaminated sites within the McKinley Road Project Area.

2.2.4 Topography

The McKinley Road Project Area topography varies in height from 45 m AHD to 85 m AHD, with the majority of the lower lying land in the south, with the exception of an 85 m AHD peak in the most southern portion, and the higher land in the north and east (Figure 6).

2.2.5 Hydrology

The McKinley Road Project Area is located within the Swan/Avon catchment, in the sub-catchment of Lower Swan. The Swan/Avon River has a total catchment area of 125,000 km^2, extending from Dalwallinu in the north, Southern Cross in the north-east and Lake King in the south-east, down to the river mouth at Fremantle.

Over a quarter of the SCP subregional land area from Wedge Island to Dunsborough is wetland (Mitchell et al. 2002). Most of the wetlands on the SCP occur in inter-dunal swales and are hence also orientated in the north–south direction. Although some are perched, the majority of the SCP wetlands are hydraulically connected to the underlying superficial aquifers. At low points in the landscape, the water table frequently intersects the land surface to form lakes and swamps (Salama et al. 2005).

Surface water quality of the wetlands largely reflects groundwater quality, with the Bassendean wetlands historically tending to be coloured, base-poor and slightly acidic, while wetlands on the Spearwood and Quindalup dunes tend to be richer in calcium carbonate with relatively high to very high pH.

2.2.5.1 Groundwater

Groundwater contours indicate that the groundwater flow direction is west towards the Indian Ocean (Figure 6). The maximum groundwater contours across the site range from 23 m AHD in the west to 63 m AHD in the east.

Perth Groundwater Atlas indicates that the site lies within the Gnangara Underground Water Pollution Control Area (Priority 1 Zone).

2.2.5.2 Surface Water

There are no nationally important, or internationally significant, wetlands within a 10 km radius of the McKinley Road Project Area.

There are small sections of two CCWs in the north-eastern and one in the south-eastern portion of the McKinley Road Project Area and one entire CCW in the southern portion of the area. There is also one REW in the southern portion of the area (Figure 7). There are no CCWs or REWs within the proposed excavation area boundary.

2.3 Biological Environment

2.3.1 Vegetation and Flora

Rocla will not be undertaking any clearing of existing vegetation as part of this proposal. Rocla's proposed sand quarrying will occur in areas of the Gnangara-Moore State Forest pine plantation after clearing of existing vegetation is undertaken by the FPC.

Although no existing vegetation will need to be cleared as part of the proposal, it is likely Rocla will need to clear any regrowth that occurs after the existing pines are cleared by the FPC. The potential for regrowth to occur is heightened by the fact FPC will undertake clearing of large portions of the Project Area e.g. 100 ha at any one time, however, Rocla's sand quarrying activities will be limited to approximately 30 ha at any one time over the 50+ quarry life of the McKinley Road Project. As a result, large tracts of previously vegetated areas within the Gnangara-Moore State Forest are likely to be "exposed" for extended periods of time (e.g. 20+ years) before Rocla undertakes sand quarry activities on that portion of the site. There is the potential over this time frame for regrowth (pines and native vegetation) to occur in open or exposed areas.

The extent and rate at which existing vegetation at the McKinley Road Site is cleared will be determined by the FPC. In the absence of details regarding the likely area to be cleared and volume of seed (and seed type) in the soil, the extent of potential regrowth at the McKinley Road Site is not clear. However, regrowth (likely to be pine trees) based on Rocla's past experience in cleared pine plantations is anticipated to occur. Rocla will need to clear such regrowth prior to commencing sand extraction activities.

Threatening processes to vegetation in the Project Area include salinity, acidification, eutrophication and Dieback. In addition, weeds like Watsonia and bridle creeper are spreading and feral animals, particularly rabbits and pigs, are pervasive (Mitchell et al. 2002).

A search of the EPBC Protected Matters Search Tool with a 10 km radius returned two TECs; Aquatic Root Mat Community in Caves of the SCP and Sedgelands in Holocene dune swales of the southern SCP. The search also returned nine species of threatened plants and 13 species of weeds that are likely to occur in the area (Appendix 1).

A NatureMap search with a 10 km radius revealed three species of alga, 281 species of Dicotyledon (including one threatened, two priority one, two priority two, seven priority three and two priority four species), one species of Gymnosperm, 130 species of Monocotyledon (including one threatened and one priority one species), two species of slime mould and one species of water mould, (Appendix 2).

The site wholly encompasses 12 Bush Forever sites (1, 95, 136, 137, 139, 140, 425, 444, 446, 451, 455 and 457). In addition, eight Bush Forever sites (0, 135, 290, 293, 380, 410, 411 and 428) are intersected along the boundaries of the site (Figure 8c).

The vegetation complex present within Bush Forever sites 1, 410 and 411 is:

- Spearwood Dunes
  - Karrakatta Complex – Central and South (most northern occurrence)
  - Cottesloe Complex – North
  - Cottesloe Complex – Central and South.

The vegetation complexes present within Bush Forever sites 95, 135, 136, 137, 139, 140, 425, 428, 444, 446, 451, 455 and 457 are:

- Spearwood Dunes
  - Karrakatta Complex – Central and South
  - Cottesloe Complex – Central and South

- Wetlands
  - Pinjar Complex.

The vegetation complex present within Bush Forever sites 290 and 293 is:

- Spearwood Dunes
  - Karrakatta Complex – Central and South
  - Cottesloe Complex – Central and South.

The vegetation complexes present within Bush Forever site 380 are:

- Bassendean Dunes
  - Bassendean Complex – North
  - Bassendean Complex – North Transition (restricted complex, contains significant area)
  - Bassendean Complex – Central and South Transition (restricted complex, contains significant area, most southern occurrence)

- Spearwood Dunes
  - Karrakatta Complex – North (most southern occurrence)
  - Karrakatta Complex – North Transition (restricted complex, contains significant area, most northern occurrence)
  - Karrakatta Complex – Central and South (restricted complex, contains significant area).

2.3.2 Fauna

A common species list compiled from the individual EPBC searches is shown in Table C below.

Table C: Common Species List (DSEWPC 2012b)

Species	Common Name	Status
Birds		
Botaurus poiciloptilus	Australasian bittern	Endangered
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	Vulnerable
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo, short-billed black cockatoo	Endangered
Leipoa ocellata	Malleefowl	Vulnerable, Migratory
Rostratula australis	Australian painted snipe	Vulnerable
Sternula nereis nereis	Fairy tern (Australian)	Vulnerable
Merops ornatus	Rainbow bee-eater	Migratory
Haliaeetus leucogaster	White-bellied sea-eagle	Migratory
Ardea alba	Great egret, white egret	Migratory
Ardea ibis	Cattle egret	Migratory
Rostratula benghalensis s. lat.	Painted snipe	Vulnerable, Migratory
Mammals		
Dasyurus geoffroii	Chuditch, western quoll	Vulnerable

A search of the EPBC Protected Matters Search Tool returned 14 threatened bird species (including seven migratory and one marine species), one insect and four mammals (including one threatened and three invasive species) (Appendix 1).

A NatureMap search with a 10 km radius returned four amphibians, 96 birds (including one threatened species), four invertebrates (including one threatened, two Priority 3 and one Priority 4 species), 11 mammals (including three threatened, one priority four and one Priority 5 species) and 32 reptiles (including one "other specially protected fauna" species) (Appendix 2).

2.4 Social Environment

2.4.1 Land Use and Tenure

The McKinley Road Project Area outside of the pine plantation and Bush Forever sites is surrounded by rural properties and market gardens (Figure 8).

Only areas of pine plantation will become excavation areas.

2.4.2 Aboriginal Heritage

A search of the Aboriginal Heritage Enquiry System returned two Indigenous sites in the local region of the McKinley Road Project Area – Doogarch Site (Indicative Place) and Orchestra Shell Cave (Appendix 1).

The Aboriginal Heritage Enquiry System also returned two "other heritage places"; Dunstan's Quarry and Lake Neerabup. Aboriginal Heritage Enquiry System mapping indicates that these sites are to the south-west of the Project Area (Figure 9).

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3.0 IMPACTS AND MANAGEMENT

3.1 McKinley Road Neerabup Project Area (M70/1316) Proposed Excavation Areas

Figures 3A and 3B illustrates the proposed stage 1 and 2 excavation areas and also highlights possible future areas, which consider all relevant environmental and social restrictive areas and their associated buffers.

All impacts associated with mining activities undertaken on all sites will relate only to these areas.

As noted Rocla will be mining vacant land, after clearing has been undertaken by FPC.

3.1.1 Buffers

The proposed excavation areas have been drafted to avoid key environmental assets (e.g. Bush Forever sites and wetlands) and have incorporated the following buffers:

- A 50 m buffer will be maintained from all CCWs.
- A 50 m buffer will be maintained from all REWs (only 30 m is required).
- A 50 m buffer will be maintained from all DoW bores.
- A 50 m buffer will be maintained from all "high to moderate risk" areas.
- A 50 m buffer will be maintained from all heritage sites.
- A 50 m buffer will be maintained from all road reserves.
- A 50 m buffer will be maintained between mining activities and areas of native vegetation.
- A 50 m buffer will be maintained between mining activities and rural properties on the proposed excavation area boundaries.

Access to and from the McKinley Road Project Area will occur from the existing road network for delivery to the local market.

3.2 Environmental

3.2.1 Geology, Soils and Landforms

There is no native topsoil available for rehabilitation at the sites. The excavation areas in the McKinley Road Project Area will solely consist of areas of *Pinus pinaster* plantation.

3.2.1.1 Acid Sulfate Soils

The majority of sites are within a moderate to low risk area or no risk area and due to excavation activities not intersecting the water table, ASS risks are low.

3.2.2 Hydrology

3.2.2.1 Surface Water

High infiltration rates are expected as a result of the large pore space and lack of water holding capacity of the Bassendean Sands.

There are no surface drainage lines within close proximity of any of the excavation areas and all existing runoff at the site is assumed to be via shallow dispersed flow.

Flooding and inundation of vegetation can cause vegetation stress and death; however, such impacts are unlikely from this project. Surface water may cause some temporary pooling in surrounding areas, although this pooling is expected to be of short duration due to the high infiltration rates and the likely short duration of any significant rain events. This temporary and infrequent pooling is unlikely to have a negative impact on surrounding vegetation outside of the tenement.

Potential surface water impacts include:

- erosion or scour at drainage outlets
- changes to natural hydrology (surface flows, erosion, inundation and surface/groundwater interaction)
- changes in surface water flows to nearby wetlands and lakes
- contamination of surface water with hydrocarbons or chemicals.

To manage the potential impacts the excavation areas will be designed, constructed and operated to avoid disruption of surface water flows and ensure that potential contaminants are not released into any surrounding wetlands, lakes or Bush Forever sites.

The two nationally important wetlands (Joondalup Lake and Loch McNess System) are considered to be far enough away (approximately 7 km and 5 km, respectively) that no additional management measures will be required.

To manage the potential impacts on water quality from the discharge of stormwater with elevated sediment levels or any other contaminants, the following practices will be implemented:

- A 50 m buffer will be maintained from all CCWs.
- A 30 m buffer will be maintained from all REWs.
- Tree stumps will be retained as long as possible.
- Stockpiles of erodible material will be located away from roads and pavements to minimise sediment transport in run-off.
- Each stage will be rehabilitated at completion of excavation.
- Spill response equipment will be available at each site.
- Bunds and drains will be established along the access roads to contain run-off.
- Hydrocarbon management measures will ensure surface water contamination does not occur (contamination and spills management will be implemented.

3.2.2.2 Groundwater

The excavation will take place into the hillside and will not intersect the water table.

The main potential impact to groundwater is contamination via hydrocarbons and sewerage. There are minimal hydrocarbons and chemicals to be stored on site, reducing the likelihood of any major groundwater contamination.

The majority of the McKinley Road Project Area lies within a Priority 1 (P1) Public Drinking Water Source Area (PDWSA). The objective of PDWSAs, as outlined in the Western Australian Planning Commission's State Planning Policy 2.7, *Public Drinking Water Source* Policy (2003), is to ensure that land use and development within PDWSAs is compatible with the protection and management of the public water supply. According to the policy, Priority 1 is the highest level of protection and, in areas with this classification, protection of the public water supply is the most important consideration with respect to use of the land.

The McKinley Road Project Area fall under the jurisdiction of State Planning Policy 2.2, *Gnangara Groundwater Protection* (2005), which lists mining as a "compatible with conditions" land use in Priority 1 protection areas. The conditions outlined in this policy pertain to the management of fuels and chemicals, and to the depth of excavation relative to the water table.

State-wide Planning Policy No. 1, *Policy and Guidelines for Construction and Silica Sand Mining in Public Drinking Water Source Areas* (WRC 1999), outlines guidelines for protection of water quality and quantity from sand extraction activities in PDWSAs. It lists the policy principles as follows:

- Operations in Public Drinking Water Source Ares will only be acceptable if it can be demonstrated that there is sufficient clearance above the water table.
- Fuel and chemical storage facilities shall meet the Department of Water specified standards.
- Operations shall incorporate appropriate mine-site management procedures to ensure surface water run-off, waste disposal and water abstraction do not compromise the water resource objectives for the McKinley Road Project Area.
- Operators shall demonstrate that end land uses are compatible with the water resource objectives for the area.

In addition to PDWSAs, State Planning Policy 2.7 also defines well-head protection zones in Priority 1 areas as having a 500 m radius, within which land uses and activities are restricted to prevent direct contamination of the water source at its point of abstraction.

A Groundwater Management Plan (GMP) will be prepared and implemented to the satisfaction of the DoW for each excavation area prior to the commencement of mining activities. In addition, monitoring bores will be installed to determine the depth to groundwater within the excavation areas and, as a result, the finished floor level.

Management measures that will be implemented include:

- clearance of 5 m to estimated future maximum groundwater level, in the absence of on-site groundwater elevation data. After two years of monitoring has occurred, the finished floor level will have a clearance of 3 m to the estimated future maximum groundwater level in Priority 1 areas and 2 m in Priority 2 and other non-Priority areas
- contamination and spills management (with correct storage and handling there is low risk that a spill would move off site, or infiltrate groundwater beneath the excavation area)

- surface water management including stage mining, surveying the excavation levels, monitoring groundwater and storage of fuel on site will minimise the risk of contamination to groundwater via infiltration of surface water
- installation of monitoring bores at each excavation area to measure levels and water quality
- waste management to ensure that all wastes are disposed of appropriately, minimising the risk of groundwater contamination.

In conjunction with the water level monitoring, it is proposed to monitor baseline groundwater quality. The future groundwater quality resulting from the excavation works can then be compared with the baseline data to assess any impacts associated with the excavation area activities.

Table D outlines a potential groundwater monitoring program, which would be conducted.

Table D: Proposed Baseline Monitoring Program

Location	Proposed Analytes	Potential Source	Frequency
Three bores adjacent to excavation	Total Petroleum Hydrocarbons	Hydrocarbon spill/ leak	Twice over water level monitoring period (winter high and summer low).
Three bores adjacent to excavation	pH, Total Iron, Total Aluminium	Acidic Groundwater from Regional Area	
Three bores adjacent to excavation	Total N, Total P	On-site toilets	
All bores	Water levels	Regional	Monthly

The specifics of this monitoring program may be adjusted pending results over the interim period. Final details will be provided to DoW in order to establish the appropriate excavation depth and water quality parameters for monitoring.

A 500,000 kL water licence will be applied to allow for the washing of sand to meet market requirements, if the market determines this is required. This water allowance will also assist with dust management.

3.2.3 Hydrocarbons

Rocla will ensure that current management procedures based on Australian Standard *AS 1940:2004: The storage and handling of flammable and combustible liquids* are implemented to prevent any potential hydrocarbon contamination to the environment. Hydrocarbons will be managed during construction and operation to prevent any contamination to the surrounding environment.

3.2.3.1 Fuel Management

Rocla is committed to ensuring that its extraction activities do not adversely impact the local groundwater resources and this section outlines the McKinley Road Project Area specific fuel management measures.

Several guidelines have been utilised in the development of fuel management measures, including:

- Statewide Policy No. 1: Policy and Guidelines for Construction and Silica Sand Mining in Public Drinking Water Source Areas (WRC 1999)
- Water Quality Protection Guidelines No. 1 – Water Quality Management in Mining and Mineral Processing: an overview (WRC 2000a)
- Water Quality Protection Note 60 – Tanks for mobile fuel storage in PDWSAs (DoW 2008)
- Water Quality Protection Note 65 – Toxic and hazardous substances: storage and use (DoW 2006)
- *Australian Standard AS 1940:2004. The storage and handling of flammable and combustible liquids.*

Rocla will operate each excavation area to minimise potential contamination by following these procedures:

- The proposed fuel storage tanks to service the machinery will be required to comply fully with the *Australian Standard 1940:2004 The Storage and Handling of Flammable and Combustible Liquids.*
- Procedures will be implemented for the correct handling, storage, spill management and clean up.
- Contaminated material will be removed and bio-remediated (if biodegradable) or disposed of at a licensed facility.
- Spill response equipment will be located in the vicinity of work areas, with site personnel trained in spill response management. Any spills or leaks will be cleaned up immediately. Any absorbent material that has become contaminated as a result of a spill or leak will be disposed of in accordance with legal requirements and contaminated soil will be taken off site by a licences waste contractor in accordance with relevant legislation. Any contaminated materials and soil will be disposed of at a licensed landfill facility.

Fuel management measures are important and will include:

- The excavation area will consist of a self-bunded above-ground fuel tank.
- All care should be taken when coupling and uncoupling hoses between vehicles to minimise any loss of liquids.
- An emergency response plan should be prepared to address any spill that may result from a mobile refuelling vehicle or storage tank. The plan should be made available to all personnel.
- Provision of an adequate buffer separation distance between fuel storage facilities and conservation valued wetlands.
- A 3 m buffer zone of undisturbed sand profile will be maintained to the water table in Priority 1 areas and 2 m in Priority 2 and other non-Priority areas.
- No fuel storage tanks shall be installed in a wellhead protection zone.

3.2.3.2 Fuel Storage

The proposed mining operation will incorporate storage of hydrocarbons in a 17,500 L self bunded tank for each excavation area on excavation area;. The proposed fuel storage tanks to service the machinery will be required to comply fully with the *Australian Standard 1940:2004 The storage and handling of flammable and combustible liquids.* A mobile service truck will be used to transport fuel to machinery to the excavation area.

3.2.3.3 Fuel Spill Prevention

The management practices which will be implemented to prevent fuel spillage to the soil and underlying water resources include:

- Fuel transfer points (delivery into tank and machine refuelling) will be located on concrete hardstand to capture potential fuel spills or leaks.
- Fuel transfer will be undertaken by hand to ensure that fuel is managed carefully without spillage. Connector hoses/funnels will be used to prevent fuel spillage.
- A refuelling buffer of approximately 350 m will apply to all adjacent wetlands.
- Site personnel and operators of heavy machinery will be advised of the protocol in relation to refuelling, and actions to be undertaken in the event of a spillage. A copy of an Emergency Response Plan will be contained within each vehicle for quick access if required.

As specified in WRC (1999) a buffer of at least 2 m of undisturbed soil will be maintained to the water table to minimise the risk of contamination of groundwater from hydrocarbons and allow time for remediation to take place.

The following protocol will be applied in the case of a fuel spillage:

- The area of soil impacted is to be removed immediately. This may be undertaken via hand shovel or use of mechanical equipment if necessary. A shovel is to be kept on the service vehicle at all times).
- Visual analysis to confirm all impacted soil has been removed.
- The operating team are to phone the Operations Manager immediately to report the spillage.
- The Operations Manager is to inform the DPaW of the spillage and remedial action undertaken.
- Should the spillage exceed 20 L, the Operations Manager will also contact the Water Corporation to advise of the spillage and remedial action proposed/undertaken. Laboratory testing of soils from the remediated area will also be undertaken to confirm all fuel was removed.
- Rocla Quarry Products "Incident Report" to be prepared and submitted to the Resource and Development Manager and the Health and Safety Advisor.
- Contaminated soil will be taken off excavation site by a licensed waste contractor in accordance with relevant legislation.
- Contaminated absorbent material and soil will be disposed of to a licensed landfill facility in accordance with legal requirements.

3.2.3.4 Proposed Water Quality Monitoring Program

As specified in Section 3.2.2.2, it is proposed to monitor baseline groundwater quality. The monitoring will include hydrocarbon monitoring in bores that will be installed across the excavation site. Table D (Section 3.2.2.2) summarises the proposed groundwater monitoring program, which will be conducted.

3.2.4 Waste

It is important to manage waste properly to reduce the impacts to visual amenity, groundwater, soil and surface water contamination and human health issues. The following wastes will potentially be produced by the proposed project:

- hydrocarbon and chemical contaminated wastes

- general domestic waste
- sewerage and domestic wastewater.

The following waste management strategies will be implemented during operations:

- Hydrocarbons and chemical containers will be removed from the excavation site and disposed of at a licensed landfill facility at regular intervals.
- Sewage waste will be transported off the excavation site for treatment and disposal by a licensed contractor.
- Site personnel will be informed of on-site waste management procedures.
- Mobile machinery will store all waste oil and remove it from the excavation site daily.

3.2.5 Vegetation and Flora

No clearing of existing native vegetation will be undertaken as the proposed staged areas are located solely within the existing Gnangara-Moore State Forest pine plantation. The areas of pine plantation will be cleared by the FPC. Rocla will only commence operations after clearing by the FPC has occurred. However, as noted, it will be necessary for Rocla to clear any regrowth that occurs within areas of the Gnangara-Moore State Forest that are cleared by the FPC.

There presently exists uncertainty regarding the environmental management of the project area. Rocla's proposal involves a 50-year time frame, during which time extraction will be staged. However, the timing and extent of FPC clearing is not presently known. It is not possible for Rocla to commit to its excavation proceeding at the same rate as the FPC clearing or Rocla's excavation occurring within a particular time frame after clearing by the FPC. This may potentially result in large areas of land being cleared of vegetation without the commencement of excavation being imminent (i.e. within six months). Furthermore, it is not known how the FPC will deal with cleared land that is not required for excavation within the next six months (i.e. it is not known whether cleared land will be revegetated or otherwise stabilised or what weed management actions will be undertaken by the FPC).

During operations, the following management procedures will be followed:

- Adequate buffers will be maintained to all remnant vegetation in surrounding bush forever sites and nearby wetlands.
- Vehicles will be restricted to designated access roads.
- Areas will be cleared of tree stumps in stages, as they help stabilise the soil.

In is anticipated a portion of the extraction areas will be revegetated with pine plantation by the FPC after operations are complete in each area as part of their forestry management program.

It is likely that native vegetation will also be planted within some of the extraction areas. This is mainly due to the impact that the removal of 20,000 ha of pine plantation will have on black cockatoo species. Rehabilitation of the pine plantation is estimated to cost $500 million and the post-mining restoration with *Banksia* species would assist with a significant environmental issue in relation to foraging habitat for black cockatoos. The majority of *Banksia* species are considered medium–high priority for planting for use by Carnaby's, whereas the four pine species listed are considered low–medium priority (DPAW 2011).

3.2.5.1 Banksia Seed Farm

Rocla propose to construct Western Australia's first production seed farm for *Banksia* species required for the company's restoration work on the Perth Swan Coastal Plain. Rocla's intention to develop seed farms will secure *Banksia* seed for long-term future use in the Gnangara Pine Plantation for restoration after mining works and will be the first of its type in Australia to address native seed supply using innovative native seed farming. Importantly, the farm will underpin seed security for restoration of *Banksia* species important to sustaining natural foraging habitat for the Carnaby's Black-Cockatoo.

Full details are included as Appendix 4.

3.2.5.2 Dieback

The arrival and spread of Dieback disease, otherwise known as *Phytophthora* root-rot, in Western Australia has been catastrophic for the biota of a number of south-west Australian ecosystems. It has also been a major problem for road construction, timber harvesting, mining and other industries since land managers realised that the movement of soil is the most important method of spread of the soil-borne pathogen (which is actually a water mould, not a fungus as previously believed). There are several species of *Phytophthora* present in native vegetation in the south-west of Western Australia, but by far the most widespread and destructive is *Phytophthora cinnamomi* thought to have been introduced soon after European settlement. (Dieback Consultative Council 2012)

Due to the removal of native vegetation during the 1920s to establish pine plantation within the McKinley Road Project Area and the absence of Dieback indicator species, it is not possible to detect whether Dieback is present or not; the tenement area is un-interpretable. As a result, the excavation areas will be managed by way of the precautionary principle and as such, hygiene guidelines will be implemented prior to entry and exit of each excavation area. Mobile excavation equipment will be targeted for Dieback management as they hold the greatest risk of transporting soil.

The aim of Dieback management during operations is to minimise the risk of entry of Dieback to the excavation areas. This is achieved by preventing the import of any soil or plant material on mobile equipment and vehicles. The risk of this transportation is low due to the vehicles and machinery travelling on sealed roads prior to entering the excavation areas.

Management strategies for Dieback control are very similar to that of weed control and the two practices should be considered together. Several of the practices outlined below are recommended for un-interpretable sites in the Management of *Phytophthora* Dieback in Extractive Industries document (Dieback Working Group 2005).

- Unauthorised and/or unhygienic entry must not be permitted into the site. This may be achieved via restrictive fencing, and provision of parking areas off site. Similarly a boundary fence around the site will minimise the risks associated with boundary breaches.

- All vehicles or equipment entering the compound are to be "clean on entry", and therefore are required to be washed down prior to entering the site. Once clean, vehicles and equipment can move around within the site without hygiene restrictions. All footwear should also be clean upon entry to the site.

- Training programs and inductions shall be conducted for all site personnel.

- Areas will be "quarantined" ahead of excavation.

- All surface water and wash-down water will be contained. Run-off from the quarry pit, stockpiles and haul roads will be contained, and not released into areas of native vegetation.

- Light vehicles and machinery will be restricted to access roads, tracks and fire breaks, if present. Off-road driving will be prohibited and excavation equipment will be restricted to excavation areas only.

- Vehicles which travel off the limestone tracks must be cleaned down at the designated "clean down bay". Clean down will consist of:
  - in dry soil conditions
    - use a brush and/or blow with air to remove clods of soil and a metal bar or spade to remove compacted soil, where necessary
    - dust adhering to the sides of vehicles does not need to be removed
    - material removed shall be collected on the limestone pad in the clean down bay and periodically covered with fresh limestone

- alternately (in wet soil conditions)
  - wash down using a suitable hose to remove all clods of soil
  - clean wash-down water will be provided in an on-site mobile tank filled via water truck from an external clean source (mains water)
  - wastewater will be collected in a limestone lined controlled area within the clean down bay and allowed to drain through the limestone base.

- No soil or vegetation will be brought on-site, except that for use in rehabilitation. Only certified Phytophthora Dieback free materials (e.g. soil, mulch and compost) will be brought to the site. Plants will be purchased from accredited nurseries and direct seeding would be considered, rather than planting seedlings.

3.2.5.3 Weeds

Earthworks, topsoil and overburden transportation, vehicle movement and several other factors have the potential to introduce additional weeds and spread existing populations of introduced flora within the proposed excavation areas. A weed is a non-native plant in any particular area or region and is considered a nuisance due to excessive growth and/or disturbance to the local ecosystem. The management strategies for weed management are similar to those of plant disease and generally, if Dieback management procedures are followed, weeds will be controlled as a result.

The majority of the McKinley Road Project Area consists of pine plantation or cleared areas of land. All excavation areas will be monitored at the conclusion of operations for any signs of weeds and if they are found, they will be removed, buried or sprayed with herbicide.

The following strategies will assist in minimising the risk of introducing weeds:

- All vehicles or equipment entering the compound are to be "clean on entry", and therefore are required to be washed down prior to entering the excavation areas. Once clean, vehicles and equipment can move around within the excavation areas without hygiene restrictions. All footwear should also be clean upon entry to the excavation areas.
- Any illegally dumped rubbish located during operations will be removed and disposed of as soon as practicable, as rubbish is a major source of weed species.
- Vegetation and topsoil from weed-infested areas will be stripped and stockpiled separately from non-weed infested areas.
- Site personnel will be educated and inducted on weed risk reduction methods and the identification of problem species.

3.2.6 Fauna

The proposed McKinley Road Project Area has been planned to eliminate the requirement for clearing of native vegetation. The excavation area footprints will be located within areas of cleared pine plantation and as a result, it is unlikely that significant fauna habitat species will be impacted by the project. Some localised loss of fauna is possible due to the additional traffic around the excavation area and between the excavation area and customer locations. However, this impact is considered so minimal it is unlikely to be of any significance to the conservation status of any fauna that may be found within the region.

Loss of fauna may arise however from recolonisation if vegetation regrowth (generating suitable habitat) occurs between vegetation being cleared by the FPC and Rocla commencing excavation within that area. As noted, Rocla's proposal involves a 50-year time frame, during which time extraction will be staged. However, the timing and extent of FPC clearing is not presently known. It is not possible for Rocla to commit to its excavation proceeding at the same rate as the FPC clearing or Rocla's excavation occurring within a particular timeframe after clearing by the FPC. Consequently, regrowth may occur, which may be suitable foraging or breeding habitat, prior to Rocla's excavation commencing in that area. If this occurs it will be necessary for Rocla to clear that regrowth habitat prior to the commencement of excavation.

Other potential impacts to fauna include contaminated water consumption or coming into contact with hazardous substances resulting in sickness or death. In addition, stygofauna and troglofauna, if present, may also be affected by contamination, excavation, altering of groundwater levels and soil compaction by excavation area machinery.

Management strategies that will be employed during operations include:

- No clearing within wetland buffers of Bush Forever sites.
- Rehabilitation of disturbed areas will occur once each stage is complete.
- Speed limits will apply on site to limit accidental road kill.
- All site personnel will be informed of avoidance measures and the importance of avoiding causing harm to significant species. In addition, positive sighting of any significant species will be reported to the DPaW as soon as practical.
- No non-native fauna will be permitted on the excavation areas.
- No excavation will occur below the water table, meaning impacts to any stygofauna and troglofauna that may be present is avoided.

3.2.7 Noise

The proposed operation is likely to generate some noise pollution as a result of the operation of earthmoving equipment, traffic along transport routes and noise generated by the screening machinery. However, the Project Area is isolated and is not located near or adjacent to any sensitive premises.

Noise associated with quarrying falls under the *Mines Safety and Inspection Act 1994* and Regulations 1995. Management generally includes necessary hearing protection and conducting inductions and education for all site personnel.

Given the geology of the local area, no blasting or breaking of a dense duricrust will be required. The noise levels emitted from quarrying sand is expected to be much less in comparison to other forms of mining. Disturbance from vibrations is also expected to be minimal as no blasting is proposed.

Significant noise impacts are not expected from the operations across the McKinley Road Project Area and Rocla will ensure that all emissions comply with the requirements of the Environmental Protection (Noise) Regulations 1997 and the *Mining Act 1978* at all times. The distance between dwellings and screening bunds in place will offer sufficient buffers to not adversely impact nearby residents.

Research on noise impacts to fauna is limited, however, it is understood that fauna will adapt quickly to man-made noise in the absence of other significant threats. The noise generated by operations at the excavation areas is unlikely to impact local fauna.

In general, sound travels along a line-of-sight and as a result the majority of noise management strategies involve locating equipment and plant in a topographical depression or behind stockpile bunds to reflect/absorb the noise. The McKinley Road Project Area is well removed from sensitive land uses, however if during operations noise is identified as an issue to sensitive land uses then the following strategies will be implemented:

- The screening plant and excavation areas will be located behind stockpiles to reduce noise impacts to nearby residents.
- Operations will occur between 0600 and 1900 hours daily.
- All mobile equipment will be maintained with efficient mufflers and noise shielding devices.
- Mobile equipment without audible reversing alarms will be utilised where possible.
- All personnel will be provided with appropriate noise protection equipment and will be inducted on safe work practices.

- Access roads and tracks will be maintained to a suitable standard to reduce traffic noise as a result of empty trucks entering the excavation areas.

- Should a justifiable noise complaint be received during operations, Rocla commit to contracting an acoustic consultant to identify the noise source and provide possible solutions. Any complaints received regarding noise will be investigated immediately.

3.2.8 Dust

Excessive dust may impact the health of site personnel and surrounding vegetation. However, the Mackinley Road Project Area is very isolated and not adjacent to any sensitive premises.

Dust generated from the proposed operations is likely to be minimal and localised and may be caused by:

- earthworks during construction and operation
- clearing and stripping
- excavation
- screening
- loading and transport
- vehicle movement
- wind erosion of exposed surfaces.

The EPA Guidance Statement 18: *Prevention of Air Quality Impacts from Land Development Sites* (EPA 2000) outlines control of dust and smoke from land development sites. Assessments of potential dust impacts were undertaken using the Draft Guideline for the Development and Implementation of a Dust Management Program (DEC 2008).

The following factors were taken into account when calculating the dust risk of the proposed excavation areas:

- nuisance potential of yellow sand when disturbed
- topography
- exposed area on at excavation area
- nature of works
- proximity to sensitive receptors
- effect of prevailing winds.

The excavation areas were assessed and resulted in an overall "low" site dust-risk potential, predominantly due to the coarse material properties. Minimal control and contingency measures are required for this level of risk (DEC 2008).

Allowances will be made for water cart operation and Rocla will ensure the disturbed area exposed is kept to a minimum at all times. Adhering to the requirements of the *Mines Safety and Inspection Act 1994* and Regulations 1995, with respect to occupational health risks resulting from dust exposure, Rocla will ensure all personnel working on the excavation areas will have access to adequate and efficient dust masks at all times.

Standard dust suppression measures will be implemented during construction and operations to minimise the impacts on surrounding vegetation. Management strategies that will be undertaken include:

- Dust suppression measures, such as water sprays, are implemented as necessary, in the event that high levels of dust are observed.
- Visual monitoring of dust will be undertaken daily.
- Tree stumps will be cleared in stages to assist with soil stabilisation.
- Access roads will be constructed of crushed limestone and well maintained.
- Activities will high dust generating potential will not be undertaken during adverse weather conditions.
- Vehicles will be confined to designated roads and tracks, with speed limits enforced.
- Material drop heights between loaders and trucks, and trucks to stockpiles, will be kept to the minimum practical height.
- Any complaints will be investigated immediately.

Pine plantation areas will be cleared in stages by the FPC to meet their requirements and markets. Once cleared, Rocla will extract from the area with approximately 30 ha open area at any given time. On completion of the extraction activities, the FPC will replant pines as part of their forestry management; this approach will minimise the size of open areas and in turn, minimise dust nuisance (Figure 10). It is also likely that the extraction areas will be rehabilitated with native *Banksia* species in order to assist in alleviating a significant environmental issue surrounding the lack of suitable foraging habitat for black cockatoos.

3.3 Social

3.3.1 Aboriginal Heritage

A search of the Aboriginal Heritage Enquiry System returned two Indigenous sites in close proximity to the McKinley Road Project Area; Doogarch Site (Indicative Place) and Orchestra Shell Cave (Figure 9) (Appendix 1).

None of the registered sites are recorded within the McKinley Road Project Area (M70/1316).

While it is possible that there are other sites present that have not been registered, it is very unlikely given the duration of the current land use (pine plantation). Extraction and the associated operations have the potential to damage Aboriginal artefacts if they exist in the proposed mining footprint.

Should any evidence of early aboriginal occupation be uncovered during works, all activities will be stopped in compliance with the *Aboriginal Heritage Act 1972–1980* pending an assessment by a recognised consultant. If it is unavoidable that the operations will disturb a site, a Section 18 application will be made to the Department of Indigenous Affairs under the *Aboriginal Heritage Act 1972*.

3.3.2 Local Community

The McKinley Road Project Area as it is located within the Gnangara Mound is isolated from residential dwellings (or noise sensitive receptors) in Neerabup. The local community may be impacted by noise, dust and truck movements to and from the excavation areas. In the event of a community complaint, Rocla will investigate and take immediate action to remediate.

In line with management measures outlined in the EPA Guidance No. 3: *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2005) a 300–500 m (depending on the size of the excavation areas) buffer will be maintained at all times.

3.3.3 Visual Amenity

Visual impact can occur when the operation is visible from neighbouring properties or roads. Impacts are greatest when operations occur high in the landscape, too close to neighbours, or if they have insufficient visual screening. The McKinley Road Project Area is within cleared areas of the Gnangara pine plantation therefore it is unlikely the project will result in visual amenity impacts for Neerabup local residents.
Potential management strategies include:

- rehabilitation of cleared pine plantation areas when excavation works are completed

- ensure barrier fences and gates are compatible with the semi-rural style of the surround land areas and natural landscape
- locate the screening plant so the stockpile area and fringing vegetation screen it from well-used roads
- locate buildings and other site infrastructure in areas of low visual impact
- locate stockpiles to create screening bunds
- adopt good house-keeping practices, such as orderly storage and removal of disused equipment or waste.

4.0 APPROACH TO ENVIRONMENTAL ASSESSMENT

4.1 Stakeholder Consultation

In accordance with the OEPA's advice the McKinley Road Project was requested to be referred as a standalone proposal under Section 38(a) of the *Environmental Protection Act 1986*. The likely outcome would be an Assessment on Proponent Information (API), depending on the level of information provided with the referral.

In consultation with the FPC (pers. comm. Russell Warnes and Michael Lobb late 2011) it was discussed that Rocla would manage and plan their operations to align with FPC forestry management and planning; Rocla will extract from recently harvested pine plantation areas. When extraction activities are completed, the FPC will replant pine.

Table E: Stakeholder Consultation

Stakeholder/ Organisation	Contact	Comment/Outcome
DPaW	Owen Donovan	Various letter correspondence (2010–2011) regarding approvals for access to site for drilling program
DPaW	Grant Lamb	Written correspondence (2010–2011) regarding gaining approval from Minister for Environment and exploratory drilling program.
DPAW	Director General	Correspondence outlining the commitment and support of the development within E70/3276 and E70/3279, including notification of the Conservation Commission sign-off and progress of the application to the Minister for Environment.
DMP	Mike Freeman	Meeting on 17 June 2011 to discuss the proposal approach and requirement for material due to market demand
DoP	Geoff Findlay	Discussions regarding proposal in late 2010
DoW	James Mackintosh	Discussions and correspondence (2010–2011) regarding groundwater, separation levels and exploration works
EPA	Anthony Sutton, Darren Foster	Assessment of the proposal, referral approach and likely outcomes discussed at meetings on 11 March 2011 and 31 October 2011
FPC	Michael Lobb	Excavation activities will be planned and managed to coincide with forestry management and planning
Whadjuk People (SWLASC)	Carolyn Fennelle	Discussion and agreement of Negotiation Protocol for Native Title Agreement 2012–2013

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5.0 MINE CLOSURE

5.1 Post-mining Land Use

The DPaW, through the Gnangara Sustainability Strategy (GSS), has identified up to 19 potential ecological leakages throughout the pine plantations in Gnangara. In total, approximately 9,300 ha, or 60% of the area covered by the linkages, requires restoration (Maher 2009).

After the completion of sand extraction, the land will be rehabilitated in accordance with a rehabilitation plan prepared in concurrence with the DPaW and FPC.

5.2 Closure Plan

Rocla commits to decommissioning all infrastructure. It is anticipated FPC will replant pine in all excavated areas, unless rehabilitation with native vegetation is undertaken in accordance with pine revegetation process outlined in Figure 10.

A formal Rehabilitation and Closure Plan will be submitted to the DPaW as they are currently reviewing the rehabilitation requirements of the Gnangara Pine Plantation.

5.2.1 Landform Reconstruction

Once quarrying of each stage is complete, the excavation area will be backfilled with oversize screened material and reshaped. Overburden will be spread evenly over backfilled material and other areas where waste has been picked up. Surfaces will be ripped or ploughed along the contour to minimise erosion from water run-off and relieve compaction.

As part of the final landform reconstruction, surface drainage lines will be established to control surface run-off and minimise potential erosion.

5.2.2 Topsoil Replacement

There is no native topsoil available for rehabilitation within the McKinley Road Project Area. The Project Area has been used as a pine plantation since the 1920s therefore no native seed bank in the topsoil would be available for rehabilitation use.

5.2.3 Revegetation

Broadcast seeding will likely be required. The species list will depend on the future land use planned by the FPC and DPaW. If it is determined to be Banksia woodland, the methods and species detailed by the Botanic Gardens and Parks Authority (Kings Park) will be used.

5.2.4 Decommissioning

At the end of the excavation areas' lives, Rocla will undertake the following actions to decommission:

- all buildings and infrastructure removed
- any hard stand surfaces will be removed and used to backfill the pit
- overburden and scalps (oversize screened material) will be used as backfill
- the area will have the slopes and soils constructed to allow for regeneration of pine plantation or native vegetation
- broadcast seeding will likely be used, or native vegetation topsoil if available.

6.0 MONITORING AND REPORTING

All quarry activities and potential environmental impacts require ongoing monitoring to ensure legislation, policies, standards and guidelines are being met.

6.1 Inspections and Audits

Monthly environmental, health and safety (EHS) inspections will be undertaken by a suitably appointed EHS representative, using a pre-determined checklist. All corrective actions will be logged and must be completed.

6.2 Annual Reporting

Under the *Mining Act 1978*, mining lease holders are required to submit an Annual Environmental Report (AER) to the Department of Mines and Petroleum (DMP) each year. An AER will also be submitted to the Department of Environmental Regulation for the Works Approval Licence.

An AER will be prepared for each excavation area and shall include:

- excavation progress, including volume of sand removed
- volume of material screened
- contingency actions and outcomes
- environmental incidents, if any
- community complaints and responses, if any.

6.3 Incidents and Complaints

Rocla commit to reporting any environmental incidents that may occur at the excavation areas during operations. An environmental incident is any event that could or does result in an impact to the environment, including, but not limited to, the following:

- water (surface or ground) contamination
- soil contamination
- incorrect waste disposal
- illegal clearing of native vegetation
- wildlife fatalities
- hazardous material spills
- unauthorised land disturbance, including clearing or disturbance of heritage sites
- community complaints.

Rocla will systematically investigate any incidents that occur, identify the cause and implement management measures to eradicate the possibility of the incident reoccurring.

7.0 ENVIRONMENTAL SUMMARY

Environmental Factor	Environmental Objective	Potential Impacts	Management Measures	Predicted Outcome
Flora and Vegetation	To maintain abundance, diversity, geographic distribution interconnectedness and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	▪ Disturbance to nearby conservation significant flora ▪ Changes to wetland hydrology ▪ Introduction and spread of weeds ▪ Introduction and spread of Dieback ▪ Dust emission and deposition	▪ The potential spread of weeds and Dieback, if present, during operations will be prevented. ▪ Dust will be managed during the quarrying operations to protect surrounding native vegetation. ▪ The extent of vegetation clearing will not extend past that of the FPC and stumps will be cleared in stages. ▪ Adequate buffers will be maintained between staged excavation areas and adjacent Bush Forever sites. ▪ Vehicles will be restricted to designated roads. ▪ At the completion of operations, adequate rehabilitation will occur across the McKinley Road Project Area. A rehabilitation plan will be devised and implemented to the satisfaction of the DPaW and DMP.	▪ This proposal does not involve any clearing of existing native vegetation and will therefore have minimal impact on this environmental factor. ▪ Detailed vegetation rehabilitation management
Fauna	To maintain abundance, diversity, geographic distribution, interconnectedness and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	▪ Habitat fragmentation and disturbance and impacts due to loss and degradation of habitat through clearing. ▪ Physical Injury or Fatality ▪ Indirect Effects on Adjacent Habitats	▪ Rehabilitation of potential fauna habitat species after the completion of operations, dependant on FPC requirements. ▪ Management measures will be implemented to reduce indirect disturbance of surrounding fauna habitat. ▪ Staged removal of pine stumps to allow for acclimatisation for any remaining fauna in the area. ▪ The control and monitoring of dust, noise and smoke. ▪ Induction of machinery operators involved in the operations and stump removal process. Operators will be advised to be alert for fauna, and to take steps to avoid impacts, where practical. ▪ Speed limits will apply at the excavation areas to limit fauna fatalities. ▪ Non-native fauna will be prohibited from excavation areas.	▪ No fauna species will cease to exist or have their conservation status adversely affected because of the implementation of this proposal. ▪ The proposal area (cleared pine plantation) does not contain any critical habitats for protected species or populations. ▪ The proposal will result in the reduction in the general availability of habitat (including fragmentation) for those fauna species that are present in the area.

Environmental Factor	Environmental Objective	Potential Impacts	Management Measures	Predicted Outcome
Groundwater Resources	To maintain the integrity, ecological functions and environmental values of GDEs to ensure that any impacts are appropriately managed	▪ Impacting on GDEs in the area ▪ Oxidation of Potential Acid Sulfate Soils (no to low risk) ▪ Impact to Subterranean Fauna (from changes in GW level and direct impact)	▪ Quarry operations will not excavate to within 5 m of the estimated future maximum groundwater level. ▪ A Groundwater Management and Monitoring Plan (GMMP) will be developed and implemented when the quarries are operational. Following the collection of sufficient groundwater level data, the separation distance will reduce to 3 m (Priority 1 areas) and 2 m (Priority 2 and other non-Priority areas). It will include ongoing groundwater quality monitoring and the establishment of appropriate water quality criteria. The plan will be developed with input from DoW and DPaW, with threshold levels being consistent with the intent of the ANZECC/ARMCANZ guidelines and the DoW guidelines: The Plan will also include provision for timely and appropriate responses to contingent events, including responses to possible temporary episodes of reduced water quality. ▪ Waste management to ensure all wastes are disposed of appropriately, minimising the risk of groundwater contamination. ▪ Surface water management will minimise the risk of contamination to groundwater via infiltration.	▪ There will be minimal, if any, impact to groundwater levels or water quality resulting from quarry operations.
Acid Sulfate Soils	To maintain the integrity, ecological functions and environmental values of the soil and landform.	▪ Increase in heavy metal concentrations ▪ Loss of visual amenity	▪ An adequate buffer will be maintained to high to moderate ASS risk area at all times during operations. ▪ Excavation will not intersect the water table at any time during operations, minimising the risk of exposing potential ASS.	▪ The management measures will ensure that the risk of potential impacts occurring as a result of the quarrying operations is minimal.
Noise	To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.	▪ Construction noise impacts upon local residents and workers. ▪ Ongoing operational noise impacts upon local residents and workers.	To protect the amenity of the receiving environments from noise impacts, the following key management measures will be implemented during the construction and operation phase: ▪ Limiting construction work; operating 6.00 am to 7.00 pm, daily. ▪ Design the mine excavation areas to provide enhanced landform and constructed noise screening (i.e. bunds). ▪ Maintain noise suppression devices in good condition on all operational machinery. ▪ Shut down equipment when not in use. ▪ Operate machinery only within the designated hours of operation. ▪ Schedule activities to minimise the likelihood of noise nuisance. ▪ Use the dedicated transport route. Record any complaints received regarding noise disturbance and instigate follow-up action instigated immediately to minimise the cause, to the greatest possible extent.	▪ The excavation areas are relatively isolated from surrounding land uses. ▪ The predicted outcome of the proposed operations is that that the amenity of residents is unlikely to be affected by construction or operation noises.

Environmental Factor	Environmental Objective	Potential Impacts	Management Measures	Predicted Outcome
Air Quality	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards	▪ Dust emissions may occur as a result of the excavation. ▪ Minor levels of exhaust emissions are anticipated from mine equipment. ▪ Vehicle movements associated with the quarry operations will result in exhaust emissions and potential dust emissions from unsealed roads.	To prevent or minimise dust generation during quarry operations, the following dust management measures will be implemented during the construction and operation phase: ▪ The excavation will occur over several stages. A key objective is to minimise the disturbance or open area at any one time, as far as practicable. ▪ Maintain haul road surface in a good condition and with suitable grades. ▪ Restrict vehicle movements to defined roads. ▪ All vehicles leaving the excavation areas are required to have covered loads. ▪ Use water as appropriate to wet down roads and trafficked areas. ▪ Use dust suppressants where appropriate (either mixed with water to enhance dust suppression and vegetation cover, or applied periodically to specific areas). ▪ Limit the speed of vehicles on the excavation areas. ▪ Apply surface treatments (e.g. mulch, ground cover) to stabilise any bare areas which might be prone to wind erosion. ▪ Define buffer areas within the excavation areas to avoid any unnecessary disturbance of stabilised surfaces or vehicle traffic. ▪ Limit the quantity of machinery / vehicles in operation. ▪ Inducting all contractors working within the excavation areas. Record any complaints received and instigate follow-up action instigated immediately to minimise the cause, to the greatest possible extent.	▪ The predicted outcome is that emissions are unlikely to affect adversely the area's environmental values or the health, welfare and amenity of neighbouring residences. The objective of ensuring that emissions from construction works do not adversely affect environmental values or the health, welfare and amenity of people and land uses will be met through managing potentially adverse construction and operation impacts as per the air quality management measures.
Hydrocarbons and Waste	Ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and	▪ Contamination of local soil, groundwater or surface waters as a result of waste materials generated by construction and operation and the possible	▪ Procedures will be implemented for the correct handling, storage, spill management and clean up. ▪ Contaminated material will be removed and bio-remediated (if biodegradable) or disposed of at a licensed facility. ▪ Spill response equipment will be located in the vicinity of work areas, with site personnel trained in spill response management. ▪ The proposed fuel storage tanks to service the machinery will be required to comply fully with the Australian Standard 1940:2004 The Storage and Handling of Flammable and Combustible	▪ The objective of ensuring that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land will be met through managing adverse construction impacts in accordance with Australian Standard

Environmental Factor	Environmental Objective	Potential Impacts	Management Measures	Predicted Outcome
	acceptable standards	inadequate handling, storage or disposal of hydrocarbons and chemicals ▪ Sewerage and waste discharge adding nutrients and pollutants to the soil and groundwater.	Liquids. This standard specifies requirements for security, bunding, signage, fire protection and handling.	1940:2004, Guideline No. 1: Controlling Waste Generators (DoE, 2004a). ▪ The management of general and hazardous waste is expected to result in negligible environmental impacts.
Visual Amenity	To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape to as low as reasonably practicable.	▪ Views of "natural" vegetation will be altered by the addition of a "man-made" excavation pit	▪ The pit design will be such that natural topography and sand bunds will be utilised to shield the view of the mine from surrounding land uses. ▪ Ensure barrier fences and gates are compatible with the semi-rural style of the surround land areas and natural landscape. ▪ Ensure orderly storage and removal of disused equipment or waste.	▪ The predicted outcome of the operations will be a minor change in the nature of the natural vegetation in each area with an increased element of "man-made" structures impacting on the view-scape. ▪ Considering the limited surround land uses, the impact on visual amenity is expected to be minimal.
Aboriginal Heritage	▪ To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	▪ Damage or loss to Aboriginal heritage sites	▪ Any significant sites identified during construction will not be removed, damaged or altered without approval under Section 18 of the *Aboriginal Heritage Act 1972.* ▪ Training will be provided to all construction workers detailing the importance of avoiding heritage sites and reporting of any suspected heritage sites. Exclusion zones will also be identified and clearly communicated to project personnel in the event of a heritage site being uncovered.	▪ Significant sites identified from the Aboriginal Sites register and during construction will not be removed, damaged or altered without approval under Section 18 of the *Aboriginal Heritage Act 1972.* ▪ No "other heritage site" occurs within the McKinley Road Project Area, so impact is expected to be minimal.

8.0 REFERENCES

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FIGURES

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RPS

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Drafted by: MA
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Figure 1

Site Location

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Timaru Nature Reserve

Yeal Nature Reserve

Yanchep National Park

Gnangara-Moore River State Forest

Gnangara-Moore River State Forest

Neerabup Nature Reserve

Neerabup National Park

Gnangara-Moore River State Forest

Lake Joondalup Nature Reserve

Jandabup Nature Reserve

Woodvale Nature Reserve

LEGEND

- McKinley Road, Neerabup Project Area (M70/1316)

DEC Estate

- 5(1)(g) Reserve (Limestone Quarry)
- Conservation Park
- Miscellaneous Reserve
- National Park
- Nature Reserve
- State Forest

RPS

Job Number: L11438
Doc Number: McK-002
Date: 18.02.14
Scale: 1:100,000 @ A3
Created by: MA
Source: Cadastre & Orthophoto - Landgate, 2014 DEC Estate - 2013

GDA 1994 MGA Zone 50

0 0.5 1 2 3 4 km

Figure 2

Site Context

LEGEND

- Roads
- Site Access
- Site Facilities
- McKinley Road, Neerabup Project Area (M70/1316)
- Bush Forever
- 50 m from Bush Forever

Aboriginal Heritage Sites (DIA, 2012)

- Registered Aboriginal Heritage Site
- Other Heritage Place
- 50m from Aboriginal Heritage
- EPP Lake Boundary (DEC, 18.12.92)

Acid Sulfate Soil Risk Mapping (DEC, 25.01.2010)

- High to Moderate Risk
- Moderate to Low Risk
- 50m from Acid Sulfate Soils

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- 50m from Wetlands

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Site: 409 | Site: 411 | Site: 1 | Site: 380 | Site: 0 | Site: 425 | Site: 290 | Site: 95 | Site: 417 | Site: 134 | Site: 137 | Site: 135 | Site: 136 | Site: 451 | Site: 293 | Site: 139 | Site: 446 | Site: 140 | Site: 455 | Site: 457 | Site: 444 | Site: 428 | Site: 382 | Site: 383 | Site: 384

SITE ID: 17450 Mythological

SITE ID: 3366 Artefacts / Scatter

SITE ID: 4404 Engraving, Artefacts / Scatter

SITE ID: 3693

UFI 8021 | UFI 8017 | UFI 8019 | UFI 7938 | UFI 8201 | UFI 7916 | UFI 7920 | UFI 7921 | UFI 7915 | UFI 15005 | UFI 7917 | UFI 7934 | UFI 7947 | UFI 7948 | UFI 7937 | UFI 13373 | UFI 7929 | UFI 7931 | UFI 7933 | UFI 13374

TOMAR RD | DELMA RD | BAILEY RD | CARABOODA RD | KILN RD | MCLENNAN DR | HAKEA RD | SINTRA RD | CYPRESS RD | RAAF BOUNDARY RD | MCKINLEY RD | WATER RD | SHRIKE | COOLIBAH RD | PORCUPINE RD | BOTTLEBRUSH RD | JACKSONIA RD | CUTLER RD | TIFWAY PL | GODEL RD | HOPKINS RD | PORTUGAL RD | OLD YANCHEP RD | SERPA RD | LISBON RD | WESCO RD | GIBBS RD | NOWERGUP RD | WANNEROO RD | DUNSTAN RD | MANZAS PL | DAYRELL RD | WATTLE AV W | WATTLE AV E | LAKE RD | ORCHID RD | ANDERSON RD | PERRY RD | ZIATAS RD

RPS

Job Number: L11438
Doc Number: L11438-McK-003A
Date: 18.02.14
Scale: 1:35,000 @ A3
Created by: MA
Source: Wetlands - DEC, 2013

GDA 1994 MGA Zone 50

0 0.2 0.4 0.8 1.2 1.6 km

Figure 3A

McKinley Road, Neerabup Project Area with Key Environmental Mapping

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LEGEND

- Roads
- Site Access
- Site Facilities
- McKinley Road, Neerabup Project Area (M70/1316)
- Stage 1 and 2
- Future Stage
- Bush Forever
- 50 m from Bush Forever

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- 50m from Wetlands

STAGE 1

STAGE 2

HADDRILL RD
MARDO RD
FOX RD
AQUA RD
PARROT RD
NISA RD
KESTRAL RD
SHRIKE RD
DINGO RD
TOMAR RD
COOLIBAH RD
PORCUPINE RD
DELMA RD
JACKSONIA RD
BOTTLEBRUSH RD
SINTRA RD
RAAF BOUNDARY RD
CYPRESS RD
BAILEY RD
CARABOODA RD
CUTLER RD
TIFWAY PL
KILN RD
OLD YANCHEP ROAD
SERPA RD
PORTUGAL RD
HOPKINS RD
HAKEA RD
MCLENNAN DR
GODEL RD
LISBON RD
WESCO RD
GIBBS RD
NOWERGUP RD
WANNEROO RD
DUNSTAN RD
MANZAS PL
DAYRELL RD
WATTLE AV W
WATTLE AV E
LAKE RD
ANDERSON RD
ORCHID RD
PERRY RD
ZIATAS RD

Site: 381
Site: 408
Site: 410
Site: 409
Site: 411
Site: 1
Site: 380
Site: 0
Site: 425
Site: 290
Site: 95
Site: 417
Site: 134
Site: 136
Site: 137
Site: 135
Site: 293
Site: 451
Site: 139
Site: 446
Site: 140
Site: 455
Site: 457
Site: 444
Site: 428
Site: 382
Site: 383
Site: 384

UFI 7916
UFI 7920
UFI 7921
UFI 7915
UFI 15005
UFI 7917
UFI 7935
UFI 7947
UFI 7934
UFI 7948
UFI 7937
UFI 8201
UFI 13373
UFI 7938
UFI 7929
UFI 7931
UFI 7933
UFI 13374
UFI 8021
UFI 8017
UFI 8018

RPS

Job Number: L11438
Doc Number: L11438-McK-003B
Date: 21.02.14
Scale: 1:35,000 @ A3
Created by: MA
Source: Wetlands - DEC, 2013

GDA 1994 MGA Zone 50

0 0.2 0.4 0.8 1.2 1.6 km

Figure 3B

McKinley Road Project Area Proposed Stage Areas

LEGEND

- Roads
- Site Access
- Site Facilities
- Stage 1 and 2
- Future Stage
- McKinley Road, Neerabup Project Area (M70/1316)

Geology

CODE, Narrative

- Cps:PEATY CLAY - dark grey and black with variable sand content, of lacustrine origin
- LS1:LIMESTONE - light yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, a trace of feldspar, shell debris, variably lithified, surface kankar of eolian origin
- LS2:LIMESTONE - light yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, a trace of feldspar, shell debris, variably lithified, surface kankar of eolian origin
- S4:SAND - greyish brown, medium to coarse-grained, quartz, variable silt content, moderately well sorted, of lacustrine origin
- S7:SAND - pale and olive yellow, medium to coarse-grained, sub-angular quartz and a trace of feldspar, moderately sorted of residual origin
- S8:SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin
- S9:SAND - yellowish brown, medium to coarse-grained, angular to sub-rounded, quartz, some fine grained pisolitic laterite, little fines, of lacustrine origin
- S10:SAND over PEBBLY SILT - sand as S8 overlying Mgs1 gravelly silt
- Water:

HADDRILL RD, MCKINLEY RD, RAAF BOUNDARY RD, TOMAR RD, JACKSONIA RD, DELMA RD, COOLIBAH RD, PORCUPINE RD, CYPRESS RD, BOTTLEBRUSH RD, SINTRA RD, BAILEY RD, CARABOODA RD, CUTLER RD, NISA RD, GREENLEES WY, OLDYANCHEP RD, KILN RD, SERPA RD, PORTUGAL RD, MCLENNAN DR, GODEL RD, HOPKINS RD, HAKEA RD, LISBON RD, WESCO RD, GIBBS RD, DASYPOGON RD, PERSOONIA RD, REGELIA RD, PERRY RD, HIGGINS RD, WANNEROO RD, DUNSTAN RD, ANDERSON RD, ORCHID RD, MANZAS PL, DAYRELL RD, WATTLE AV W, WATTLE AV E, ZIATAS RD

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Scale: 1:40,000 @ A3
Created by: MA
Source: Cadastre & Orthophoto - Landgate, 2014 Geology - DoIR, 1999

GDA 1994 MGA Zone 50

0 0.225 0.45 0.9 1.35 1.8 km

Figure 4

Geology

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LEGEND

- Roads
- Site Access
- McKinley Road, Neerabup Project Area (M70/1316)
- Stage 1 and 2
- Future Stage
- Site Facilities

MARDO RD
NISA RD
HADDRILL RD
PARROT RD
KESTRAL RD
FOX RD
AQUA RD
DINGO RD
WATER RD
SHRIKE RD
MCKINLEY RD
TOMAR RD
RAAF BOUNDARY RD
COOLIBAH RD
PORCUPINE RD
DELMA RD
CYPRESS RD
JACKSONIA RD
BOTTLEBRUSH RD
SINTRA RD
BAILEY RD
CARABOODA RD
CUTLER RD
TIFWAY PL
OLD YANCHEP RD
KILN RD
SERPA RD
PORTUGAL RD
MCLENNAN DR
HOPKINS RD
GODEL RD
HAKEA RD
LISBON RD
PERRY RD
GIBBS RD
WESCO RD
NOWERGUP RD
WANNEROO RD
DUNSTAN RD
ANDERSON RD
ORCHID RD
MANZAS PL
DAYRELL RD
WATTLE AV W
LAKE RD
WATTLE AV E
ZIATAS RD

RPS

Job Number: L11438
Doc Number: L11438-McK-005
Date: 18.02.14
Scale: 1:35,000 @ A3
Created by: MA
Source: ASS - DEC, 2010

GDA 1994 MGA Zone 50

0 0.2 0.4 0.8 1.2 1.6 km

Figure 5

Acid Sulfate Soils Risk Mapping

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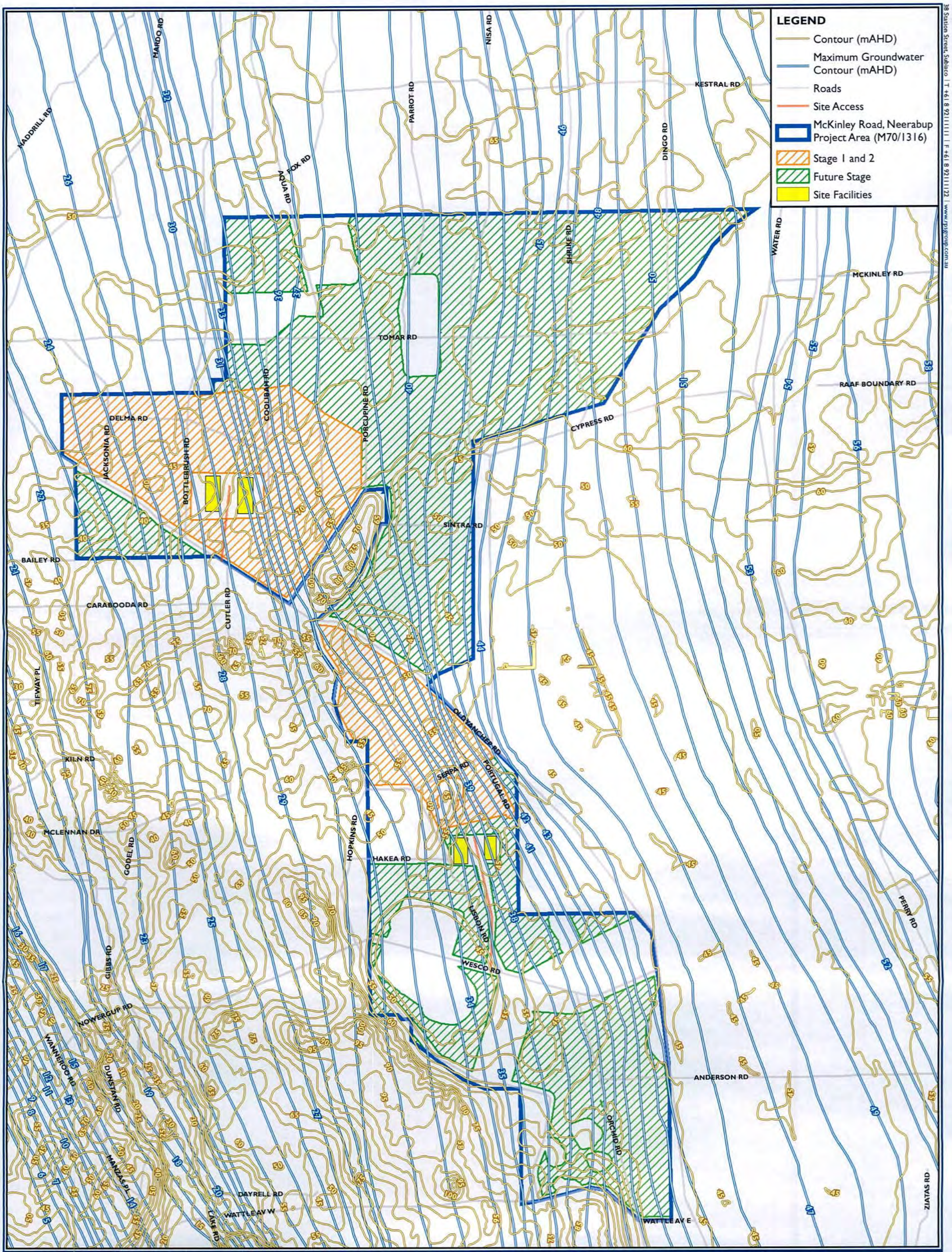


RPS

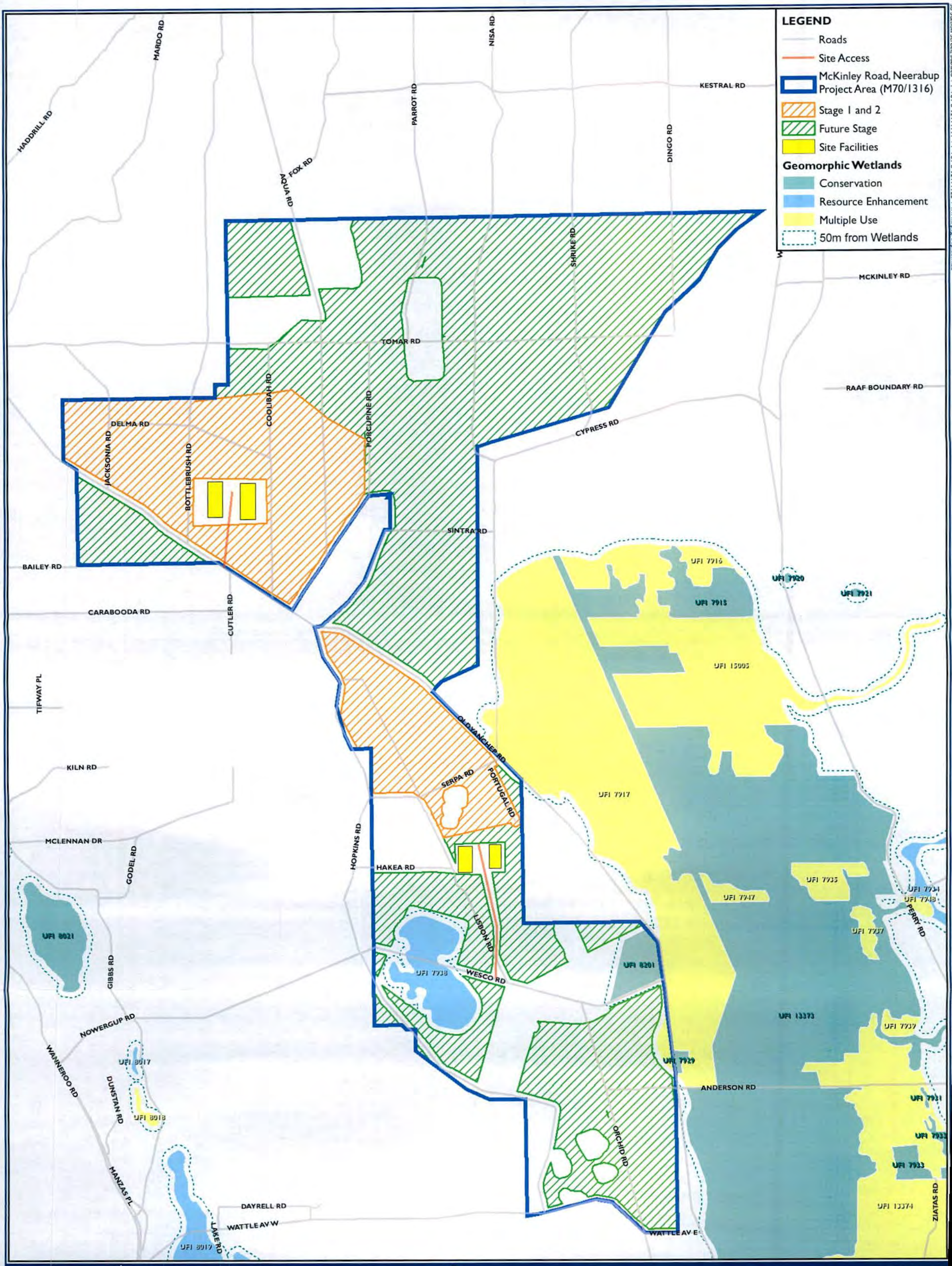
Job Number: L11438
Doc Number: L11438-McK-006
Date: 18.02.14
Scale: 1:35,000 @ A3
Created by: MA
Source: ASS - DEC, 2010

GDA 1994 MGA Zone 50

0 0.2 0.4 0.8 1.2 1.6 km

Figure 6

Topography and Groundwater



RPS

Job Number: L11438
Doc Number: L11438-McK-007
Date: 18.02.14
Scale: 1:35,000 @ A3
Created by: MA
Source: Wetlands - DEC, 2013 EPP - DEC, 1992

GDA 1994 MGA Zone 50

0 0.2 0.4 0.8 1.2 1.6 km

Figure 7

Hydrology

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LEGEND

- Roads
- Site Access
- Site Facilities
- McKinley Road, Neerabup Project Area (M70/1316)
- Stage 1 and 2
- Future Stage
- Bush Forever

STAGE 1

STAGE 2

HADDRILL RD
MARDO RD
FOX RD
AQUA RD
PARROT RD
NISA RD
SHRIKE RD
DINGO RD
KESTRAL RD
WATER RD
MCKINLEY RD
RAAF BOUNDARY RD
TOMAR RD
COOLIBAH RD
PORCUPINE RD
DELMA RD
JACKSONIA RD
BOTTLEBRUSH RD
CYPRESS RD
SINTRA RD
BAILEY RD
CARABOODA RD
CUTLER RD
TIFWAY PL
KILN RD
MCLENNAN DR
GODEL RD
HOPKINS RD
HAKEA RD
SERPA RD
PORTUGAL RD
OLD YANCHEP RD
LISBON RD
WESCO RD
ORCHID RD
GIBBS RD
NOWERGUP RD
WANNEROO RD
DUNSTAN RD
MANZAS PL
DAYRELL RD
WATTLE AV W
WATTLE AV E
LAKE RD
ANDERSON RD
PERRY RD
ZIATAS RD

Site: 381
Site: 408
Site: 410
Site: 409
Site: 411
Site: 1
Site: 380
Site: 0
Site: 425
Site: 290
Site: 95
Site: 417
Site: 134
Site: 136
Site: 137
Site: 135
Site: 451
Site: 293
Site: 139
Site: 446
Site: 140
Site: 455
Site: 457
Site: 444
Site: 428
Site: 383
Site: 384
Site: 382

RPS	Job Number: L11438 Doc Number: L11438-McK-008 Date: 18.02.14 Scale: 1:35,000 @ A3 Created by: MA Source: Bush Forever - DPI, 2009

GDA 1994 MGA Zone 50

0 0.2 0.4 0.8 1.2 1.6 km

Figure 8

Bush Forever

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LEGEND

- Roads
- Site Access
- Site Facilities
- McKinley Road, Neerabup Project Area (M70/1316)
- Stage 1 and 2
- Future Stage

Aboriginal Heritage

- Registered Aboriginal Heritage Site
- Other Heritage Place

HADDRILL RD
MARDO RD
PARROT RD
NISA RD
KESTRAL RD
DINGO RD
FOX RD
AQUA RD
SHRIKE RD
WATER RD
MCKINLEY RD
TOMAR RD
RAAF BOUNDARY RD
COOLIBAH RD
PORCUPINE RD
CYPRESS RD
DELMA RD
JACKSONIA RD
BOTTLEBRUSH RD
STAGE 1
SINTRA RD
BAILEY RD
CARABOODA RD
CUTLER RD
OLD YANCHEP RD
STAGE 2
KILN RD
SERPA RD
PORTUGAL RD
MCLENNAN DR
GODEL RD
HOPKINS RD
HAKEA RD
LISBON RD
WESCO RD
DASYPOGON RD
PERRY RD
SITE ID: 17450
Mythological
NOWERGUP RD
SITE ID: 3366
Artefacts / Scatter
GIBBS RD
WANNEROO RD
DUNSTAN RD
ANDERSON RD
ORCHID RD
SITE ID: 4404
Engraving, Artefacts / Scatter
MANZAS PL
SITE ID: 3693
DAYRELL RD
WATTLE AV W
LAKE RD
WATTLE AV E
ZIATAS RD

RPS

Job Number: L11438
Doc Number: L11438-McK-009
Date: 18.02.14
Scale: 1:35,000 @ A3
Created by: MA
Source: Aboriginal Heritage - DAA, 2012

GDA 1994 MGA Zone 50

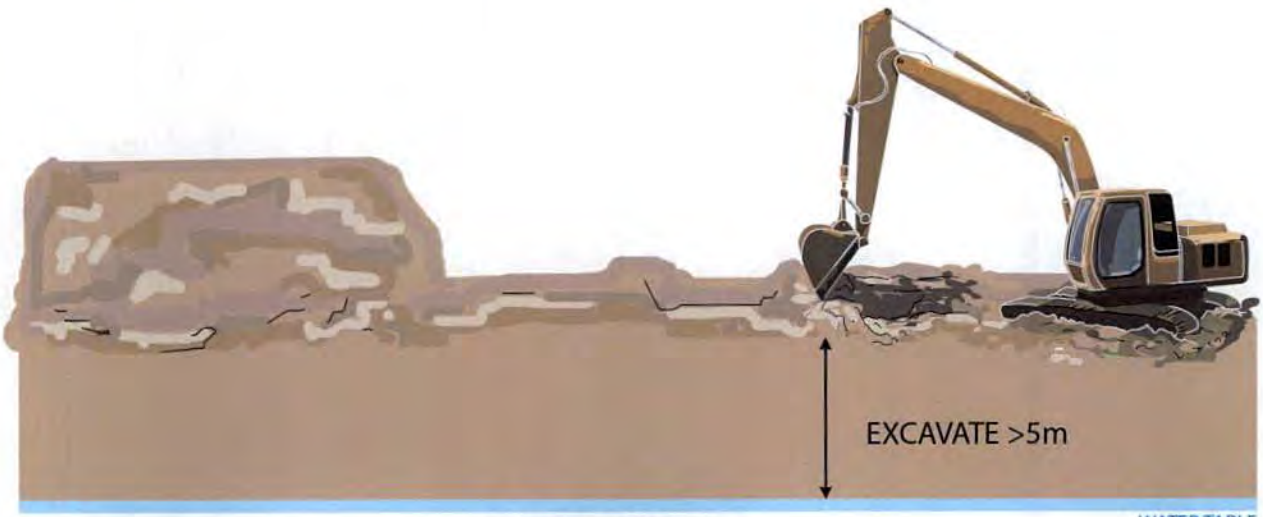
0 0.2 0.4 0.8 1.2 1.6 km

Figure 9

Aboriginal Heritage Sites

PINE PLANTATION

HARVEST (Forestry Products Commission)



EXCAVATE (Rocla)

REPLANT PINE PLANTATION (Forestry Products Commission)

RPS

Job Number: L11438
Doc No: McK-010
Date: 18.02.14
Scale: Not to Scale @ A4
Drafted by: SC
Source: RPS

Figure 10

Pine Plantation Cycle

RPS

APPENDIX I

EPBC Protected Matters Search Results

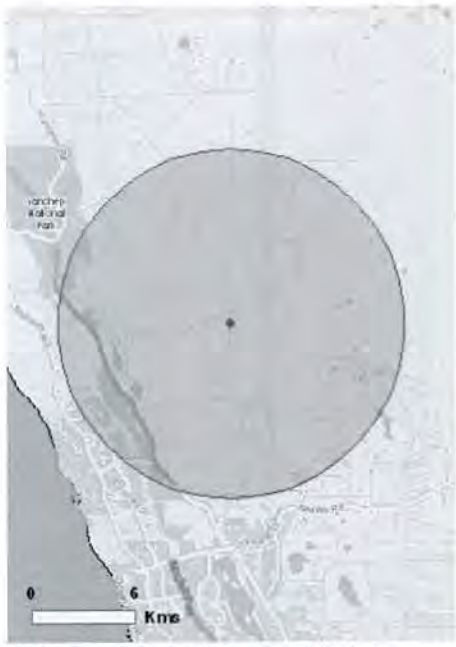
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 12/03/12 17:05:58



Coordinates
Buffer: 10.0Km

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	2
Threatened Species:	17
Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	2
Commonwealth Heritage Places:	1
Listed Marine Species:	7
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	10
State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	16
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Aquatic Root Mat Community in Caves of the Swan Coastal Plain	Endangered	Community known to occur within area
Sedgelands in Holocene dune swales of the	Endangered	Community known to

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
southern Swan Coastal Plain		occur within area

Threatened Species

[Resource Information]

Name	Status	Type of Presence
BIRDS		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Fairy Tern (Australian) [82950]	Vulnerable	Species or species habitat may occur within area
INSECTS		
Synemon gratiosa Graceful Sun Moth [66757]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
PLANTS		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. Gingin (N.G.Marchant s.n. 4/11/1988) Gingin Wax [64649]	Endangered	Species or species habitat may occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Epiblema grandiflorum var. cyaneum Baby Blue Orchid, Blue Babe-in-the-cradle Orchid [67182]	Endangered	Species or species habitat may occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat likely to occur within area
Grevillea curviloba subsp. curviloba Curved-leaf Grevillea [64908]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Defence - MUCHEA ARMAMENT RANGE

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Muchea / Pearce Air Weapons Range	WA	Indicative Place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Muchea / Pearce Air Weapons Range	WA	Indicative Place
Ridges Management Priority Area	WA	Indicative Place
Ridges Management Priority Area and State Forest No 65	WA	Indicative Place
Wanneroo Wetlands Eastern Chain	WA	Indicative Place
Neerabup National Park	WA	Registered
Nowergup Lake Fauna Reserve	WA	Registered
Yanchep National Park	WA	Registered
Yeal - Gnangara Area	WA	Registered
Indigenous		
Doogarch Site	WA	Indicative Place
Orchestra Shell Cave	WA	Registered

State and Territory Reserves [Resource Information]

Name	State
Neerabup	WA
Neerabup	WA
Yanchep	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		

Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Coordinates

-31.59903 115.7811

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra

-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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RPS

APPENDIX 2

NatureMap Search Results

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 13/03/2012

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°46' 51" E,31°35' 56" S
Buffer 10km
Group By Species Group

Species Group	Species	Records
Alga	3	4
Amphibian	4	17
Bird	96	1220
Dicotyledon	281	733
Gymnosperm	1	6
Invertebrate	4	75
Mammal	11	23
Monocotyledon	130	361
Reptile	32	92
Slime Mould	2	2
Water Mould	1	8
TOTAL	**565**	**2541**

	Name ID	Species Name	Naturalised	Conservation Code	†Endemic To Query Area
Alga					
1.	26731	*Cystoseira trinodis*			
2.	27392	*Dictyota dichotoma var. intricata*			
3.	26946	*Hormophysa cuneiformis*			
Amphibian					
4.	25400	*Crinia insignifera (Squelching Froglet)*			
5.	25410	*Heleioporus eyrei (Moaning Frog)*			
6.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
7.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
Bird					
8.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
9.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
10.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
11.	24262	*Acanthiza inornata (Western Thornbill)*			
12.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
13.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
14.	25536	*Accipiter fasciatus (Brown Goshawk)*			
15.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
16.	24312	*Anas gracilis (Grey Teal)*			
17.	24315	*Anas rhynchotis (Australasian Shoveler)*			
18.	24316	*Anas superciliosa (Pacific Black Duck)*			
19.	24561	*Anthochaera carunculata (Red Wattlebird)*			
20.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
21.	24285	*Aquila audax (Wedge-tailed Eagle)*			
22.	24341	*Ardea pacifica (White-necked Heron)*			
23.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
24.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
25.	24318	*Aythya australis (Hardhead)*			
26.	24319	*Biziura lobata (Musk Duck)*			
27.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
28.	25716	*Cacatua sanguinea (Little Corella)*			
29.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*			
30.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
31.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
32.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo)*		T	
33.	25625	*Carduelis carduelis (Goldfinch)*			
34.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
35.	24321	*Chenonetta jubata (Australian Wood Duck)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
36.	24288	*Circus approximans (Swamp Harrier)*			
37.	24289	*Circus assimilis (Spotted Harrier)*			
38.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
39.	24399	*Columba livia (Domestic Pigeon)*			
40.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
41.	25592	*Corvus coronoides (Australian Raven)*			
42.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
43.	25595	*Cracticus tibicen (Australian Magpie)*			
44.	25596	*Cracticus torquatus (Grey Butcherbird)*			
45.	24322	*Cygnus atratus (Black Swan)*			
46.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*			
47.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
48.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
49.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
50.	25622	*Falco cenchroides (Australian Kestrel)*			
51.	25623	*Falco longipennis (Australian Hobby)*			
52.	25727	*Fulica atra (Eurasian Coot)*			
53.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
54.	25530	*Gerygone fusca (Western Gerygone)*			
55.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
56.	24443	*Grallina cyanoleuca (Magpie-lark)*			
57.	24295	*Haliastur sphenurus (Whistling Kite)*			
58.	24689	*Halobaena caerulea (Blue Petrel)*			
59.	25734	*Himantopus himantopus (Black-winged Stilt)*			
60.	24491	*Hirundo neoxena (Welcome Swallow)*			
61.	24577	*Lichenostomus ornatus (Yellow-plumed Honeyeater)*			
62.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
63.	25661	*Lichmera indistincta (Brown Honeyeater)*			
64.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
65.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
66.	25654	*Malurus splendens (Splendid Fairy-wren)*			
67.	24583	*Manorina flavigula (Yellow-throated Miner)*			
68.	24598	*Merops ornatus (Rainbow Bee-eater)*			
69.	24738	*Neophema elegans (Elegant Parrot)*			
70.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
71.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
72.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
73.	24328	*Oxyura australis (Blue-billed Duck)*			
74.	25679	*Pachycephala pectoralis (Golden Whistler)*			
75.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
76.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
77.	25682	*Pardalotus striatus (Striated Pardalote)*			
78.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
79.	24659	*Petroica goodenovii (Red-capped Robin)*			
80.	25697	*Phalacrocorax carbo (Great Cormorant)*			
81.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
82.	24409	*Phaps chalcoptera (Common Bronzewing)*			
83.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
84.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
85.	25720	*Platycercus icterotis (Western Rosella)*			
86.	25703	*Podargus strigoides (Tawny Frogmouth)*			
87.	25704	*Podiceps cristatus (Great Crested Grebe)*			
88.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
89.	25722	*Polytelis anthopeplus (Regent Parrot)*			
90.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
91.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
92.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
93.	30948	*Smicrornis brevirostris (Weebill)*			
94.	25597	*Strepera versicolor (Grey Currawong)*			
95.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*			
96.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*			
97.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
98.	24331	*Tadorna tadornoides (Australian Shelduck)*			
99.	24844	*Threskiornis molucca (Australian White Ibis)*			
100.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
101.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
102.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
103.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			

Dicotyledon

104.	15470	*Acacia barbinervis subsp. borealis*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
105.	3237	*Acacia benthamii*		P2	
106.	3262	*Acacia cochlearis (Rigid Wattle)*			
107.	3282	*Acacia cyclops (Coastal Wattle)*			
108.	3408	*Acacia lasiocalyx (Silver Wattle)*			
109.	11611	*Acacia lasiocarpa var. lasiocarpa*			
110.	3502	*Acacia pulchella (Prickly Moses)*			
111.	15482	*Acacia pulchella var. goadbyi*			
112.	3525	*Acacia rostellifera (Summer-scented Wattle)*			
113.	30032	*Acacia saligna subsp. saligna*			
114.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
115.	3584	*Acacia truncata*			
116.	6205	*Actinotus leucocephalus (Flannel Flower)*			
117.	1775	*Adenanthos cygnorum (Common Woollybush)*			
118.	11336	*Adenanthos cygnorum subsp. chamaephyton*		P3	
119.	1728	*Allocasuarina fraseriana (Sheoak)*			
120.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
121.	2668	*Amaranthus powellii (Powell's Amaranth)*	Y		
122.	2671	*Amaranthus viridis (Green Amaranth)*	Y		
123.	6311	*Andersonia heterophylla*			
124.	6314	*Andersonia lehmanniana*			
125.	12724	*Anthotium junciforme*			
126.	20283	*Astartea scoparia*			
127.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
128.	6331	*Astroloma microcalyx (Native Cranberry)*			
129.	6334	*Astroloma pallidum (Kick Bush)*			
130.	34161	*Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)*			
131.	1800	*Banksia attenuata (Slender Banksia)*			
132.	1819	*Banksia grandis (Bull Banksia)*			
133.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
134.	1834	*Banksia menziesii (Firewood Banksia)*			
135.	5382	*Beaufortia elegans*			
136.	11564	*Boronia ramosa subsp. ramosa*			
137.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
138.	7878	*Brachyscome iberidifolia*			
139.	11187	*Brassica barrelieri subsp. oxyrrhina (Smooth-stem Turnip)*	Y		
140.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
141.	2856	*Calandrinia liniflora (Parakeelya)*			
142.	5415	*Calothamnus lateralis*			
143.	5426	*Calothamnus quadrifidus (One-sided Bottlebrush)*			
144.	35816	*Calothamnus quadrifidus subsp. quadrifidus*			
145.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower)*			
146.	5458	*Calytrix flavescens (Summer Starflower)*			
147.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
148.	2798	*Carpobrotus virescens (Coastal Pigface)*			
149.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
150.	2957	*Cassytha racemosa (Dodder Laurel)*			
151.	11799	*Cassytha racemosa forma racemosa*			
152.	6539	*Centaurium erythraea (Common Centaury)*	Y		
153.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
154.	2483	*Chenopodium album (Fat Hen)*	Y		
155.	6543	*Cicendia filiformis (Slender Cicendia)*	Y		
156.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
157.	4552	*Comesperma confertum*			
158.	4554	*Comesperma flavum*			
159.	1857	*Conospermum acerosum (Needle-leaved Smokebush)*			
160.	15607	*Conospermum acerosum subsp. acerosum*			
161.	1876	*Conospermum incurvum (Plume Smokebush)*			
162.	1882	*Conospermum stoechadis (Common Smokebush)*			
163.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
164.	1885	*Conospermum triplinervium (Tree Smokebush)*			
165.	15521	*Conospermum unilaterale*			
166.	6347	*Conostephium minus (Pink-tipped Pearl flower)*			
167.	6348	*Conostephium pendulum (Pearl Flower)*			
168.	20074	*Conyza sumatrensis*	Y		
169.	17104	*Corymbia calophylla (Marri)*			
170.	17926	*Craspedia arenicola*			
171.	11221	*Crassula alata var. alata*	Y		
172.	17701	*Crassula closiana*			
173.	3137	*Crassula colorata (Dense Stonecrop)*			
174.	13527	*Croninia kingiana*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
175.	4802	*Cryptandra mutila*			
176.	4809	*Cryptandra pungens*			
177.	11021	*Cuscuta planiflora*	Y		
178.	7454	*Dampiera linearis (Common Dampiera)*			
179.	6218	*Daucus glochidiatus (Australian Carrot)*			
180.	3793	*Daviesia angulata*			
181.	3805	*Daviesia decurrens (Prickly Bitter-pea)*			
182.	3807	*Daviesia divaricata (Marno)*			
183.	16585	*Daviesia nudiflora subsp. nudiflora*			
184.	3832	*Daviesia physodes*			
185.	3845	*Daviesia triflora*			
186.	4453	*Diplolaena angustifolia (Yanchep Rose)*			
187.	4746	*Diplopeltis huegelii*			
188.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
189.	3098	*Drosera glanduligera (Pimpernel Sundew)*			
190.	3106	*Drosera macrantha (Bridal Rainbow)*			
191.	13216	*Drosera menziesii subsp. penicillaris*			
192.	3117	*Drosera paleacea (Dwarf Sundew)*			
193.	3118	*Drosera pallida (Pale Rainbow)*			
194.	31233	*Drosera patens*			
195.	30712	*Drosera x sidjamesii*		P1	
196.	6132	*Epilobium ciliatum*	Y		
197.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
198.	13950	*Eremaea asterocarpa subsp. asterocarpa*			
199.	5541	*Eremaea pauciflora*			
200.	5542	*Eremaea purpurea*			
201.	17175	*Eremophila glabra subsp. albicans*			
202.	4332	*Erodium botrys (Long Storksbill)*	Y		
203.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
204.	13091	*Eucalyptus argutifolia (Wabling Hill Mallee)*		T	
205.	5615	*Eucalyptus decipiens*			
206.	13536	*Eucalyptus decipiens subsp. decipiens*			
207.	5628	*Eucalyptus drummondii (Drummond's Gum)*			
208.	5649	*Eucalyptus foecunda (Narrow-leaved Red Mallee)*			
209.	5659	*Eucalyptus gomphocephala (Tuart)*			
210.	20808	*Eucalyptus petiolaris*	Y		
211.	13541	*Eucalyptus petrensis*			
212.	5763	*Eucalyptus rudis (Flooded Gum)*			
213.	13511	*Eucalyptus rudis subsp. rudis*			
214.	10765	*Exocarpos sparteus (Broom Ballart)*			
215.	7976	*Galinsoga parviflora (Potato Weed)*	Y		
216.	7323	*Galium murale (Small Goosegrass)*	Y		
217.	20473	*Gastrolobium ebracteolatum*			
218.	6143	*Glischrocaryon aureum (Common Popflower)*			
219.	7991	*Gnephosis drummondii*			
220.	8005	*Gnephosis uniflora*			
221.	3945	*Gompholobium aristatum*			
222.	10909	*Gompholobium confertum*			
223.	11083	*Gompholobium scabrum*			
224.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
225.	6161	*Gonocarpus pithyoides*			
226.	19286	*Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)*			
227.	15839	*Grevillea preissii subsp. preissii*			
228.	2119	*Grevillea vestita*			
229.	2784	*Gyrostemon ramulosus (Corkybark)*			
230.	2146	*Hakea costata (Ribbed Hakea)*			
231.	2175	*Hakea lissocarpha (Honey Bush)*			
232.	2197	*Hakea prostrata (Harsh Hakea)*			
233.	2203	*Hakea ruscifolia (Candle Hakea)*			
234.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
235.	2216	*Hakea varia (Variable-leaved Hakea)*			
236.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
237.	3016	*Heliophila pusilla*	Y		
238.	16934	*Hemiandra glabra subsp. glabra*			
239.	6838	*Hemiandra linearis (Speckled Snakebush)*			
240.	6839	*Hemiandra pungens (Snakebush)*			
241.	5112	*Hibbertia aurea*			
242.	5133	*Hibbertia helianthemoides*		P3	
243.	5134	*Hibbertia huegelii*			
244.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			

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245.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
246.	11461	*Hibbertia spicata subsp. leptotheca*		P3	
247.	5173	*Hibbertia subvaginata*			
248.	6222	*Homalosciadium homalocarpum*			
249.	3966	*Hovea pungens (Devil's Pins)*			
250.	3968	*Hovea trisperma (Common Hovea)*			
251.	12741	*Hyalosperma cotula*			
252.	12742	*Hyalosperma demissum*			
253.	5216	*Hybanthus calycinus (Wild Violet)*			
254.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
255.	6232	*Hydrocotyle hispidula*			
256.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
257.	14783	*Jacksonia calcicola*			
258.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
259.	4027	*Jacksonia sericea (Waldjumi)*		P4	
260.	4029	*Jacksonia sternbergiana (Stinkwood)*			
261.	4044	*Kennedia prostrata (Scarlet Runner)*			
262.	5832	*Kunzea ericifolia (Spearwood)*			
263.	7572	*Lechenaultia expansa*			
264.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
265.	7580	*Lechenaultia linarioides (Yellow Leschenaultia)*			
266.	2344	*Leptomeria empetriformis*			
267.	2352	*Leptomeria preissiana*			
268.	5847	*Leptospermum erubescens (Roadside Teatree)*			
269.	6425	*Leucopogon oxycedrus*			
270.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
271.	6434	*Leucopogon polymorphus*			
272.	6436	*Leucopogon propinquus*			
273.	6440	*Leucopogon racemulosus*			
274.	19460	*Leucopogon sp. Yanchep (M. Hislop 1986)*		P3	
275.	6445	*Leucopogon squarrosus*			
276.	7676	*Levenhookia pusilla (Midget Stylewort)*			
277.	7677	*Levenhookia stipitata (Common Stylewort)*			
278.	7408	*Lobelia tenuior (Slender Lobelia)*			
279.	4066	*Lupinus cosentinii*	Y		
280.	6456	*Lysinema ciliatum (Curry Flower)*			
281.	34736	*Lysinema pentapetalum*			
282.	2838	*Macarthuria apetala*			
283.	2839	*Macarthuria australis*			
284.	5920	*Melaleuca huegelii (Chenille Honeymyrtle)*			
285.	13271	*Melaleuca huegelii subsp. huegelii*			
286.	5952	*Melaleuca preissiana (Moonah)*			
287.	33022	*Melaleuca sp. Wanneroo (G.J. Keighery 16705)*		P1	Y
288.	18598	*Melaleuca systena*			
289.	5978	*Melaleuca teretifolia (Banbar)*			
290.	5983	*Melaleuca trichophylla*			
291.	5986	*Melaleuca urceolaris*			
292.	8105	*Millotia myosotidifolia*			
293.	8106	*Millotia tenuifolia (Soft Millotia)*			
294.	4666	*Monotaxis occidentalis*			
295.	6192	*Myriophyllum drummondii*			
296.	2401	*Nuytsia floribunda (Christmas Tree)*			
297.	18255	*Opercularia vaginata (Dog Weed)*			
298.	36177	*Ornduffia albiflora*			
299.	4356	*Oxalis pes-caprae (Soursob)*	Y		
300.	12643	*Ozothamnus cordatus*			
301.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
302.	12670	*Parietaria cardiostegia*			
303.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
304.	2258	*Persoonia comata*			
305.	2273	*Persoonia saccata (Snottygobble)*			
306.	20368	*Petrophile axillaris*			
307.	2299	*Petrophile linearis (Pixie Mops)*			
308.	2301	*Petrophile macrostachya*			
309.	2308	*Petrophile seminuda*			
310.	2309	*Petrophile serruriae*			
311.	4675	*Phyllanthus calycinus (False Boronia)*			
312.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		
313.	5237	*Pimelea calcicola*			
314.	5243	*Pimelea ferruginea*			

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315.	18117	*Pimelea rosea subsp. rosea*			
316.	5268	*Pimelea sulphurea (Yellow Banjine)*			
317.	8163	*Pithocarpa corymbulosa (Corymbose Pithocarpa)*		P3	
318.	4524	*Platytheca galioides*			
319.	8175	*Podolepis gracilis (Slender Podolepis)*			
320.	8177	*Podolepis lessonii*			
321.	8182	*Podotheca angustifolia (Sticky Longheads)*			
322.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
323.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
324.	4691	*Poranthera microphylla (Small Poranthera)*			
325.	11775	*Ptilotus humilis subsp. humilis*			
326.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
327.	8195	*Quinetia urvillei*			
328.	6012	*Regelia ciliata*			
329.	6014	*Regelia inops*			
330.	2578	*Rhagodia baccata (Berry Saltbush)*			
331.	15035	*Rhodanthe corymbosa*			
332.	13312	*Rhodanthe pyrethrum*			
333.	2906	*Sagina apetala (Annual Pearlwort)*	Y		
334.	13182	*Scaevola repens var. repens*			
335.	13152	*Scaevola thesioides subsp. thesioides*			
336.	2909	*Silene gallica (French Catchfly)*	Y		
337.	2910	*Silene nocturna (Mediterranean Catchfly)*	Y		
338.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
339.	6988	*Solanum americanum (Glossy Nightshade)*	Y		
340.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
341.	4207	*Sphaerolobium medium*			
342.	4828	*Spyridium globulosum (Basket Bush)*			
343.	4733	*Stackhousia monogyna*			
344.	2918	*Stellaria media (Chickweed)*	Y		
345.	19704	*Stenanthemum sublineare*		P2	
346.	3080	*Stenopetalum robustum*			
347.	2316	*Stirlingia latifolia (Blueboy)*			
348.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
349.	7696	*Stylidium calcaratum (Book Triggerplant)*			
350.	7709	*Stylidium crossocephalum (Posy Triggerplant)*			
351.	7717	*Stylidium divaricatum (Daddy-long-legs)*			
352.	7745	*Stylidium junceum (Reed Triggerplant)*			
353.	7756	*Stylidium longitubum (Jumping Jacks)*		P3	
354.	13127	*Stylidium maritimum*		P3	
355.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
356.	7785	*Stylidium repens (Matted Triggerplant)*			
357.	20521	*Stylidium rigidulum*			
358.	7798	*Stylidium schoenoides (Cow Kicks)*			
359.	7806	*Stylidium utricularioides (Pink Fan Triggerplant)*			
360.	2329	*Synaphea spinulosa*			
361.	15532	*Synaphea spinulosa subsp. spinulosa*			
362.	4256	*Templetonia retusa (Cockies Tongues)*			
363.	5105	*Thomasia triphylla*			
364.	6280	*Trachymene pilosa (Native Parsnip)*			
365.	4292	*Trifolium campestre (Hop Clover)*	Y		
366.	4295	*Trifolium dubium (Suckling Clover)*	Y		
367.	4297	*Trifolium glomeratum (Cluster Clover)*	Y		
368.	4309	*Trifolium scabrum (Rough Clover)*	Y		
369.	16998	*Tripterococcus paniculatus*		P4	
370.	1141	*Trithuria submersa*			
371.	11665	*Trymalium ledifolium var. ledifolium*			
372.	8254	*Urospermum picroides (False Hawkbit)*	Y		
373.	8255	*Ursinia anthemoides (Ursinia)*	Y		
374.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
375.	7153	*Utricularia tenella*			
376.	7157	*Utricularia violacea (Violet Bladderwort)*			
377.	7665	*Velleia trinervis*			
378.	15432	*Verticordia densiflora var. densiflora*			
379.	11474	*Vicia sativa subsp. nigra*	Y		
380.	4325	*Viminaria juncea (Swishbush)*			
381.	7389	*Wahlenbergia preissii*			
382.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
383.	13333	*Waitzia suaveolens var. suaveolens*			
384.	6289	*Xanthosia huegelii*			

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Gymnosperm					
385.	85	*Macrozamia riedlei (Zamia)*			
Invertebrate					
386.	33973	*Austrosaga spinifer (cricket)*		P3	
387.	33977	*Hylaeus globuliferus (bee)*		P3	
388.	33992	*Synemon gratiosa (Graceful Sunmoth)*		T	
389.	34113	*Westralunio carteri*		P4	
Mammal					
390.	24161	*Bettongia lesueur subsp. graii (Boodie)*			
391.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie)*		T	
392.	24251	*Bos taurus (European Cattle)*			
393.	24092	*Dasyurus geoffroii (Chuditch)*		T	
394.	24041	*Felis catus (Cat)*			
395.	24153	*Isoodon obesulus subsp. fusciventer (Quenda)*		P5	
396.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
397.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
398.	24142	*Petrogale lateralis subsp. lateralis (Black-flanked Rock-wallaby)*		T	
399.	24243	*Rattus fuscipes (Western Bush Rat)*			
400.	24167	*Tarsipes rostratus (Honey Possum)*			
Monocotyledon					
401.	1208	*Acanthocarpus preissii*			
402.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
403.	1056	*Alexgeorgea nitens*			
404.	200	*Amphipogon turbinatus*			
405.	1409	*Anigozanthos humilis (Catspaw)*			
406.	17234	*Austrostipa compressa*			
407.	17240	*Austrostipa flavescens*			
408.	231	*Avellinia michelii*	Y		
409.	233	*Avena barbata (Bearded Oat)*	Y		
410.	234	*Avena fatua (Wild Oat)*	Y		
411.	740	*Baumea arthrophylla*			
412.	743	*Baumea juncea (Bare Twigrush)*			
413.	748	*Baumea vaginalis (Sheath Twigrush)*			
414.	244	*Briza maxima (Blowfly Grass)*	Y		
415.	245	*Briza minor (Shivery Grass)*	Y		
416.	249	*Bromus diandrus (Great Brome)*	Y		
417.	1276	*Caesia micrantha (Pale Grass-lily)*			
418.	11038	*Caladenia bicalliata*			
419.	1592	*Caladenia flava (Cowslip Orchid)*			
420.	15348	*Caladenia flava subsp. flava*			
421.	1595	*Caladenia hirta (Sugar Candy Orchid)*			
422.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
423.	1605	*Caladenia marginata (White Fairy Orchid)*			
424.	1213	*Calectasia cyanea (Blue Tinsel Lily)*		T	
425.	29103	*Calectasia sp. Pinjar (C. Tauss 557)*		P1	
426.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
427.	13122	*Centrolepis cephaloformis subsp. cephaloformis*			
428.	1125	*Centrolepis drummondiana*			
429.	1131	*Centrolepis inconspicua*			
430.	1132	*Centrolepis mutica*			
431.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
432.	1280	*Chamaescilla corymbosa (Blue Squill)*			
433.	17833	*Chordifex microcodon*			
434.	1418	*Conostylis aculeata (Prickly Conostylis)*			
435.	1423	*Conostylis aurea (Golden Conostylis)*			
436.	1427	*Conostylis candicans (Grey Cottonhead)*			
437.	12027	*Conostylis candicans subsp. calcicola*			
438.	1436	*Conostylis juncea*			
439.	1443	*Conostylis pauciflora (Dawesville Conostylis)*			
440.	1454	*Conostylis setigera (Bristly Cottonhead)*			
441.	1285	*Corynotheca micrantha (Sand Lily)*			
442.	10916	*Cyrtostylis huegelii*			
443.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
444.	17663	*Desmocladus asper*			
445.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
446.	1259	*Dianella revoluta (Blueberry Lily)*			
447.	1287	*Dichopogon capillipes*			
448.	19649	*Disa bracteata*	Y		

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449.	15406	*Drakaea gracilis*			
450.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
451.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
452.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
453.	1645	*Epiblema grandiflorum (Babe-in-a-cradle)*			
454.	376	*Eragrostis curvula (African Lovegrass)*	Y		
455.	1646	*Eriochilus dilatatus (White Bunny Orchid)*			
456.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
457.	1468	*Haemodorum laxum*			
458.	439	*Hemarthria uncinata (Matgrass)*			
459.	1293	*Hensmania turbinata*			
460.	445	*Holcus setiger (Annual Fog)*	Y		
461.	1070	*Hypolaena exsulca*			
462.	910	*Isolepis cernua (Nodding Club-rush)*			
463.	917	*Isolepis marginata (Coarse Club-rush)*	Y		
464.	16091	*Lachenalia bulbifera*	Y		
465.	20019	*Lachnagrostis filiformis*			
466.	19955	*Lachnagrostis plebeia*			
467.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
468.	28342	*Landoltia punctata (Thin Duckweed)*			
469.	11911	*Laxmannia ramosa subsp. ramosa*			
470.	1075	*Lepidobolus preissianus*			
471.	925	*Lepidosperma angustatum*			
472.	944	*Lepidosperma scabrum*			
473.	36060	*Lepidosperma sp. Coastal Dunes (R.J. Cranfield 9963)*			
474.	945	*Lepidosperma squamatum*			
475.	946	*Lepidosperma striatum*			
476.	1653	*Leporella fimbriata (Hare Orchid)*			
477.	1090	*Lepyrodia muirii*			
478.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
479.	1228	*Lomandra hermaphrodita*			
480.	1231	*Lomandra maritima*			
481.	14542	*Lomandra micrantha subsp. micrantha*			
482.	1239	*Lomandra preissii*			
483.	1243	*Lomandra sericea (Silky Mat Rush)*			
484.	1246	*Lomandra suaveolens*			
485.	1097	*Lyginia barbata*			
486.	17694	*Meeboldina scariosa*			
487.	955	*Mesomelaena pseudostygia*			
488.	485	*Microlaena stipoides (Weeping Grass)*			
489.	15419	*Microtis media subsp. media*			
490.	1537	*Orthrosanthus laxus (Morning Iris)*			
491.	1667	*Paracaleana nigrita (Flying Duck Orchid)*			
492.	1550	*Patersonia occidentalis (Purple Flag)*			
493.	1478	*Phlebocarya ciliata*			
494.	573	*Poa drummondiana (Knotted Poa)*			
495.	578	*Poa porphyroclados*			
496.	17267	*Pterostylis brevisepala*			
497.	1693	*Pterostylis recurva (Jug Orchid)*			
498.	12217	*Pterostylis sanguinea*			
499.	18645	*Pterostylis sp. limestone (B.J. Keighery & G.J. Keighery 65)*			
500.	18658	*Pterostylis sp. short sepals (W. Jackson BJ259)*			
501.	1698	*Pterostylis vittata (Banded Greenhood)*			
502.	1556	*Romulea rosea (Guildford Grass)*	Y		
503.	973	*Schoenus asperocarpus (Poison Sedge)*			
504.	978	*Schoenus brevisetis*			
505.	979	*Schoenus caespititius*			
506.	982	*Schoenus clandestinus*			
507.	984	*Schoenus curvifolius*			
508.	985	*Schoenus discifer*			
509.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
510.	997	*Schoenus lanatus (Woolly Bog-rush)*			
511.	1002	*Schoenus nanus (Tiny Bog Rush)*			
512.	1006	*Schoenus odontocarpus*			
513.	1018	*Schoenus subfascicularis*			
514.	1023	*Schoenus tenellus*			
515.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
516.	1558	*Sparaxis bulbifera*	Y		
517.	1260	*Stypandra glauca (Blind Grass)*			
518.	1036	*Tetraria octandra*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
519.	10856	*Thelymitra benthamiana (Cinnamon Sun Orchid)*			
520.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
521.	1343	*Thysanotus patersonii*			
522.	1351	*Thysanotus sparteus*			
523.	1357	*Thysanotus thyrsoideus*			
524.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
525.	1363	*Tricoryne tenella*			
526.	18587	*Triglochin nana*			
527.	152	*Triglochin trichophora*			
528.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
529.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
530.	1256	*Xanthorrhoea preissii (Grass tree)*			
Reptile					
531.	25011	*Acritoscincus trilineatum*			
532.	25241	*Antaresia stimsoni subsp. stimsoni*			
533.	24991	*Aprasia repens*			
534.	25333	*Brachyurophis fasciolata subsp. fasciolata*			
535.	25245	*Brachyurophis semifasciata*			
536.	25337	*Chelodina oblonga (Oblong Turtle)*			
537.	24980	*Christinus marmoratus (Marbled Gecko)*			
538.	30893	*Cryptoblepharus buchananii*			
539.	30899	*Ctenophorus adelaidensis (Southern Heath Dragons)*			
540.	25027	*Ctenotus australis*			
541.	25039	*Ctenotus fallens*			
542.	25087	*Cyclodomorphus celatus*			
543.	25296	*Demansia psammophis subsp. reticulata*			
544.	24939	*Diplodactylus polyophthalmus*			
545.	25100	*Egernia napoleonis*			
546.	25119	*Hemiergis quadrilineata*			
547.	25133	*Lerista elegans*			
548.	25165	*Lerista praepedita*			
549.	25005	*Lialis burtonis*			
550.	25184	*Menetia greyii*			
551.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*		S	
552.	25191	*Morethia lineoocellata*			
553.	25192	*Morethia obscura*			
554.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
555.	25252	*Notechis scutatus (Tiger Snake)*			
556.	25253	*Parasuta gouldii*			
557.	24907	*Pogona minor subsp. minor*			
558.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
559.	25271	*Ramphotyphlops australis*			
560.	25285	*Ramphotyphlops pinguis*			
561.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
562.	25227	*Varanus tristis subsp. tristis (Racehorse Monitor)*			
Slime Mould					
563.	39079	*Physarum viride*			
564.	39094	*Trichia affinis*			
Water Mould					
565.		*Phytophthora cinnamomi*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

RPS

APPENDIX 3

Aboriginal Heritage Search Results

Search Criteria

4 sites in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6496445	379096
6507240	392904

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status

L - Lodged		ACMC Decision Made
Information lodged, awaiting assessment	→	R - Registered Site I - Insufficient information S - Stored Data

Spatial Accuracy

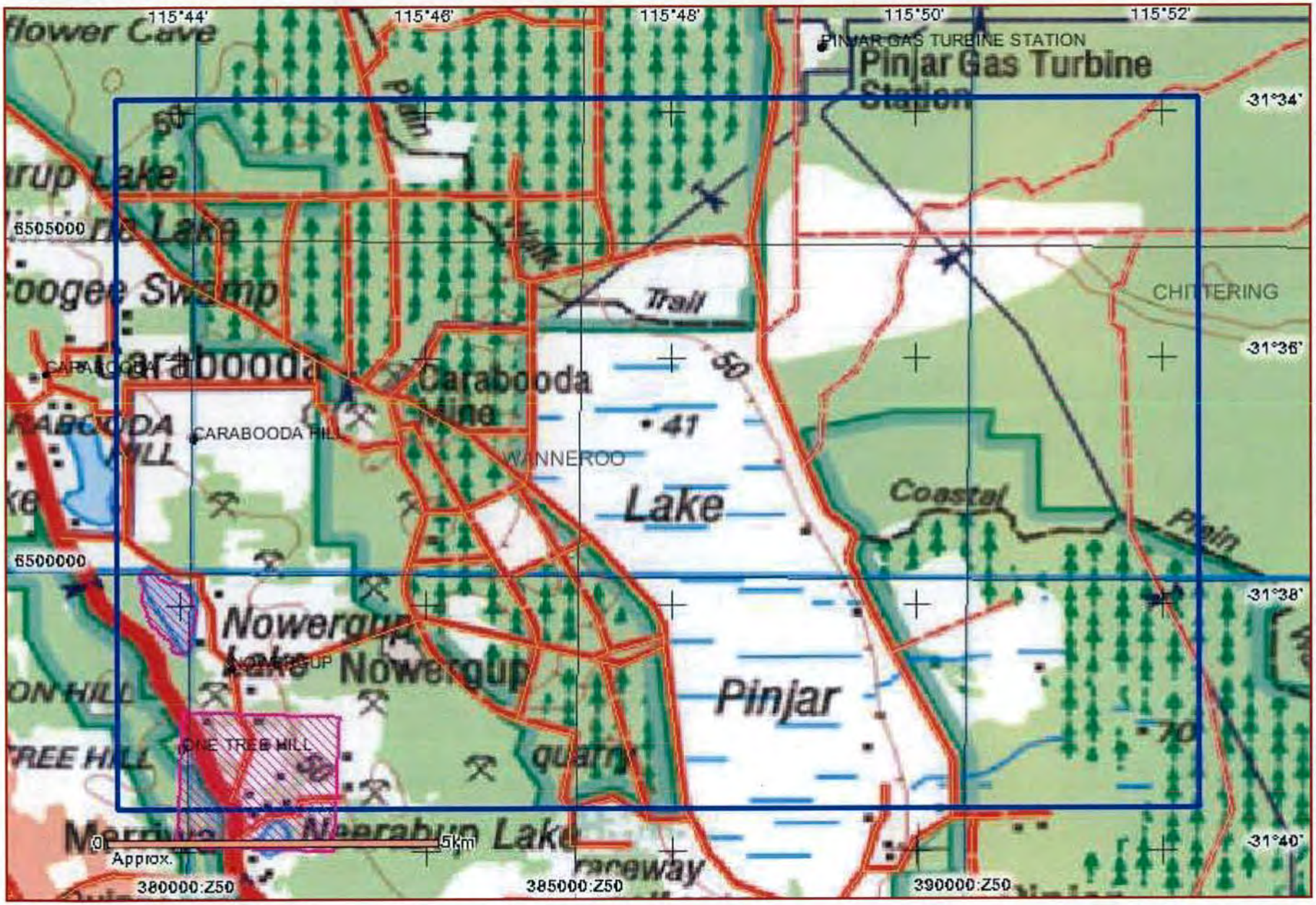
Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels

List of 2 Registered Aboriginal Sites with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
4404	R	C	N	Orchestra Shell Cave.	Engraving, Artefacts / Scatter	Archeological Deposit, [Other: PA 19, NE], [BP Dating: 6500BP to 1730BP]	*Registered Informant names available from DIA.	Not available for closed sites	S00051
17450	R	O	N	Nowergup Lake	Mythological		*Registered Informant names available from DIA.	379733mE 6499450mN Zone 50 [Reliable]	



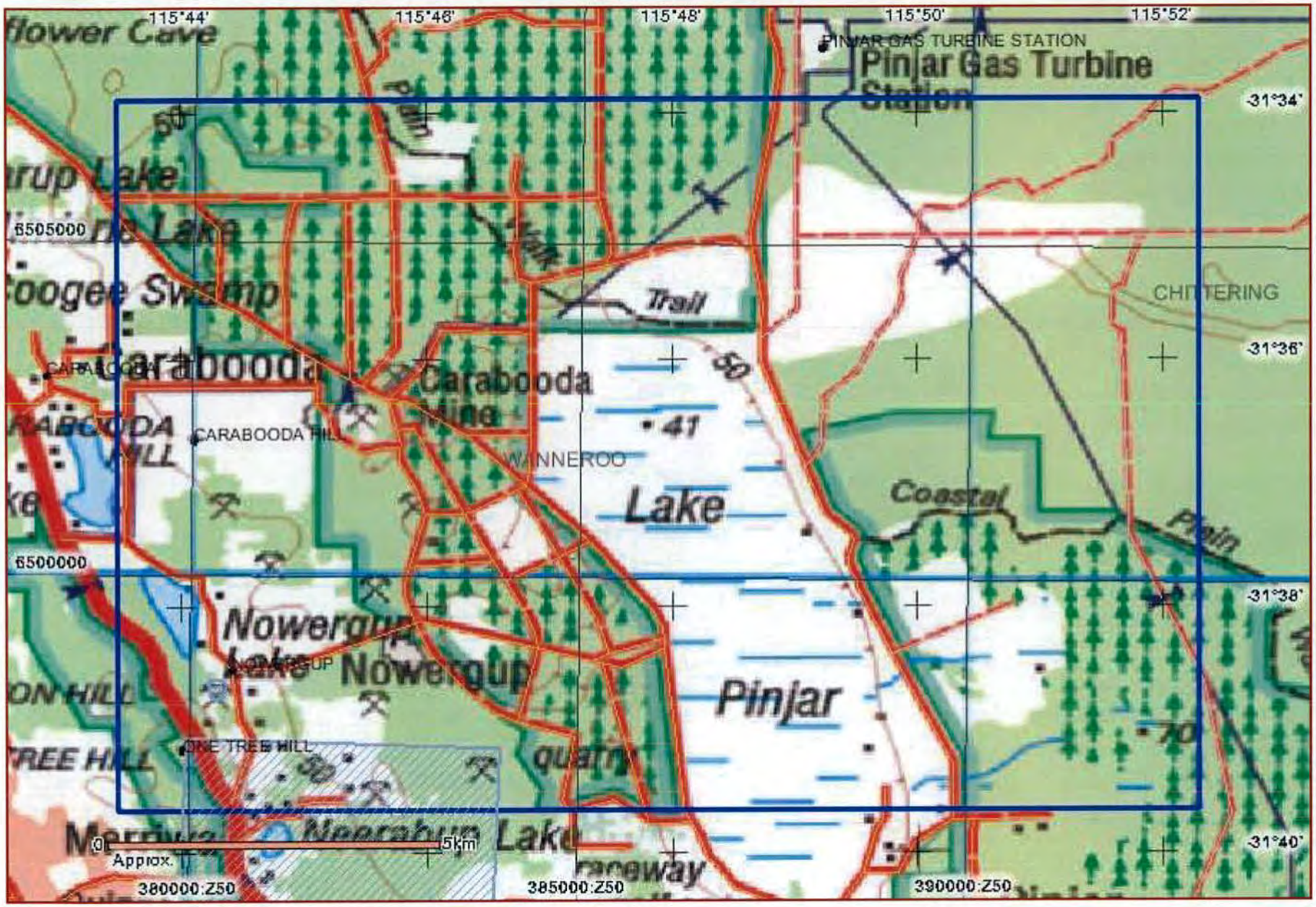
Legend

Selected Heritage Sites

- Registered Sites
- Town
- Map Area
- Search Area

List of 2 Other Heritage Places with Map

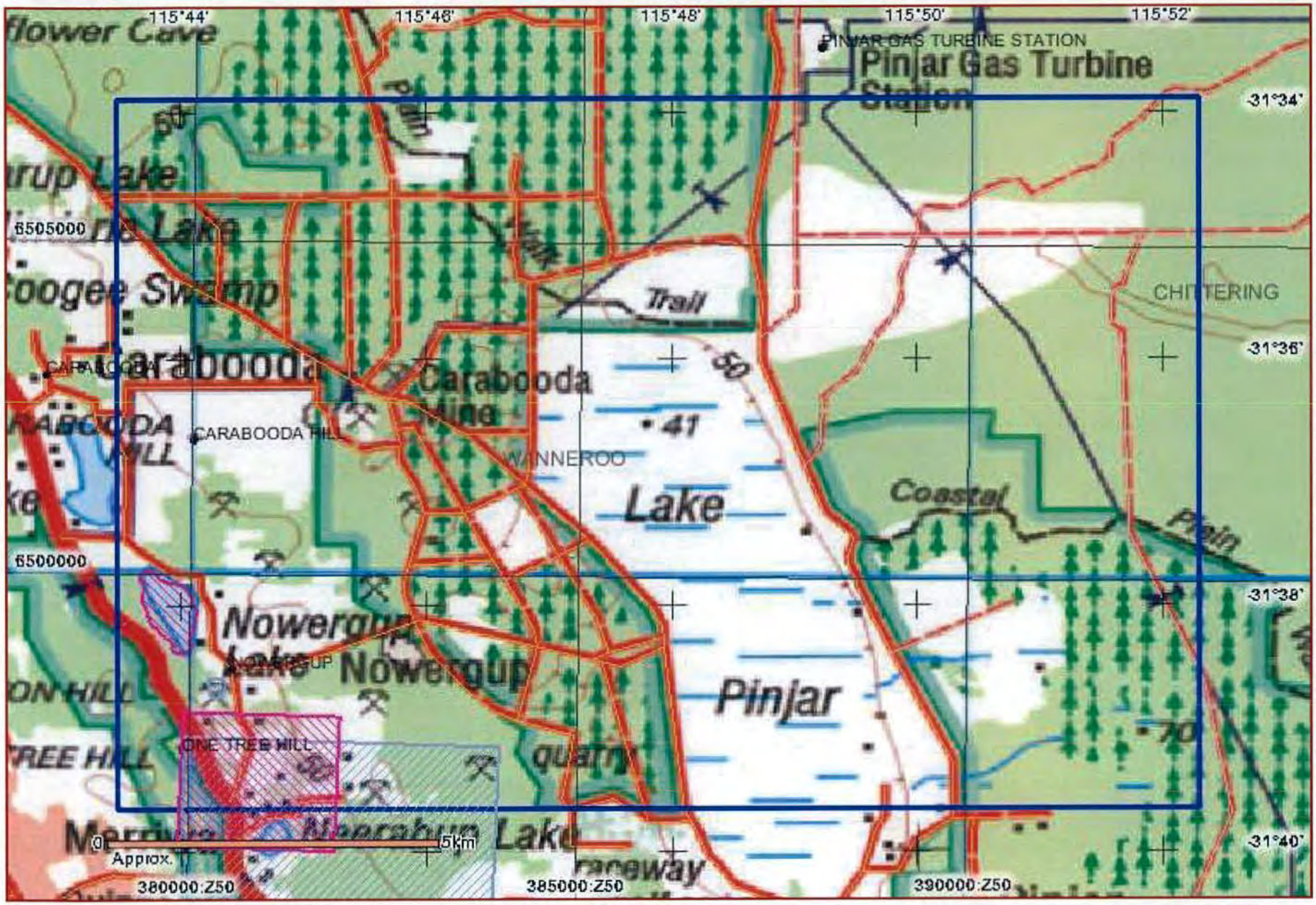
Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
3366	I	O	N	Dunstan'S Quarry.	Artefacts / Scatter	Camp		380352mE 6498281mN Zone 50 [Unreliable]	S00158
3693	I	C	N	Lake Neerabup.		Named Place	*Registered Informant names available from DIA.	Not available for closed sites	S02255



Legend

- Selected Heritage Sites
- Other Heritage Places
- Town
- Map Area
- Search Area

Map Showing Registered Aboriginal Sites and Other Heritage Places



Legend

Selected Heritage Sites

- Registered Sites
- Other Heritage Places
- Town
- Map Area
- Search Area

RPS

APPENDIX 4

Banksia Seed Farm Rocla Quarry Products

Banksia Seed Farm

1.0 INTRODUCTION

Rocla proposes to construct Western Australia's first production seed farm for Banksia species required for the company's restoration work on the Perth Swan Coastal Plain. The farms will be located as part of Rocla's new operations within this environmental assessment and will underpin bio-diverse restoration works Rocla is undertaking and at future sand operations in the Gnangara Pine Plantation.

The seed farms will leverage the $6 million that Rocla has expended in Banksia woodland restoration research in the past 20 years.

Considering the reduction of Banksia species, as a result of land clearing, seed will become short in supply. Where Banksia seed was once purchased by the kilogram, now seed is often sold per seed with costs up to $3 per seed making large scale restoration expensive and problematic. Banksia woodlands are progressively removed through urban development and climate change limits seed production. Combined with this, the removal of 20,000 hectares (ha) of the Gnangara Pine Plantation will have negative impact on the foraging and feeding capacity of Carnaby's Black Cockatoo.

Rocla's intention to develop seed farms will secure Banksia seed for long-term future use in the Gnangara Pine Plantation for restoration and post-mining works, and will be the first of its type in Australia to address native seed supply through the use of innovative native seed farming. Importantly, the farm will underpin seed security for restoration of Banksia species important to sustaining Carnaby's Black Cockatoo.

Preliminary cost calculations estimate the establishment of a 100 ha farm to be approximately $4 million, with ongoing management to cost approximately $1.5 million per year, with a total cost in the first five years of operation of $11.5 million.

2.0 BANKSIA – ORIGINS, DISTRIBUTION AND BIOLOGY

2.1 Origin

Banksias have evolved over the last 40 to 50 million years. There are about 76 species in Australia and nearby islands.

In 1770 Joseph Banks and Daniel Solander collected, classified and named the first Banksia on the east coast of Australia at Botany Bay. Approximately 21 years later the first Banksias from Western Australia were collected near Albany.

2.2 Distribution

The widest range of Banksia species (58) occurs in the south-west of Western Australia but there are 14 species restricted to the east coast and Tasmania. A few grow in the tropics of northern Australia, northern islands and parts of Papua New Guinea.

Banksias are mainly restricted to coastal areas with reasonable rain. However, there are several species which grow with little rain and are drought tolerant in desert areas. *Banksia elderiana* grows in the Great Victoria Desert as well as between Narembeen, Lake King and Peak Charles.

2.3 Biology

This evergreen woody perennial can be a large tree or a small prostrate shrub. New vegetative growth has a wide range of forms and colours compared to that of mature leaves.

The *Banksia* genus is part of the Protea-ceae family which includes *Grevillea*, *Adenanthos*, *Persoonia* and also the South African *Protea*.

Banksias have a specialised proteoid root system in the wild. The root system is highly branched and has large numbers of root hairs. The large surface area of the roots improves the efficiency of nutrient absorption in infertile soils. Under more fertile conditions the roots may lose their proteoid nature.

The flower and fruit (nut) are of interest. The inflorescence has a woody axis running up the centre and there are often thousands of individual flowers spiraling over the spike.

Banksia seeds develop from the remnant bracts and the woody follicles (seed valves) produced by the fertilised ovary. Only a few of the thousands of flowers produce seed.

2.4 Banksia Seed Requirements

Three years ago Rocla began investigating the viability of a Banksia seed production farm to facilitate our restoration at mine sites as native seed became more difficult to source in the future.

There has been a rapid reduction in Banksia woodland surrounding the Perth Metropolitan Region as urban development continues to clear bushland. Due to this the availability of Banksia seed harvested in Western Australia is declining.

Requirements for bushland restoration and requirements for creating foraging habitat for Carnaby's Black Cockatoo (a commonwealth protected species) are becoming a legislative and regulatory requirement on all urban development and mining projects within the Perth Metropolitan Region.

Additionally, there are significant environmental issues confronting the community in Perth along the Swan Coastal Plain, including the requirement to revegetate 12,000 ha of pine plantation back to Banksia woodland and providing foraging habitat for Carnaby's Black Cockatoo. This restoration project requires 120 tonne of Banksia seed at a cost of $60 – $80 million. The 12,000 ha of Pines are being removed to protect the Gnangara Water Mound, which has been severely affected by draw from human consumption and the pine plantations. By removing the pines it is anticipated that the water table will rise due to increased infiltration from future rainfall.

Unfortunately, due to the reasons outlined above, there is currently not enough seed on the Swan Coastal Plain to complete this project. The State Government Agency – Department of Environment and Conservation are currently considering ways to address this problem which could cost at least $500 million to fully restore the Gnangara Pine Plantation to native Banksia woodland.

In the past 3 years the cost of Banksia seed used for rehabilitation has increased by over 100% and it is anticipated this trend will continue into the future as supply cannot meet demand because of the reductions in available Banksia woodland for seed collection.

2.5 Rocla's Current Expertise in Banksia Woodland Restoration

Rocla has been committed to sustainable development and restoration of Banksia woodlands; Rocla along with Botanic Gardens and Parks Authority (BGPA) were recognised for the development of rehabilitation techniques for the successful restoration of the biodiverse Banksia woodland at Rocla's sand quarries.

This recognition resulted in Rocla and BGPA being awarded the states most prestigious environmental award "The Golden Gecko" in 2008.

Rocla has invested many years of work in this project and the main benefit is the marked improvements in the survival rates of species. Rocla are continuing to find different techniques to gain a greater variety of species survival.

The 20 year long research program has resulted in techniques for increasing germination and seedling establishment including smoke application, seed coatings and best practice for topsoil management.

With little knowledge at the onset of the project on how to restore Banksia woodland, which is an iconic plant community to the Perth area, Rocla and BGPA began investigating how the Banksia woodland ecosystem operates, together with restoration principles.

The first year returned very little success in terms of returning plants to site, with only one or two species represented in post-restoration sites out of a potential 150-200 species that typically occur in a Banksia woodland.

Rocla began a research program to look at the topsoil seed bank; the topsoil is an important source of returning plants to a post-mine restoration site.

At the time, there was little understanding about the Banksia woodland seed bank, so that was the first step in the research program. Rocla had to gain an understanding as to what was in that seed bank and how the seeds were distributed through the seed bank to gain benchmark data on species return.

The research program also investigated if there were seeds in the topsoil seed bank, then what sort of restoration principles were needed to improve seedling recruitment and, ultimately, plant survival.

Within Rocla's first restoration site, there were two species represented out of a potential 150-200 species and plant numbers were quite low with about one plant per five square metres. Now, restoration activities are returning more than 100 species to sites.

Rocla is now using these findings when planning mining operations in order to improve rehabilitation success and the seed farm is an important requirement for the future.

3.0 BANKSIA SPECIES AND VARIETIES

The two key species required for seed, and those that are likely to be in short supply for Rocla's restoration projects in the near future, are *Banksia attenuata* and *Banksia menziesii.* These are key foraging species for Carnaby's Black Cockatoo. Other species will also be required and will be planted for seed as required.

3.1 *Banksia menziesii* (Firewood Banksia)

B.menziesii originates from areas between the Murchison River and Pinjarra. It prefers deep sands and can grown into a tree up to 10 m tall.

There is of range of colours available, from yellow to red, and flowers are 10-12 cm long by 7-8 cm wide. This species has a lignotuber.

3.2 *Banksia attenuata* (Candle Banksia)

B.attenuata is found from Fitzgerald River to Kalbarri in Western Australia. It has mainly been bush-picked, with only a few cultivated plants. It grows from 2 to 10 m in height.

The slender cylindrical flowers are an intense sulphur yellow and are 5 to 26 cm in length and up to 5cm in diameter.

4.0 BANKSIA ESTABLISHMENT

Banksias grow well in deep, well-drained, slightly acidic sand, sometimes overlying limestone or gravel lenses. Highly alkaline soils are best avoided for most species. Site selection for successful Banksia seed production is therefore important.

The following criteria need to be addressed before considering a Banksia farm.

4.1 Identifying suitable soil types

Banksias will grow on a variety of soil types from sands to sands over clay.

Sandy soils from deep white-grey sands to the yellow sands found in the Gnangara Pine Plantations are suitable. Land that becomes waterlogged in winter is not suitable and therefore will not be considered.

4.2 Site Security

As the farm will be part of the sand extraction operations, security of the site will be part of the operational footprint.

4.3 Weed identification and control strategies

The weed burden in harvested pine plantation locations is significant, and will need to be brought under control prior to planting.

Therefore weed control must start well before planting, especially for broad-leaf weed infestations. The same applies to sorrel, capeweed and oxalis. Flat weeds such as wild turnip and doublegee cannot be controlled in a single year. However, their effect on new plantings can be greatly reduced.

Weed control options available once the crop is established are:

- Careful applications of knockdown herbicides, targeted only at the weeds;
- Hand weeding around the plants or in-row mulching.

4.4 Planting densities and planting design

No research has been conducted to determine the optimum planting design for Banksia species. It is anticipated that single rows will be planted, with species in each section of the farm grouped together.

Determining factors will be:

- Species size at maturity;
- Irrigation or non irrigation production;
- Mechanical harvesting;
- Topography; and
- Vehicle access.

4.5 Plant bed preparation

Preparation of the plant bed will be required.

The following points need to occur:

- Cultivation of the plant beds;
- Non cultivation of inter rows;
- Ripping;
- Mounding;
- Mulching; and
- Windbreaks.

5.0 PRUNING BANKSIA

Pruning will be a management practice used for cultural improvement and productivity.

6.0 IRRIGATION OF BANKSIA

Many Banksia species in the wild are able to utilise surface soil moisture and groundwater at depth. They utilise surface water when it rains and they also develop extensive tap roots that can extract water from up to 7 m to survive summer dry spells.

On the deep Bassendean sands located within the Gnangara Pine Plantation, where Rocla's future mining and seed farms will operate, Banksias will require irrigation, particularly if there has not been adequate rain to affect recharge of the water aquifer.

Although Banksias can tolerate low levels of water supply of prolonged drying periods, this will compromise the seed production. Therefore, Rocla will utilise existing approved water licences or apply to the Department of Water for additional licences to enable irrigation of the farm to occur.

7.0 FERTILISERS FOR BANKSIA PRODUCTION

Although there is limited information on the fertiliser requirements, Banksias appear to respond well to balanced fertilisers applied at moderate rates from research completed by Rocla and BGPA. Having a suitable fertiliser program could be critical to producing plentiful seed production.

8.0 DISEASES

Banksias are subject to a number of diseases including Phytophthora or Dieback. Many of these diseases can be controlled through good management practices and use of pesticides.

To minimise the risk of introducing or spreading diseases, disease free plants will be secured and quarantine measures implemented. These include fencing the site and using foot and vehicle wash down areas. In addition, soil movement will be prevented from surrounding areas into the site.

The use of lime to a depth of 10 cm on roadways is also thought to be an effective control, as many organisms cannot survive in the raised pH environment. Rocla intends to use best practice to minimise risk to the seed farm.

Plants showing early disease symptoms will be treated with appropriate fungicides.

9.0 GNANGARA WATER MOUND

Most of Rocla's proposed sand extraction operations are located on the Gnangara Water Mound, which supplies critical water to the city of Perth. The majority of the mound is comprised of Priority 1 or Priority 2 water resource areas.

Rocla has identified four suitable locations, one within each of the Mining Tenements M70/1306, E70/3275, M70/1316 (previously E70/3276) and E70/3279 where the seed farms will be located. Refer to Attachment 1 for their locations. Attachment 2 provides greater detail relating to the location of the McKinley Road Neerabup (M70/1316) seed farm relating to this proposal. These identified locations are not within the Priority water source areas and as a result should not affect the integrity of the mound.

10.0 SITE LOCATIONS

The intention is to create a seed farm approximately 100 ha in size across the four sand extraction operations -M70/1306, E70/3275, M70/1316 (McKinley Road) and E70/3279. Each will be in close proximity to sand extraction operations for security purposes and to minimise overhead costs. The intention is for these farms to be located off the Gnangara Water Mound.

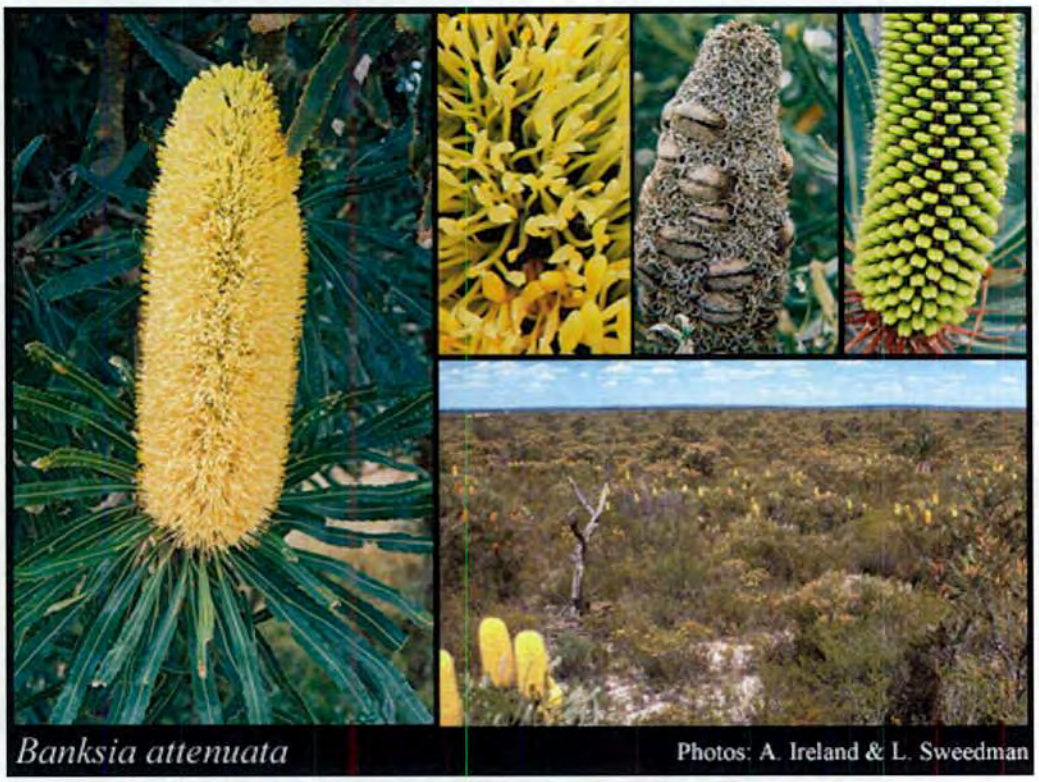
11.0 PHOTOS

11.1 Banksia Woodland

Banksia woodland plant communities are among the most biodiverse woodland types in Australia.

The woodlands have developed on deeply weathered and leached sands that form the basis of major sand extraction for silica products and building sands.

11.2 *Banksia attenuata*



(Photo source: Florabase, 2012)

11.3 *Banksia menziesii*

(Photo source: Florabase, 2012)

12.0 REFERENCES

The Banksia Production Manual, Department of Agriculture and Food, Bulletin No. 4710, ISSN:1833-7236 April 2007

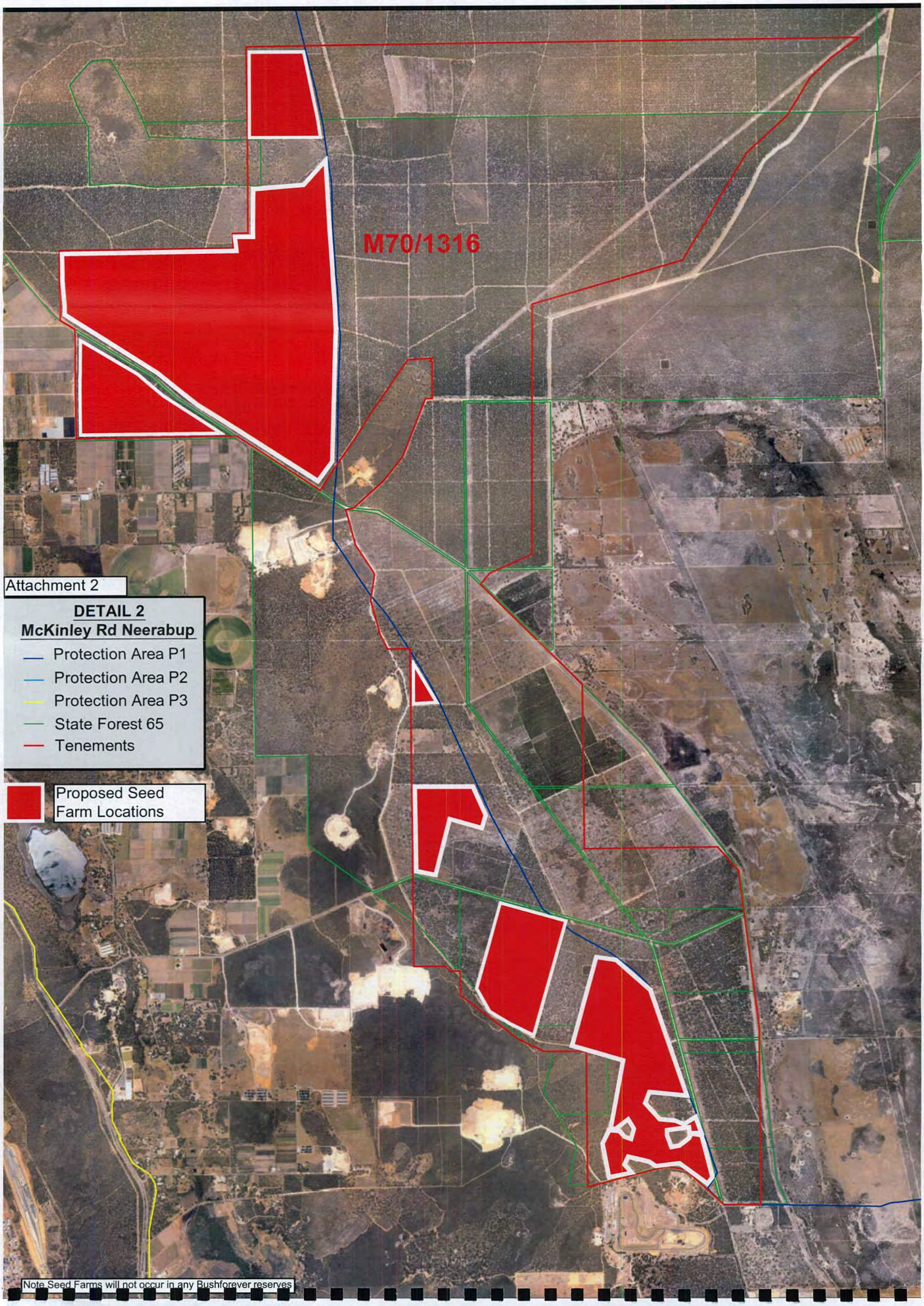
Protection Area P1
Protection Area P2
Protection Area P3
State Forest 65
Tenements
Proposed Seed Farm Location

Attachment 1

E70/3583
E70/3554
E70/3279
E70/3275
E70/3272
M70/1316
M70/1306
M70/23
4
3
2
1

N
W
E
S

Rocla
Quarry Products


M70/1316
Attachment 2
DETAIL 2
McKinley Rd Neerabup
Protection Area P1
Protection Area P2
Protection Area P3
State Forest 65
Tenements
Proposed Seed Farm Locations
Note Seed Farms will not occur in any Bushforever reserves