7.2.7 Social environment

Urban Resources would implement heritage management procedures to ensure no inadvertent disturbance of any unknown Aboriginal heritage sites.

Baldivis comprises a combination of residential, rural and natural land use. Land neighbouring the Project area is residential and rural, including properties with uncleared vegetation, market gardens, horse paddocks and vineyard. The closest residents are located along Stakehill Road, 200 m north of the Project area. To effectively engage neighbours and other stakeholders, Urban Resources will continue to implement the stakeholder consultation program, as detailed in Section 4.

Gaps and future data collection

Urban Resources will implement a stakeholder consultation program to ensure that ongoing and appropriate engagement of stakeholders is undertaken, and that the interests and concerns of key stakeholders have been considered.

The objective of stakeholder engagement strategy is to:

- inform stakeholders of closure planning options through providing accurate and accessible information
- provide adequate opportunities and timeframes for stakeholders to consider the closure options and to engage in meaningful dialogue
- demonstrate an appropriate level of consultation to DMP through the use of current and effective consultation techniques
- identify and attempt to resolve potential issues.

8. Identification of closure issues

This section describes the identified key closure risks to ensure the issues are managed in such a way as to not compromise post-closure land use(s).

A risk assessment approach was used to identify and potential impacts for each aspect that might compromise the closure objectives for the Karnup Sand Mining Project. Assessment criteria were derived from:

- EPA guidelines on environmental factors (EPA 2013)
- outcomes of stakeholder consultation.

Closure risks were identified for each general closure item and closure domain, and assessed according to facilities expected at the site, types of mining undertaken at the site and the EPA/DMP (2015) guidance. Likelihood of occurrence and consequences were also identified to determine a risk ranking. Potential risks were ranked to determine inherent risk arising from a potential impact prior to the implementation of mitigation/management measures. Mitigation measures were identified for each potential impact, from which a residual risk rating was determined for each risk issue.

A summary of the highest ranked risks for each closure domain is summarised in the sections below. The complete risk assessment is detailed in Appendix 1. The sections below identify potential impacts with a residual risk of medium or higher, and the commitments made to modulate these risk rankings.

8.1.1 General closure risks

One aspect relating to general closure was assessed as having a Medium residual risk rating without mitigation. This was the potential failure of final landforms resulting in injury/death to public.

Failure of the final landform is considered unlikely to occur, particularly if appropriate geotechnical investigations have been undertaken and signed-off by qualified technical experts and the DMP Safety Branch. Investigations will be undertaken to close any gaps in knowledge over the course of the Project, as detailed in Section 5. The closure investigations as detailed in Section 5 will be progressed over.

If testing of the final landforms show some instability, investigation into the cause and potential remediation of these areas will be undertaken.

8.1.2 Specific closure risks

A summary of the highest ranked risks is presented in the following sections. For those risks that currently demonstrate a Medium or higher residual risk rating, further work will be undertaken by Urban Resources to develop measures to reduce the residual risk level to a lower than medium risk level.

No aspects with Extreme or Major residual risk were identified.

Medium residual risk

One aspect with a Medium residual risk was identified during the risk assessment, which related to the potential for topsoil stored in stockpiles to no longer be viable for use in rehabilitation.

The topsoil becoming unviable is unlikely to occur as rehabilitation will be undertaken progressively on site. If topsoil stockpiles are no longer viable for use in rehabilitation, the topsoil would be remediated by adding nutrients as required, or topsoil would be sourced from other sources, such as nurseries.

9. Closure implementation

Urban Resources will implement closure progressively during the operational phase, such that the post-operation phase closure activities are limited to the project areas utilised in the final stages of operation. This progressive approach means that rehabilitation is integrated into mining operations for the life-of-mine and supports the strategy of rehabilitating as much of the site as practicable prior to cessation of mining.

Additional investigations will be proposed over the life of the mine in order to minimise potential risks arising from gaps in closure data and to assist in refining closure implementation strategies for each domain and each mine area.

9.1 Closure schedule

Based on current mine planning, with the life of mine extending to 2020, mine closure activities are anticipated to take place progressively between 2018 and 2021, as each stage of mining is completed. All components of the project will be closed as soon as possible after the cessation of mining activities. Where possible, rehabilitation of non-active mining activities will be completed as a priority.

9.2 Closure material sources

More detailed investigations into closure material sources, quantities available and likely to be required, will be undertaken and will continue to be updated throughout operations to clearly identify the quantity of available materials prior to final mine closure.

Based on current estimates, material quantities available are sufficient to enable construction and rehabilitation of final landforms. Rehabilitation materials will be sourced primarily from overburden and topsoil stockpiles following clearing of the Project area. Additional assessment of materials identified for potential use in rehabilitation is required and discussed in Section 5 and below.

Future revisions of this plan will be updated as additional information on closure materials becomes available.

9.3 Rehabilitation planning

A Rehabilitation Management Plan will be prepared, covering the full range of actions to be implemented in rehabilitation, including the following.

1. Soil handling:
    - topsoil stripping
    - salvage
    - stockpiling
    - replacement.
2. Rehabilitation works:
    - landform design and reconstruction
    - erosion control
    - mine areas
    - roads and tracks
    - infrastructure area.

3. Revegetation:
    - species selection
    - establishment
    - seed collection, processing and storage
    - weed control.
4. Monitoring program.

9.4 Closure domains and task register

The closure domains associated with the Karnup Sand Mining Project are:

1. Mine area in previously cleared areas and within the decommissioned explosives area.
2. Mine area on the western boundary of the Project area.
3. Ancillary infrastructure.

9.4.1 Mine area in previously cleared areas and within the decommissioned explosives area closure work program

The following components are included within this domain:

- mine pit
- overburden, topsoil and vegetative material stockpiles.

Overburden, topsoil and vegetative material generated throughout mining activities will be stockpiled and utilised for progressive rehabilitation as mining stages are completed.

The mine pit will be backfilled using overburden to ground level where required for the final land use and for other areas the mine pit will be partially backfilled and contoured to a safe and stable landform, enabling the site to be used as a Parks and Recreation Reserve for the future residential developments within the area.

Topsoil and vegetative material will be respread on site for revegetation following backfilling of pits.

Closure and rehabilitation of the mine pits will be progressively undertaken towards the end of operations. Table 9-1 outlines the closure works program and domain specific requirements to ensure successful closure at the completion of mining.

Table 9-1: Closure works program: Mine area in previously cleared areas and within the decommissioned explosives area

Closure Standards		Requirements
Description of domain	Area of disturbance	33.82 ha (not including haul road).
Applicable land use objectives, and completion criteria/ performance indicators	Closure objectives specific to final mine areas as outlined in Section 6: 1. To design and build a safe and stable mine area that can be integrated into surrounding and downstream areas. 2. Topography and surface drainage are consistent with, and complementary to, the overall landscape.	
Landform design	Design requirements/ specifications	Backfill of mine pit to ground level where required for the final land use of Parks and Recreation. Mine pit slopes not backfilled to ground level will be subject to geotechnical investigations throughout the mining process to ensure stability upon completion of operations. Gates and signage will be installed at the perimeter to prevent public access.

Closure Standards		Requirements
Schedule of work for progressive rehabilitation	Key tasks and milestones	Mine pits will be progressively shaped in such a way as to reduce erosion, enable progressive backfilling and to promote progressive rehabilitation sufficient for the final land-use of Parks and Recreation. Rehabilitation will be undertaken in accordance with a detailed Rehabilitation Management Plan to be developed in consultation with relevant stakeholders.
Availability and management of closure material sources	Overburden, topsoil and vegetative material	Any overburden/topsoil and vegetative material stockpiles will backfilled into the mine void or respread on site. Overburden, topsoil and vegetative material generated throughout the duration of mining activities will be stockpiled and utilised for progressive rehabilitation.
Unexpected closure	Key tasks	In the event of unexpected closure, the mine pit will be left as is until further notice. Fencing and signage will be erected to ensure access from unauthorised personnel and fauna does not occur. Safety inspections and monitoring will continue until further notice.
Decommissioning tasks	Construction of final landforms/ rehabilitation	Final landforms and rehabilitation will be undertaken through: • movement of material into final landform design • contouring and shaping of final landforms • spreading of overburden, topsoil and vegetative material • deep ripping of topsoil • assessing stability of final landform.
Decontamination	Compliance with requirements of *Contaminated Sites Act 2003* including remediation	No contaminated sites (as defined by the *Contaminated Sites Act 2003*) requiring ongoing management beyond five years post-closure. Compliance will be established through: • inspection and reporting on any potentially contaminated areas • implementation of remediation program as required or removal and disposal of affected materials off-site via a licensed contractor • monitoring success of remediation program through monitoring of soil geochemistry and presence of hydrocarbons.
Monitoring and Maintenance	Monitoring against completion criteria	Closure monitoring will take place during reconstruction of the landscape in accordance with the closure monitoring and maintenance identified in Section 10.
	Maintenance	Where monitoring indicates that criteria are not being met or indicating a future issue, maintenance activities will be undertaken to remedy the gap.

Identification and management of information gaps

The following investigations are required to close gaps in closure data:

1. Geotechnical stability of mine pits: undertaken throughout project operations and upon completion of project activities during closure.
2. Detailed materials balance to determine quantity of available overburden, topsoil and vegetative material for use in rehabilitation, including:
   (a) assessment of overburden quantity, quality and the amount required for use in rehabilitation
   (b) assessment of topsoil required for rehabilitation of the site (assuming 100 mm of topsoil is spread over rehabilitation areas).
3. Assessment of viability of topsoil stockpiles.

9.4.2 Mine area within the western boundary of the Project area closure work program

The following components are included within this domain:

- mine pit
- overburden, topsoil and vegetative material stockpiles.

Overburden, topsoil and vegetative material generated as part of mining activities will be stockpiled and utilised for progressive rehabilitation.

The mine pit will be backfilled to ground level using overburden. Topsoil and vegetative material stockpiles will then be respread on site to enable the area to be potentially revegetated predominately with Black Cockatoo foraging species.

Closure and rehabilitation of the mine pits will be progressively undertaken towards the end of operations. Table 9-1 outlines the closure works program and domain specific requirements to ensure successful closure at the completion of mining.

Table 9-2: Closure works program: Mine area within the vegetated linear corridor on the western boundary of the Project area

Closure Standards		Requirements
Description of domain	Area of disturbance	6.54 ha
Applicable land use objectives, and completion criteria/ performance indicators	Closure objectives specific to final mine areas as outlined in Section 6: 1. To design and build a safe and stable mine area that can be integrated into surrounding and downstream areas. 2. Topography and surface drainage are consistent with, and complementary to the overall landscape. 3. The vegetated linear corridor on the western boundary of the Project area is to be revegetated to establish native vegetation foraging species suitable for Black Cockatoos[2].	
Landform design	Design requirements / specifications	Backfill of mine pit to ground level where required to enable potential revegetation with predominantly Black Cockatoo foraging species , in order to meet closure objectives and completion criteria. Gates and signage will be installed at the portals.
Schedule of work for progressive rehabilitation	Key tasks and milestones	Mine pits will be progressively shaped in such a way as to reduce erosion, enable progressive backfilling and to promote progressive revegetation along the vegetated linear corridor on the western boundary of the Project area. Rehabilitation will be undertaken in accordance with a detailed Rehabilitation Management Plan to be developed in consultation with relevant stakeholders.
Availability and management of closure material sources	Overburden, topsoil and vegetative material	Overburden, topsoil and vegetative material generated throughout the duration of mining activities will be stockpiled and utilised for progressive rehabilitation. Any overburden/topsoil and vegetative material stockpiles will backfilled into mine void or respread on site.
Unexpected closure	Key tasks	In the event of unexpected closure, the mine pit will be left as is until further notice. Fencing and signage will be erected to ensure access from unauthorised personnel and fauna does not occur. Safety inspections and monitoring will continue until further notice.
Decommissioning tasks	Construction of final landforms / rehabilitation	Final landforms and rehabilitation will be undertaken through: • movement of material into final landform design • contouring and shaping of final landforms • spreading of overburden, topsoil and vegetative material • deep ripping of topsoil • assessing stability of final landform • revegetation in accordance with the Rehabilitation Management Plan.
Decontamination	Compliance with requirements of *Contaminated Sites Act 2003* including remediation	No contaminated sites (as defined by the *Contaminated Sites Act 2003*) requiring ongoing management beyond five years post-closure. Compliance will be established through: • inspection and reporting on any potentially contaminated areas • implementation of remediation program as required or removal and disposal of affected materials off-site via a licensed contractor • monitoring success of remediation program through monitoring of soil geochemistry and presence of hydrocarbons.

[2] These objectives to be confirmed following future discussion and agreement with LandCorp on final land use of the western boundary.

Closure Standards		Requirements
Monitoring and Maintenance	Monitoring against completion criteria	Closure monitoring will take place during reconstruction of the landscape in accordance with the closure monitoring and maintenance identified in Section 10.
	Maintenance	Where monitoring indicates that criteria are not being met or indicating a future issue, maintenance activities will be undertaken to remedy the gap.

Identification and management of information gaps

The following investigations are required to close gaps in closure data:

1. Geotechnical investigation to assess stability of mine pits: undertaken throughout project operations and upon completion of project activities during closure.
2. Detailed materials balance to determine quantity of available overburden, topsoil and vegetative material for use in rehabilitation, including:
   (a) assessment of overburden quantity, quality and the amount required for use in rehabilitation
   (b) assessment of topsoil required for rehabilitation of the site (assuming 100 mm of topsoil is spread over rehabilitation areas).
3. Assessment of viability of topsoil stockpiles.
4. Rehabilitation trials into surface treatments to ensure effective rehabilitation will be undertaken progressively as mining within each stage is completed.

9.4.3 Ancillary infrastructure closure work program

The following components are included within this domain:

- haul road and access tracks
- site office and administration
- generator (20 kVA) and storage
- refuelling pad and equipment storage.

All redundant infrastructure will be removed or if appropriate, disposed of on site on completion of mining activities. The ancillary infrastructure is spatially distributed across the Project area; however, for the purposes of this plan, the components have been grouped under the one domain to the extent that decommissioning and closure activities are common.

Closure and rehabilitation of ancillary infrastructure will be undertaken on completion of operations. Table 9-3 outlines the closure works program and domain specific requirements to ensure successful closure at the completion of mining.

Table 9-3: Closure works program: Ancillary infrastructure

Closure Standards		Requirements
Description of domain	Area of disturbance	1.69 ha (including haul road).
Applicable land use objectives, and completion criteria/ performance indicators	All ancillary infrastructure will be removed unless retention is agreed in writing with relevant Government agencies (as per Completion Criteria in Section 6).	
Landform design	Design requirements / specifications	All infrastructure excluding access tracks and haul roads will be removed and dismantled for reuse or disposal off-site. Retention of specific infrastructure is agreed in writing with relevant Government agencies, or the landholder, as relevant. Landform design will endeavour to return the land contours to their pre-mining condition and will consider changes to surface water hydrology to re-establish watercourse alignments and flow systems to pre-mining conditions to the maximum practicable extent.

Closure Standards		Requirements
Schedule of work for research, investigation and trials tasks	Key tasks and milestones	Materials balance investigations (see Section 7.2.5) will be undertaken to determine quantity of material to be remediated and/or disposed of. Rehabilitation trials into surface treatments will be progressively undertaken throughout the duration of operations to ensure effective revegetation.
Schedule of work for progressive rehabilitation	Key tasks and milestones	Progressive rehabilitation will be undertaken throughout operations as areas or facilities become redundant. Rehabilitation will be undertaken in accordance with a detailed Rehabilitation Management Plan to be developed in consultation with relevant stakeholders.
Availability and management of closure material sources	Overburden, subsoil and topsoil	Materials balance investigations (see Section 7.2.5) will be undertaken to determine quantity of material to be remediated and/or disposed of.
Unexpected closure	Key tasks	In the event of unexpected closure infrastructure will be made secure and access restricted to authorised personnel only, as relevant to ensure human and fauna safety.
Decommissioning tasks	Demolition and decommissioning of plant and infrastructure	Final landforms and rehabilitation will be undertaken through: • decommissioning and removal of mine and ancillary infrastructure • treatment (or removal) of any localised soil contamination if required • movement of material into final landform design • contouring and shaping of final landforms • spreading of overburden, topsoil and vegetative material • deep ripping of topsoil • assessing stability of final landform • revegetation in accordance with the Rehabilitation Management Plan.
	Construction of final landforms / rehabilitation	No contaminated sites (as defined by the *Contaminated Sites Act 2003*) requiring ongoing management beyond five years post-closure. Compliance will be established through: • inspection and reporting on any potentially contaminated areas • implementation of remediation program as required or removal and disposal of affected materials off-site via a licensed contractor • monitoring success of remediation program through monitoring of soil geochemistry and presence of hydrocarbons.
Decontamination	Compliance with requirements of *Contaminated Sites Act 2003* including remediation	Closure monitoring will take place during reconstruction of the landscape in accordance with the closure monitoring and maintenance identified in Section 10.
Monitoring and Maintenance	Monitoring against completion criteria	Where monitoring indicates that criteria are not being met or indicating a future issue, maintenance activities will be undertaken to remedy the gap.
	Maintenance	Final landforms and rehabilitation will be undertaken through: • movement of material into final landform design • contouring and shaping of final landforms • spreading of overburden, topsoil and vegetative material • deep ripping of topsoil • revegetation in accordance with the Rehabilitation Management Plan.

Identification and management of information gaps

Urban Resources will investigate potential transfer of assets to third parties as closure becomes imminent. A detailed Decommissioning Plan will be developed prior to final closure.

Gaps in closure data relevant to ancillary infrastructure will be addressed through undertaking the following studies:

1. Detailed materials balance to determine quantity of available overburden, topsoil and vegetative material for use in rehabilitation, including:
   (a) assessment of overburden quantity, quality and the amount required for use in rehabilitation
   (b) assessment of topsoil required for rehabilitation of the site (assuming 100 mm of topsoil is spread over rehabilitation areas).

10. Closure monitoring and maintenance

Given that closure planning for this project is in its early stages, the closure monitoring and maintenance components of this plan should be considered to be preliminary. The closure monitoring and maintenance schedules will be reviewed and amended every three years, to ensure that information needs are being met and that the costs of both monitoring and maintenance are regularly optimised and allowed for in budget forecasts. A detailed Post-Closure Monitoring and Maintenance Program will be developed as operations approach closure.

Closure performance monitoring will be undertaken throughout progressive rehabilitation and closure activities. Post-closure monitoring of revegetation and erosion will be undertaken, with more intensive monitoring at the start of the program becoming less intensive as information needs are gradually rationalised. Closure monitoring is expected to continue for up to 2 years following mine closure, when relinquishment of tenements is successfully approved.

Rehabilitation monitoring forms the major component of the Annual Environmental Report (AER) required to be submitted to the DMP each year of operations through to post-closure. A primary function of the AER is to document progress against agreed completion criteria and rehabilitation targets.

A preliminary strategy for monitoring and maintenance has been developed (Table 10-1) and will be further refined throughout the assessment process, based on consultation with key stakeholders.

Table 10-1: Preliminary closure and rehabilitation monitoring program

Category	Actions	Purpose	Frequency	Location
Mine pits	Monitor bunding and fencing	To provide data on safety barriers around open pits	Quarterly	At open pits
	Monitor mine voids for vegetation growth	To provide data on vegetation growth at open pits	Quarterly, and after rain events	At and around open pits
	Monitor mine void geochemistry	To provide data on mine void geochemistry	Quarterly	At open pits
Surface drainage	Monitor surface drainage pathways for erosion and sedimentation	To provide data on surface drainage pathways	Quarterly	Across site where required
	Visual wetland monitoring	To provide data on wetland quality and function	Quarterly	Across the site where required
Soil	Monitor representative soil samples across the site for potential contamination	To provide data on potential soil contamination	Quarterly	Across the site where required.
Rehabilitative success	Monitor landscape criteria to be developed including: • surface stability • infiltration/runoff • nutrient cycling status • flora and vegetation	Monitor success of rehabilitation	Quarterly	Rehabilitation sites
Inspection and Monitoring	Monitor for environmental parameters as per program established during assessment process	To provide environmental data across the site	Quarterly	Across site where required
	Update environmental monitoring data register	To store environmental data in a central repository and ensure it is up to date	Quarterly	Across site where required

10.1 Maintenance and contingency planning

In the event that monitoring targets are not being achieved, contingency actions will be fully developed in consultation with relevant stakeholders and implemented, as summarised in Table 10-2.

Table 10-2: Preliminary contingency actions for decommissioning and closure

Category	Trigger	Action
General	As below, or exceedance of limits set in licence conditions	General contingency response model: 1. Retest to confirm exceedance. 2. Investigate cause. 3. Determine remedial action (in consultation with relevant stakeholders/authorities as required). 4. Implement remedial action. 5. Report issue to relevant authority. 6. Monitor outcome. 7. Revise procedures as appropriate. 8. Repeat from Step 1 if outcome not satisfactory.
Surface Drainage	Significant erosion or sedimentation noted	Implement erosion protection measures (e.g. bunding).
	Contaminated surface water (visual assessment)	Remediate surface water.
Soil	Contaminated soil on site	Removal of soil off-site by a license contractor, followed by remediation of the site.
Rehabilitative success	Objectives and criteria not met	1. Investigate cause. 2. Implement remedial actions. 3. Monitor outcome. 4. Revise rehabilitation activities as appropriate.

11. Financial provisioning for closure

11.1 Mine closure costing methodology

Urban Resources implements provisioning processes in which the annual costs of rehabilitation activities, decommissioning activities and closure programmes are calculated out to final closure. A 'closure provision' is then created to address site final closure costs. Key aspects of the closure costing methodology are outlined in the sub-sections below.

Closure costs are calculated to reflect, as far as possible, the real cost of closure and include:

1. Decommissioning costs (which occur at or near the end of operation life) such as:
   (a) demolition and removal of unwanted facilities and services on the site
   (b) remediation: the clean-up of contaminated areas of soil or water to an agreed quality
   (c) maintenance and monitoring: the management of the site through to relinquishment.
2. Rehabilitation costs, which include the cost of rehabilitating disturbed areas that (for an operational or environmental reason), were not progressively rehabilitated during the life of the Project.
3. Project management costs, which include the human resourcing, facilities and administration related support required to implement closure activities.
4. Contingency costs which include provisions for unplanned events such as extreme weather or other external factors.

Examples of items included in each category above are further detailed in Table 11-1 below.

Table 11-1: Examples of Items included in provision accounts

Closure Category	Example Items Included
Decommissioning	• Decommissioning and removal of infrastructure, plant and equipment. • Waste disposal. • Remediation of contamination: o Survey program o Remediation program o Maintenance and monitoring.
Rehabilitation	• Earthmoving and landscape forming. • Re-vegetation. • Post Closure management of surface water drainage and erosion. • Maintenance and monitoring programs.
Project Management	• Ongoing stakeholder consultation. • Administration support. • Office and accommodation facilities. • Specialist and consultant fees. • Legal requirements.
Contingencies	• Provision for potential delays, extreme events, unsuccessful rehabilitation or other external factors relevant to closure.

11.1.1 Accounting practices

The accounting practice of estimating the material end of the mine life rehabilitation and decommissioning costs and then building up to that cost over the life of the operation by making periodic provision adjustments is utilised.

The main objective of this approach is to ensure that the full liability is accrued at the end of operation life and closure costs are allocated equitably to the periods of operation.

11.1.2 Inflation and cost increases

The provisioning process takes into account inflated costs when undertaking annual reviews of provisions. The schedule of rates that is used is also reviewed annually, to take into account inflation and other cost increases.

11.1.3 Unexpected closure

The provision includes costs set aside for unexpected closure and/or sudden placement of the site into care and maintenance.

11.1.4 Annual review

The Closure Provision is reviewed on an annual basis. This includes review of costing assumptions and any changes in circumstances that have occurred during the year. A re-assessment of provision accounts is completed in line with the company reporting schedule. This allows any changes to be factored into budgets and provisions every year. Changes in estimates of closure costs relating to operations are dealt with prospectively over the remaining Operation life.

11.1.5 Closure costing documentation

Urban Resources maintains thorough documentation of is closure provisions and assumptions behind cost estimates in company accounting databases and reports.

11.2 Financial processes

In addition to the financial securities required under the *Mining Act 1978*, adequate financial provisions to fund the implementation of closure commitments and obligations form part of the Urban Resources financial and accounting requirements under Australian legislation.

11.3 Mine Rehabilitation Fund

Urban Resources has undertaken Mine Rehabilitation Fund calculations for the project area in accordance with the *Mining Rehabilitation Fund Act 2012* or the Mining Rehabilitation Fund Regulations 2013. Mine Rehabilitation Fund calculations can be provided to DMP upon request.

12. Management of information and data

To address the requirements of the DMP/EPA mine closure planning guidelines (DMP/EPA 2015), Urban Resources will develop an operational information management framework, with systems for storage and quality assurance of environmental data as well as mine planning and operational documentation. The approach that will be adopted by Urban Resources is outlined in Table 12-1 below.

Table 12-1: Information and data management strategy

Requirement	Description of action
Establish	A systems audit will be undertaken to ascertain the types of information to be captured and stored. Following this audit, an electronic and hardcopy recording and filing system will be created. Electronic records allow ease of transfer into annual reporting documents and provide a backup to hardcopy records. Hardcopy records allow data to be recorded in the field, and allow a means of tracking data to electronic systems, establishing an auditable QA/QC process. The aim of this system will be to capture all data relevant to closure.
Assign responsible person	The project environmental officer (or other delegated person) will be assigned responsibility of the dataset. This person will ensure data is updated regularly. This person will be suitably qualified and knowledgeable regarding the requirements of environmental monitoring.
Record data	Monitoring will be undertaken on a regular basis, with all data collected transferred into the electronic database as soon as practicable. Once data transfer is complete, hardcopy monitoring records will be filed. Records will be categorised according to feature and monitoring activity (e.g. 'revegetation').
Quality Assurance and Quality Control	After each monitoring round is completed, a quality assurance and quality control (QA/QC) check will take place. This will involve an employee of suitable qualifications and rank, who is not responsible for the database, checking that data has been transferred correctly from hardcopy to electronic form. This check will then be recorded as having taken place.
Training	Monitoring and recording of data will be explained to employees during the induction process. This will ensure on-site personnel are aware of the importance of the data collection process, and will provide a point of contact should personnel wish to report any environmental changes noted on site.
Miscellaneous	Non-regular events will also be recorded in the system. These will include, for example: • seed type, provenance and volume applied to rehabilitation areas • names and volumes of reports submitted to DMP • decommissioning dates • instances of personnel leaving and entering employment at the site.

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Appendix 1
Closure Risk Analysis

Measures of likelihood

Level	Descriptor	Description	Frequency
A	Almost certain	Is expected to occur in most circumstances Common repeating occurrence	Once per week
B	Likely	Will probably occur in most circumstances Known to occur	Once per month
C	Possible	Could occur Might occur at some time	Once per year
D	Unlikely	Could occur but not expected Not likely to occur	Once per ten years
E	Rare	Occurs only exceptional circumstances Unheard of	Once in mine life

Measures of consequence

Rating	Descriptor	Potential areas of impact				
		Environment	Public safety	Cultural	Financial	Corporate reputation
1	Catastrophic	Very significant long-term impacts/off site Legal action taken against company Company not released from liability following operations	Fatality	Major impact to indigenous or European cultural sites/values resulting in permanent loss of cultural value (permanent damage to one or more restricted sites, cause of cultural community outrage, breach of statutory obligations, permanent damage to cultural relationship)	Financial loss: exceeding $1 million	Permanent damage to company reputation, outraged stakeholders, permanent damage to community values
2	Major	Serious long-term impacts off site Licence conditions breached Lengthy delay in release from liability following operations	Injury resulting in permanent disability	Major impacts to Indigenous or European cultural sites/values (damage to restricted site, cause of cultural community outrage, negative media coverage, medium term damage to cultural relationship)	Financial loss: $500,000 to $1 million	Major damage to company reputation, stakeholder mistrust, community values significantly diminished
3	Significant / moderate	Serious, medium-term impacts extending off site, but generally contained on site Delay in release from liability following operations	Lost time injury	Impacts to Indigenous or European cultural sites/values requiring some management (accessing restricted site, minor deterioration in cultural relationship)	Financial loss: $100,000 to $500,000	Moderate impact to company reputation requiring management of stakeholder and community relationship
4	Minor	Minor short-term impacts on site only	Minor injury, medical treatment required	Minor impact to Indigenous or European cultural sites/values (accessing restricted site)	Financial loss: $10,000 to $100,000	Minor impact to company reputation, stakeholder inconvenience
5	Negligible	Limited impacts to minimal area on site	Minor injury, no medical treatment required	Minimal impact to Indigenous or European cultural sites/values	Financial loss: less than $10,000	No impacts, positive company reputation

Risk ranking matrix

		Likelihood				
		A Almost certain	**B Likely**	**C Possible**	**D Unlikely**	**E Rare**
Consequence	**1 Catastrophic**					
	2 Major					
	3 Significant/Moderate					
	4 Minor					
	5 Negligible					

Risk level	**Response**
Very Low	Acceptable risk.
Low	Application of management measures will ensure risk level remains low.
Medium	Development of site specific management measures will be required to lower risk level. Prescription of environmental outcomes (e.g. Environmental Conditions) may be necessary.
Major	Development of site specific management measures will be required to lower risk level. Prescription of environmental outcomes (e.g. Environmental Conditions) considered necessary.
Extreme	Potentially unacceptable. Massive mitigation required.

Confidence level definitions

High confidence (HC)	Several expert investigations/studies. Excellent survey data. Long-term monitoring results available.
Reasonably confident (RC)	Survey data available from one expert. Short-term monitoring results available. No site-specific information/data available but able to translate information/data from other similar operations.
Low certainty/confidence (LC)	No survey data. Unable to translate information/data from other similar operations.

General closure

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Commercial/ financial	Closure objectives and completion criteria not developed in consultation with relevant stakeholders leads to closure strategies being implemented that are ultimately unacceptable to regulators, and do not contribute to final mine closure.	C	2	Major	Assume closure planning is undertaken.	Undertake closure planning process in accordance with DMP/EPA Guidelines and other mining best practice guidelines. Consult with relevant stakeholders including regulators regularly throughout closure planning (three-yearly in accordance with DMP/EPA guidance).	D	4	Very low	HC
	Inability to relinquish tenements in a timely manner due to closure objectives and criteria being developed that are unachievable.	C	2	Major	Assume regulators are flexible in the event completion criteria are not being achieved (as part of closure planning).	Consultation with regulators to determine suitability of completion criteria. In the event completion criteria are not being met, consult with regulators to develop updated completion criteria and closure objectives. Undertake continued closure investigations and monitoring.	D	4	Very low	RC
	Poorly managed or inadequate consultation with relevant stakeholders resulting in potential anger/outrage.	D	3	Very low		Undertake consultation in accordance with closure planning requirements.	D	4	Very low	HC
	Inadequate closure provisioning resulting in poor quality closure/rehabilitation activities and an associated inability to close, resulting in damage to reputation.	C	3	Medium		Closure provisioning updated three-yearly in accordance with DMP/EPA guidelines. Update closure cost provisions in line with updated costings.	D	3	Low	HC
Legal	Failure to comply with changing legislation.	D	2	Medium		Develop a legal obligations register specific to closure and update every three years.	E	4	Very low	HC

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Environment	Gaps in closure data collected resulting in unachievable closure objectives and completion criteria/inadequate closure activities.	C	2	Major		Undertake closure investigations to continue to update information and close gaps including: Investigate viability of topsoil stockpiles Investigate target ecosystem Materials balance.	D	3	Low	LC
	Disruption or death of conservation significant flora and fauna species due to vehicle strike (of fauna) or unauthorised clearing within wetland buffers during closure and rehabilitation activities	C	3	Medium	Vehicle use on site after closure will be significantly reduced and restricted to areas requiring closure activities.	All vehicle traffic restricted to areas requiring access for closure. Vehicle speed limits enforced.	D	3	Low	HC
	Suitable closure materials unavailable for rehabilitation.	C	2	Major		Undertake materials balance across the site to determine quantities of materials available for rehabilitation.	C	4	Low	LC
Landform	Excessive dust generated during rehabilitation and closure activities	C	3	Medium	Dust generating activities on site will be reduced significantly during closure, decommissioning and rehabilitation.	In times of increased activity (final landform construction) and windy conditions, water trucks will be used. In times of extreme wind and dust generation, rehabilitation activities will stop until such time as winds have decreased.	D	3	Low	HC
Safety	Failure of final landforms resulting in injury/death to public.	D	1	Major	Site will be made stable to accommodate final land use, including public areas.	Testing of the rehabilitated area will be undertaken to ensure that the area is stable.	E	1	Medium	HC

Domain 1 – Mining area (in previously cleared and decommissioned explosives area)

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Landforms	Insufficient material to level the area for Parks and Recreation	C	3	Medium		Materials balance to ensure that there is a suitable amount of overburden and topsoil to adequately level the mined area	D	3	Low	RC
Terrestrial environment	Disruption or death of flora and fauna species and vegetation of conservation significance due to unapproved clearing (i.e. in wetland buffer areas), vehicle strike (of fauna) during closure and rehabilitation activities	C	3	Major	Clearing boundaries will be clearly stipulated in approval documentation. No clearing undertaken during closure and rehabilitation – earthworks during decommissioning and closure will be in areas that have already been disturbed.	Clearing boundaries and significant habitats/ vegetation clearly marked on site during closure and rehabilitation activities. Educate site personnel as to clearing allowances and boundaries stipulated in approval documentation. Educate site personnel as to consequences of unlawful clearing.	D	3	Low	HC
	Disruption to flora and fauna through introduction of weeds around wetland areas	C	3	Medium	Weed species are already present on site.	Implementation of quarantine measures to keep all vehicle, machinery, plant, clothing, food etc entering mine weed and pest free. Reduce chances of adding new weed species by ensuring revegetation stock is subject to certified hygiene management. Weed treatment with acceptable herbicides where required. Develop a post-closure weed monitoring program to monitor weed infestations and mitigation success in the wetland areas.	D	3	Low	HC
Surface water	Changes to ecosystem values and flora and vegetation composition in wetlands due to altered surface water regimes	C	3	Medium	Wetlands will not be disturbed as part of mining activities	Install drainage structures to ensure appropriate drainage is maintained to protect wetland areas.	D	3	Low	HC

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Groundwater	Contamination of groundwater through Acid Sulphate Soils	D	2	Medium	Acid Sulfate Soils are associated with wetland areas, which will not be mined. No mining to be undertaken below the water table. Depth to groundwater approximately 3.25 mAHD	In the event of groundwater contamination, remedial action will be determined based on the severity of contamination.	D	4	Very Low	HC
Soils	Erosion of topsoil from final landforms	C	3	Medium	assume that regular prevailing winds affect the region.	Initial wetting to prevent wind erosion of topsoil material - allowing revegetation to occur. Apply nutrient rich soil that can support revegetation.	D	3	Low	HC
	Soil contamination through hydrocarbon and chemical use on site post operations	D	2	Medium	Use of hazardous substances on site will be significantly reduced during closure and rehabilitation activities.	In the event of soil contamination, remedial action will be determined based on the severity of contamination.	E	2	Low	HC
Rehabilitation	Revegetation failure due to insufficient soil type/nutrients	D	2	Medium	Assume use of topsoil where available	Topsoil will be stripped and the area will be re-spread with available topsoil for use as the growth medium and fertilised where necessary.	E	2	Low	RC
	Revegetation failure due to inadequate soil structure (compaction)	D	2	Medium		Soil will be stripped and land will be deep ripped, prior to respread of available topsoil for use as the growth medium.	E	2	Low	RC

Domain 2 – Mining area in the vegetated linear corridor on the western boundary of the Project area

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Landforms	Erosion of topsoil/subsoil stockpiles.	C	3	Medium	detailed materials balance has not been completed,	Materials balance to be undertaken progressively over the course of operations. Develop appropriate rehabilitation strategy and implement.	D	4	Very Low	RC
Terrestrial environment	Disruption to flora and fauna through introduction of weeds)	C	3	Medium	Weed species are already present on site.	Implementation of quarantine measures to keep all vehicle, machinery, plant, clothing, food etc entering mine weed and pest free. Reduce chances of adding new weed species by ensuring revegetation stock is subject to certified hygiene management and only contains endemic native species. Weed treatment with acceptable herbicides where required. Develop a post-closure weed monitoring program to monitor weed infestations and mitigation success. Undertake rehabilitation monitoring.	D	3	Low	HC
Soils	Erosion of topsoil from final landforms	C	3	Medium	Assume that regular prevailing winds affect the region.	Initial wetting to prevent wind erosion of topsoil material- allowing revegetation to occur. Apply nutrient rich soil that can support revegetation. Ongoing management to maintain native vegetation.	D	3	Low	HC

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Rehabilitation	Rehabilitation failure due to inadequate soil structure (erosion, unstable landform and compaction – vegetation unable to establish).	C	3	Medium	Assume soil has been treated following reapplication of topsoil	Materials characterisation and balance. Assess viability of topsoil. Soil will be stripped and land will be deep ripped, prior to respread of available topsoil for use as the growth medium. Investigate suitable species mixtures. Planting with local provenance species will be undertaken to re-instate the values of the original vegetation in the area (i.e. Black Cockatoo foraging habitat). Monitoring of rehabilitation to identify issues and implement appropriate remediation strategies.	D	4	Very low	RC
	Topsoil (in stockpiles) is no longer viable for use in rehabilitation.	B	3	Major		Investigate the viability of the topsoil stockpiles and implement recommended remediation	C	3	Medium	RC
	Inability to source/propagate plant species during rehabilitation.	D	3	Low		Implement rehabilitation plan incorporating seed collection program, soil bank management, consultation with DMP to determine appropriate rehabilitation criteria. Supply seed to nurseries for tube stock seedlings.	D	4	Very Low	RC
Monitoring	Monitoring frequency inadequate resulting in rehabilitation failure not detected in early stages.	C	2	Major	Consultation with DMP has been undertaken throughout operation and closure activities.	Consult with DMP to receive approval of planned monitoring frequency. Ensure monitoring plan executed at stated frequency.	E	2	Low	HC

Domain 3 – Ancillary infrastructure

Aspect	Potential impacts	Highest likelihood	Highest consequence	Inherent risk	Assumptions/ comments	Potential mitigation	Highest likelihood	Highest consequence	Residual risk	Confidence level
Groundwater	Contamination of groundwater through Acid Sulphate Soils	D	2	Medium	Acid Sulfate Soils are associated with wetland areas, which will not be mined. No mining to be undertaken below the water table. Depth to groundwater approximately 3.25 mAHD.	In the event of groundwater contamination, remedial action will be determined based on the severity of contamination.	D	3	Low	HC
Surface water	Contamination of surface water through inadvertent hydrocarbon spills on site	C	3	Medium	Use of hazardous substances on site will be significantly reduced during closure and rehabilitation activities.	Before rehabilitation commences, undertake surface sampling of areas that contain infrastructure that may include contaminated material. Where contamination is evident, implement an appropriate remediation strategy.	D	4	Very Low	HC
Landform	Revegetation failure due to inadequate soil structure (compaction)	D	2	Medium		Soil will be stripped and land will be deep ripped, prior to respread of available topsoil for use as the growth medium. Planting with approved grass species will be undertaken as the final land use if for Park and Recreations	E	2	Low	RC
Rehabilitation	Revegetation failure due to insufficient soil type/nutrients	D	2	Medium	Assume use of topsoil where available	Topsoil will be stripped and the area will be re-spread with available topsoil for use as the growth medium and fertilised where necessary.	E	2	Low	RC
	Revegetation failure due to inadequate soil structure (compaction)	D	2	Medium	Assume soil has been treated following reapplication of topsoil	Soil will be stripped and land will be deep ripped, prior to respread of available topsoil for use as the growth medium. Planting with approved grass species will be undertaken as the final land use if for Park and Recreations.	E	2	Low	RC

Referral of proposed action

Project title:

Karnup Sand Mining Project (the proposed action)

1 Summary of proposed action

1.1 **Short description**

Urban Resources Pty Ltd (Urban Resources) proposes to operate the Karnup Sand Mine within the locality of Karnup, Western Australia (the proposed action; Figure 1). The proposed action will result in disturbance of 41.96 ha, comprising 39.61 ha for the mining area, including the haul road; to facilitate access to the sand resource and topsoil, overburden and vegetative stockpiles and 0.09 ha for the site compound. A total of 30.83 ha of native and regrowth vegetation will be cleared to facilitate the project. An estimated total of 1 553800 m^3 of sand will be mined over a 5 year mining life, with proposed completion by 2020. Urban Resources will rehabilitate the landscape post mining to a form suitable for the future land use of parks and recreation, to be developed by LandCorp.

1.2 **Latitude and longitude**

Coordinates of the proposed action area are provided in Attachment A.

The location of the proposed action is presented in Figure 1.

1.3 **Locality and property description**

The proposed action is located approximately 48 km south of the Perth Central Business District in Crown Reserves 37090 and Part Reserve 38575 (part of the former Baldivis Explosives Facility). The proposed action is located within the western portion of Mining Tenement M70/1262; west of the Perth-Bunbury Highway boundary. The proposed action is bounded by Stakehill Road to the north, Perth-Bunbury Highway to the east, Mining Tenements M70/1046 and M70/1241 to the west and Amarillo Drive to the south.

1.4 **Size of the development footprint or work area (hectares)**

The proposed action comprises a total disturbance area of 41.96 ha, including disturbance of 30.83 ha of native and regrowth vegetation.

1.5 **Street address of the site**

Stakehill Road, Baldivis WA 6171.

1.6 **Lot description**

The proposed action occurs in Crown Reserves 37090 and Part Reserve 38575 within Mining Tenement M70/1262 currently held by Eclipse Resources Pty Ltd (Eclipse). Urban Resources propose to mine within the tenement as part of a sub-lease arrangement.

1.7 **Local Government Area and Council contact (if known)**

The proposed action is covered entirely by Mining Tenement M70/1262 and is currently zoned 'Parks and Recreation' under the Metropolitan Region Scheme. The proposed action is located within the City of Rockingham and, being subject to the *Mining Act 1978*, does not require approval under local government planning laws.

1.8 **Time frame**

Construction works are anticipated to commence in Q4 2015. Mining is expected to continue for up to 5 years followed by urban development of the site.

1.9	**Alternatives to proposed action**	X	No.
			Yes, you must also complete section 2.2
1.10	**Alternative time frames etc**	X	No.

			Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11	**State assessment**		No.
		X	Yes, see Section 2.5
1.12	**Component of larger action**	X	No.
			Yes, you must also complete Section 2.7
1.13	**Related actions/proposals**	X	No.
			Yes, provide details:
1.14	**Australian Government funding**	X	No.
			Yes, provide details:
1.15	**Great Barrier Reef Marine Park**	X	No.
			Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

2.1 Description of proposed action

Urban Resources proposes to operate the proposed action within Crown Reserves 37090 and Part Reserve 38575 (part of the former Baldivis Explosives Facility), located within Mining Tenement M70/1262. The Proposed action will extract sand to supply various customers predominantly in the construction industry. Sand mining operations broadly include removal of vegetation, removal of sand resource and re-contouring of the profile to final levels. Sand material will be transported out of the proposed action area via a haul road onto Stakehill Road for distribution to various recipients throughout the Perth metropolitan area.

The proposed action comprises a total disturbance area of 41.96 ha, comprising 39.61 ha for the mining area, including the haul road; to facilitate access to the sand resource and topsoil, overburden and vegetative stockpiles and 0.09 ha for the site compound. The proposed action will result in the clearance of 30.83 ha of vegetation. The majority of the proposed action area was identified to be in various stages of natural regeneration following the clearing of existing pine plantations from 2004 (approx.) with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees (Strategen 2015a). The regrowth vegetation is predominantly sparse, low and open in form. A vegetated strip of land along the western boundary of the proposed action area represented a different vegetation structure which is primarily a Jarrah-Banksia woodland which is relatively undisturbed by the historical pine plantation.

Urban Resources are investigating the potential rehabilitation of the western strip of vegetation, following the cessation of mining operations for relinquishment of Mining Lease M70/1262 to the State and eventual transfer of the site to LandCorp as a Parks and Recreation Reserve to support the adjacent future residential development.

2.2 Alternatives to taking the proposed action

There are no alternatives to taking the proposed action as the sand resources can only be extracted from a restricted area.

2.3 Alternative locations, time frames or activities that form part of the referred action

There are no alternative locations, timeframes or activities that form part of the referred action.

2.4 Context, planning framework and state/local government requirements

Legislation applicable to the proposed action includes but is not limited to those presented in Table 1.

Table 1 Applicable legislation

Title	General Description
Aboriginal Heritage Act 1972	The protection of Aboriginal Heritage sites.
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Provides for management and control of listed organisms, including introduced flora species (weeds).
Conservation and Land Management Act 1984 (CALM Act)	Provides for management of conservation reserves.
Environmental Protection Act 1986 (EP Act)	The following regulations under the EP Act are also applicable: • Environmental Protection Regulations 1987 • Environmental Protection (Noise) Regulations 1997 • Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Creation of the Environmental Protection Authority (EPA), for the prevention, control and abatement of environmental pollution, for the conservation, preservation, protection, enhancement and management of the environment.
Local Government Act 1995	Provides for a system of local government.
Mining Act 1978 (Mining Act)	Relates to the exploration for, and the exploitation of mineral resources.
Native Title (State Provisions) Act 1999	Recognises native title in lands.
Rights in Water and Irrigation Act 1914 (RIWI Act)	Provision for the regulation, management, use and protection of water resources, to provide for irrigation schemes.
Soils and Land Conservation Act 1945	Relates to the conservation of soil and land resources, and to mitigate the effects of erosion, salinity and flooding.
Wildlife Conservation Act 1950 (WC Act)	Provision for the conservation and protection of wildlife.

The following key EPA policies and guidance documents are relevant to the proposed action:

- Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012
- Environmental Assessment Guideline No. 1 – Defining the Key Characteristics of a Proposal
- EPA Environmental Assessment Guideline No. 8 – Environmental Assessment Guidelines for Environmental factors and objectives

- EPA Environmental Assessment Guideline No. 13 – Consideration of environmental impacts from noise
- EPA Position Statement No. 2 – Environmental Protection of Native Vegetation in Western Australia
- EPA Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection
- EPA Guidance Statement No. 3 – Separation Distances between Industrial and Sensitive Land Uses
- EPA Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems
- EPA Guidance Statement No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia
- EPA Guidance Statement No. 55 – Implementing best practice in proposals submitted to the environmental impact assessment process
- EPA Guidance Statement No. 56 – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia
- Environmental Protection Bulletin No. 1 – Environmental Offsets – Biodiversity.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

The proposed action is being referred to the Australian Government concurrent with submission of a Mining Proposal and Mine Closure Plan to the Department of Mines and Petroleum (DMP) for assessment under the *Mining Act 1978* (Mining Act).

A Native Vegetation Clearing Permit Application may also be required to be submitted to DMP for assessment under the Mining Act.

It is not anticipated screening activities will be required as part of the proposed action, however if required, a Works Approval would be submitted to the Department of Environment Regulation (DER) for assessment under Part V of the EP Act for the construction and operation of a mobile screening plant.

The Project will not be referred under Part IV of the EP Act as it is considered that the Project will not have a significant impact on environmental factors and these can be assessed and managed under the Mining Act in accordance with the Memorandum of Understanding between the EPA and DMP in relation to the referral of Mining Proposals.

2.6 Public consultation (including with Indigenous stakeholders)

Public consultation undertaken to date is presented in **Table 2**.

Table 2 Stakeholder consultation

Key stakeholder	Issues raised	Response
City of Rockingham	• Final land use • Groundwater levels and final finished levels • Future plans for Baldivis Tramway.	Additional information relating to impacts on flora and fauna requested (Strategen flora and fauna report). The City will seek further information from the executive team once the proposed mine plan is finalised.
DMP	• Briefing on the proposal and proposed final land use.	Approvals strategy developed (currently being implemented). Ongoing consultation will continue.
LandCorp	• Final land use • Groundwater levels and final finished levels • Future plans for the Baldivis Tramway • Mining Agreement.	Agreement on challenging final groundwater levels, confirmation of proposed final land use and preparation of a proposed schedule for presentation of proposed mine plan and submission of approvals documents.

2.7 A staged development or component of a larger project

The proposed action is not part of a larger action.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

There are no world heritage properties within or in close proximity to the proposed action.

Nature and extent of likely impact

N/A

3.1 (b) National Heritage Places

Description

There are no national heritage places in the vicinity of the proposed action.

Nature and extent of likely impact

N/A

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

Two Ramsar sites are located in proximity to the site as identified using the Department of the Environment (DotE) Protected Matters Search Tool (DotE 2015a; Attachment B):

- Becher Point wetlands – located 5.6 km west of the proposed action area
- Peel-Yalgorup system – proposed action is located within the catchment area (actual Ramsar site is located approximately 20 km away to the south).

Nature and extent of likely impact

Becher point wetland systems

The surface water flows from the site would characteristically flow toward the Serpentine River following the natural topography. Groundwater is anticipated to generally flow to the east toward the Serpentine River (Strategen 2015b). No impacts to the Becher Point wetlands are expected as the surface and groundwater from the site is flowing away from the wetlands.

Peel-Yalgorup system

The Peel main drain flows in a southerly direction from Banjup Swamp (located near Gibbs Rd, Aubin Grove) in the north to the Peel-Yalgorup system in the south (via Serpentine River). The Peel main drain passes through several pools/wetlands before discharging to the Serpentine River at Kerulup Pool. The proposed action is located within the Peel main drain catchment area.

No pit dewatering or groundwater abstraction for water supply is proposed as part of this proposed action. Environmental impacts to groundwater are therefore highly unlikely to occur. Hydrocarbons and chemicals will not be stored on site; therefore the risk of groundwater and surface water contamination is negligible. Therefore there are unlikely to be any impacts on the Peel-Yalgorup system as a result of this proposed action.

3.1 (d) Listed threatened species and ecological communities

Description

Flora

The DotE Protected Matters Search Tool identified a total of ten Threatened flora species as having the potential to occur within the proposed action area and 3 km buffer area (DotE 2015a; Attachment B).

Threatened flora species that may potentially occur within the vicinity of the proposed action are listed in **Table 3**.

Table 3 EPBC Act listed flora species potentially occurring in the proposed action area

Species Name	Common Name	EPBC Status
Andersonia gracilis	Slender Andersonia	Endangered
Caladenia huegelii	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Endangered
Centrolepis caespitosa		Endangered
Darwinia foetida	Muchea Bell	Critically endangered
Diuris micrantha	Dwarf bee-orchid	Vulnerable
Diuris purdiei	Purdie's Donkey-orchid	Endangered
Drakea elastica	Glossy-leafed Hammer-orchid, Praying Virgin	Endangered
Drakea micrantha	Dwarf Hammer-orchid	Vulnerable
Lepidosperma rostratum		Endangered
Synaphea stenoloba	Dwellingup Synaphea	Endangered

Source: DotE 2015a; Attachment B

No Threatened Ecological Communities (TECs) were identified as potentially occurring within the vicinity of the proposed action (Attachment B).

Fauna

The DotE Protected Matters Search Tool identified ten Threatened fauna species as having the potential to occur within the proposed action area and 3 km buffer area (Attachment B).

Threatened fauna species that may potentially occur within the proposed action area are listed in **Table 4**.

Table 4 EPBC Act listed fauna species potentially occurring in the proposed action area.

Species Name	Common Name	EPBC Status
Birds		
Botaurus poiciloptilus	Australasian Bittern	Endangered
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Vulnerable
Calyptorhynchus baudinii	Baudin's Cockatoo	Vulnerable
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	Endangered
Leipoa ocellata	Malleefowl	Vulnerable
Rostratula australis	Australian Painted Snipe	Endangered
Mammals		
Bettongia penicillata ogilbyi	Woylie	Endangered
Dasyurus geoffroii	Chuditch, Western Quoll	Vulnerable
Pseudocheirus occidentalis	Western Ringtail Possum	Vulnerable
Setonix brachyurus	Quokka	Vulnerable

Source: DotE 2015a; Attachment B

Nature and extent of likely impact

Flora

A Level 1 flora and vegetation survey of a 92.07 ha area (the Survey area; Figure 1) within M70/1262, including the proposed action area, (Strategen 2015a) was conducted in May 2015. This included a field assessment to:

- collect and identify the vascular plant species present within the Survey area
- search areas of suitable habitat for Threatened flora
- define and map the native vegetation types present within the Survey area.

An assessment of the likelihood of occurrence of each flora species identified in the EPBC Act Protected Matters Search Tool, based on available habitat is presented in **Table 5**.

Table 5 Likelihood of EPBC Act listed flora species occurring within the proposed action area

Species Name	Likelihood of occurrence	Justification
Andersonia gracilis Slender Andersonia	Unlikely	Habitat for this species occurs within seasonally damp, black sandy clay flats near swamps. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by the proposed action.
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Possible	This species occurs within well-drained, deep sandy soils in low mixed *Banksia*, *Allocasuarina* and Jarrah woodlands. This species was not recorded during the flora survey of the proposed action area. However, the preferred soil type/habitat occurs within the proposed action area and therefore it is possible this species may be present.
Centrolepis caespitosa	Unlikely	Habitat for this species is relatively unknown. Brown et al identified that this species occurs within winter-wet claypans dominated by low shrubs and sedges. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by this proposed action.
Darwinia foetida Muchea Bell	Highly unlikely	Muchea Bell occurs within wet/winter-damp clay under *Myrtaceous* shrubland. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by this proposed action. Additionally, both Western Australian Herbarium (1998-) and DotE (2015b) list this species' distribution to be highly restricted within the Muchea area (approximately 70 km north of Perth).
Diuris micrantha Dwarf bee-orchid	Unlikely	Dwarf bee-orchid occurs within clay-loam substrates in winter-wet depressions. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by this proposed action.
Diuris purdiei Purdie's Donkey-orchid	Unlikely	Habitat for this occurs in areas subject to winter inundation within dense heath with scattered *Myrtaceous* trees. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by this proposed action.
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin	Possible	This species occurs on bare patches of white sand over dark sandy loam on damp areas. Habitat for this species occurs within the proposed action area; however wetland areas will not be disturbed as part of mining. This species was not recorded during the flora survey. Furthermore, the proposed action area was cleared and planted with pine trees for approximately 10 years; therefore the seed bank for the species is not expected to be present. The surveys were undertaken in May, which is outside of the peak flowering period for this species. Given this, it is possible this species occurs.
Drakaea micrantha Dwarf Hammer-orchid	Possible	Occurs within cleared, open sandy patches. Habitat for this species occurs within the proposed action area; however this species was not recorded during the current flora survey or historical surveys of the proposed action area (Bennett 2006). Furthermore, the proposed action area was cleared and planted with pine trees for approximately 10 years; therefore the seed bank for the species is not expected to be present. The surveys were undertaken in May, which is outside of the peak flowering period for this species. Given this, it is possible this species occurs.
Lepidosperma rostratum	Unlikely	Habitat for this species occurs in sandy soils among low heath comprised of *Banksia telmatiaea* and *Calothamnus hirsutus* in winter-wet swamps. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by this proposed action.
Synaphea stenoloba Dwellingup Synaphea	Unlikely	Habitat for this species occurs within loamy soils in low lying areas that are seasonally inundated. The preferred soil type/habitat does not occur within the proposed action area as wetland areas will not be impacted by this proposed action.

Source: DotE 2015a, DotE 2015b, Western Australian Herbarium 1998-, Strategen 2015a, Brown et al 1998

The flora and vegetation survey conducted in 2015 did not identify any Threatened Ecological Communities or Threatened flora species within the proposed action area. Conservation significant flora species potentially occurring in the Survey area that may have been missed due to the survey timing include the three Threatened orchid species; *Caladenia huegelii*, *Drakaea elastica* and *Drakaea micrantha* which are all diminutive in stature and are at their most visible when in flower. Both *Drakaea* species are likely to be restricted to wetland/damp areas and thus are highly unlikely to be impacted by the proposed action as these areas will not be impacted. *C. huegelii* has the potential to occur outside of these wetland areas and may not have been recorded during the flora and vegetation survey due to timing constraints. Given the disturbance history of the site, the potential for the species to occur is considered low. All other Threatened flora species are considered unlikely to occur within the proposed action area; therefore, no impact on these species is considered likely as a result of the proposed action.

Fauna

Bamford Consulting Ecologists (BCE) undertook a fauna survey of an area encompassing some parts of the proposed action area and adjacent wetlands in 2006 (BCE 2006). It should be noted that in 2006, the majority of the proposed action area was occupied by pine plantation. During the most recent assessment undertaken by Strategen in 2015, the proposed action area comprised remnant native woodland vegetation and natural regeneration in areas which were previously cleared (Strategen 2015a).

An assessment of the likelihood of conservation significant species occurring within the proposed action area, based on results presented by BCE (2006) is provided in Table 6. The conservation status of each species was updated based on current listings provided by DotE (2015a). Likelihood of occurrence was also updated (where required) based on the change in vegetation within the proposed action area between 2006 and 2015. An updated desktop assessment was also conducted by Strategen (2015) to determine if any Threatened fauna species were likely to occur within the proposed action area.

In addition to the fauna survey undertaken in 2006 and the desktop assessment conducted in May 2015, a Level 1 fauna assessment of the Survey area, including the proposed action area, (Strategen 2015a) was conducted in May 2015. This fauna assessment included the following:

- foraging assessment to record any flora species with the potential to provide a food source for black cockatoos (Forest Red-tailed Black Cockatoos, Baudin's Cockatoos and Carnaby's Black Cockatoos)
- significant tree assessment to identify tree species which are considered to be potential breeding or roosting trees for black cockatoos.

An assessment of the likelihood of occurrence of each of the fauna species identified in the EPBC Act Protected Matters Search Tool is presented in **Table 6**, based on the fauna surveys undertaken within the proposed action area (BCE 2006).

Table 6 Likelihood of EPBC Act listed fauna species occurring within the proposed action area

Species Name	Likelihood of occurrence	Justification
Birds		
Botaurus poiciloptilus Australasian Bittern	Unlikely	The Australasian Bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites*, *Cyperus*, *Eleocharis*, *Juncus*, *Typha*, *Baumea*, *Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate. The proposed action area and adjacent wetlands do not contain suitable habitat for this species.
Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo	Likely	A fauna assessment of the proposed action area was undertaken by Strategen in 2015 to assess black cockatoo habitat. At a broad scale, the majority of the proposed action area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. The vegetated strip of land which runs along the western boundary of the proposed action area represented a different vegetation structure which is primarily a Jarrah-Banksia woodland which is relatively undisturbed by the historical pine plantation. Based on this assessment approximately 6.54 ha of potential Forest Red-tailed Black Cockatoo very good quality foraging habitat was recorded as occurring within the proposed action area (Figure 2). No trees that could be used by black cockatoos for roosting or breeding purposes were recorded within the proposed action area.
Calyptorhynchus latirostris Carnaby's Black Cockatoo	Foraging evidence observed	A fauna assessment of the proposed action area was undertaken by Strategen in 2015 to assess black cockatoo habitat. At a broad scale, the majority of the proposed action area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. The vegetated strip of land which runs along the western boundary of the proposed action area represented a different vegetation structure which is primarily a Jarrah-Banksia woodland which is relatively undisturbed by the historical pine plantation. Based on this assessment approximately 27.61 ha of Carnaby's Black Cockatoo foraging habitat will be impacted by the proposed action, consisting of 6.54 ha of very good quality habitat and 22.97 ha of low quality habitat was recorded as occurring within the proposed action area (Figure 2). No trees that could be used by black cockatoos for roosting or breeding purposes were recorded within the proposed action area.

Species Name	Likelihood of occurrence	Justification
Calyptorhynchus baudinii Baudin's Cockatoo	Unlikely	A fauna assessment of the proposed action area was undertaken by Strategen in 2015 to assess black cockatoo habitat within the Survey area. At a broad scale, the majority of the Survey area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. The vegetated strip of land which runs along the western boundary of the Survey area represented a different vegetation structure which is primarily a Jarrah-Banksia woodland which is relatively undisturbed by the historical pine plantation. Based on this assessment approximately 6.54 ha of potential Baudin's Cockatoo very good quality foraging habitat was recorded as occurring within the proposed action area (Figure 2). Although this species may forage in the general area during the non-breeding season, it is unlikely to be present in the proposed action area. No trees that could be used by black cockatoos for roosting or breeding purposes were recorded within the proposed action area.
Leipoa ocellata Malleefowl	Unlikely	The Malleefowl occupies shrublands and low woodlands that are dominated by mallee vegetation. The shrublands and low woodlands communities where Malleefowl occur are dominated by multi-stemmed species of eucalypts (such as *Eucalyptus socialis*, *E. dumosa* or *E. incrassata*) and occur on sandy or loamy soils that receive 200 to 450 mm of rainfall each year. The proposed action area does not contain habitat suitable for this species.
Rostratula australis Australian Painted Snipe	Unlikely	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or salt marsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (Melaleuca). The wetland habitat within the site does not form part of the proposed action area. Therefore it is unlikely that this species will be present within the proposed action area.
Mammals		
Bettongia penicillata ogilbyi Woylie	Unlikely	Woylie currently occupy open forest with a low, dense understorey of tussock grasses or woody scrub. At a broad scale, the majority of the Survey area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. Therefore, the proposed action area does not contain suitable habitat for this species.
Dasyurus geoffroii Chuditch, Western Quoll	Unlikely	Chuditch currently inhabit most kinds of wooded habitat within its current range including eucalypt forest (especially Jarrah), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. The densest populations of Chuditch have been found in riparian forest. This species is unlikely to be present due to the lack of large remnants.
Pseudocheirus occidentalis Western Ringtail Possum	Unlikely	Western Ringtail Possums occur in and near coastal Peppermint (*Agonis flexuosa*) forest and Tuart (*Eucalyptus gomphocephala*) dominated forest with a Peppermint tree understorey. Other populations occur in Jarrah forest and Jarrah-Marri forest associated with Peppermint trees, near Collie, and riverine stands of Peppermint tree near the Harvey River, east of Harvey. The main determinant of suitable habitat for the Western Ringtail Possum appears to be the presence of Peppermint tree, either as the dominant tree or as an understorey component of eucalypt forest or woodland. At a broad scale, the majority of the proposed action area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri*, *Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. Therefore, the proposed action area does not contain suitable habitat for this species.
Setonix brachyurus Quokka	Unlikely	The Quokka is a habitat specialist, preferring early seral (young) vegetation stages that have been burned within the previous ten years. This habitat meets dietary and predator refuge requirements. The Quokka also has relatively high water requirements, which necessitates close proximity to fresh water throughout the year. Hence, the species is often present in riparian and swamp habitat. The understorey structure of the habitats currently inhabited by the Quokka consist of dense, low vegetation that provides refuge from predation by owls, *Vulpes vulpes* (fox) and *Felis catus* (cat). The main habitat for mainland populations of the Quokka is dense riparian vegetation, but the species also uses a range of other habitat, including: • heath and shrubland on the mainland coast and offshore islands • *Taxandria linearifolia* (Swamp Peppermint) dominated swamps in Jarrah forest • swampy shrublands • swordgrass-dominated understorey • regrowth areas of *E. diversicolor* (Karri) forest • *Eucalyptus megacarpa* (Bullich) swamp forest • *Melaleuca* spp (Paperbark) swamp. The proposed action area does not contain dense shrubland or wetland vegetation. Therefore it is unlikely that this species occurs within the proposed action area.

Assessment of impact on black cockatoos

The fauna assessment undertaken by Strategen in May 2015 recorded the value of the vegetation within the Survey area as foraging habitat for black cockatoos. The value of each vegetation type as foraging habitat for black cockatoo species was determined based on the availability of plant food sources. Based on the results of the foraging assessment, the proposed action area contain 6.54 ha of very good quality Carnaby's Black Cockatoo foraging habitat, within which there is 6.54 ha of habitat suitable for foraging by the other two species of black cockatoo (Forest Red-tailed Black Cockatoos and Baudin's Cockatoos). The highest quality foraging habitat for black cockatoos was noted within Vegetation Type (VT) 2 which contained high densities of black cockatoo food species including eucalypts and Banksia spp. at canopy and midstorey levels. The lowest quality foraging habitat for black cockatoos (not including cleared areas) was noted within VT 5 which contained limited potential food resources for all three species of black cockatoos and in the pine plantation which provides limited food resources for Carnaby's Black Cockatoo only. For the purposes of this referral, the low quality habitat is excluded from further discussion.

The survey also included an assessment of potential breeding and roosting trees. No trees that could be used by black cockatoos for roosting or breeding purposes in the future were recorded within the Survey area.

Signs of Carnaby's Black Cockatoo foraging were observed in scattered occurrences during the fauna assessment and some of the vegetation was considered suitable for foraging by the other two species of black cockatoos (Forest Red-tailed Black Cockatoo and Baudin's Cockatoo); however, Baudin's Cockatoo are unlikely to be present within the proposed action area (Strategen 2015a).

Given the above, the proposed action will result in the clearing of 6.54 ha of Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo foraging habitat. There are two relevant Commonwealth policy documents which provide guidance for the evaluation of significant impacts on black cockatoo species:

1. DSEWPaC (2012) EPBC Act 1999: Referral Guidelines for three threatened black cockatoo species.
2. DotE (2013) Matters of National Environmental Significance, Significant Impact Guidelines 1.1.

An evaluation of the proposed action against each of these guidelines is provided below.

Table 7 assesses the proposed action against referral triggers identified in the Referral Guidelines for black cockatoos.

Table 7 Assessment of the proposed action against the black cockatoo Referral Guidelines

Referral trigger	Assessment of proposed action against referral trigger
Clearing of any known nesting tree	The proposed action will not result in the clearing of any known nesting trees. No trees that could be used by black cockatoos for nesting purposes in the future were recorded within the proposed action area.
Clearing or degradation of any part of a vegetation community known to contain breeding habitat	No known breeding trees have been recorded within the proposed action area. The proposed action area does not contain trees that could be used by black cockatoos for breeding purposes in the future.
Clearing or degradation of more than 1 ha of quality foraging habitat	Up to 6.54 ha of very good quality foraging Carnaby's Black Cockatoo and potential Fores Red-tailed Cockatoo habitat may be cleared as a result of the proposal.
Clearing or degradation of a known night roosting tree	The proposed action will not result in the clearing of any known roosting trees. No known night roosting trees have been recorded within the proposed action area.
Creating a gap of more than 4 km between patches of black cockatoo habitat	The Survey area is located in close proximity to a number of existing reserves containing potential black cockatoo habitat including: • Baldivis Tramway Reserve (north of Stakehill Road) • Karnup Nature Reserve (1.5 km) • Anstey Swamp (3.5 km) • Paganoni Swamp (3.8 km). As such, the proposal will not create a gap of more than 4 km between patches of habitat.

An assessment of the proposed action on Carnaby's Black Cockatoo is detailed in **Table 8**, with reference to the Significant Impact Guidelines (DotE 2013).

Table 8 Assessment of potential impacts to Carnaby's Black Cockatoo (Endangered) against significant impact criteria

Significant Impact Criterion	Comment
Will the action lead to a long-term decrease in the size of a population?	The proposed action area contains approximately 6.54 ha of very good quality foraging habitat for Carnaby's Black Cockatoo (Figure 2). While the local extent of foraging habitat will be reduced as a result of the proposed action, the proposed clearing will not lead to a long term decrease in the size of the Carnaby's Black Cockatoo population due to: • no evidence of breeding or roosting has been recorded within the proposed action area • limited clearing of good quality foraging habitat (6.54 ha) and retention of vegetation on the site outside of the proposed action area • suitable alternative habitat will be retained on-site (57.53 ha; comprising 1.37 ha of very good quality foraging habitat) and is available in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3) • the nature of Carnaby's Black Cockatoo populations, which are highly mobile with extensive ranges • the absence of any potential breeding or roosting trees within the proposed action area. On this basis, clearing is not expected to impact the sustainability of any Carnaby's Black Cockatoo population.
Will the action reduce the area of occupancy of the species?	The proposed action will not significantly reduce the area of occupancy of Carnaby's Black Cockatoo. Suitable habitat will be retained on-site (57.53 ha) and is available in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3). The clearing represents only 2.6% of Carnaby's Black Cockatoo habitat retained on-site and protected in the above reserves, within a 5 km radius of the proposed action area and therefore is unlikely to significantly reduce the area of occupancy of Carnaby's Black Cockatoo.
Will the action fragment an existing population into two or more populations?	The proposed action area is bounded to the east and south by native vegetation, part of the historical Baldivis Explosives Facility to the west and residential development to the north. Carnaby's Black Cockatoos are highly mobile and the clearing of 6.54 ha of very good quality Carnaby's Black Cockatoo habitat required will not present a barrier to movement across the region.
Will the action adversely affect habitat critical to the survival of a species?	The proposed action area contains 6.54 ha of very good quality foraging habitat for Carnaby's Black Cockatoos. However, there are no known breeding or roosting sites within the proposed action area. Suitable Carnaby's Black Cockatoo foraging habitat occurs in long-term conservation areas located in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3). The proposed clearing represents a small portion (2.6%) of the overall habitat available to the species reserved in the conservation areas listed above, within a 5 km radius of the proposed action area, and habitat retained on-site; therefore not considered critical to the survival of the species.
Will the action disrupt the breeding cycle of a population?	There is no breeding habitat with the proposed action area, therefore no Carnaby's Black Cockatoo breeding has been observed or recorded in the proposed action area. The clearing of this area is therefore unlikely to contribute to an increase in competition for nest hollows. On this basis the action will not disrupt the breeding cycle of a population. The proposed action is also unlikely to disrupt the breeding cycle of Carnaby's Black Cockatoo populations due to the small size of the proposed clearing and the proximity of the proposed action area to reserved areas containing high quality alternate foraging vegetation, within a 5 km radius (Figure 3).
Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The action will remove approximately 6.54 ha of very good quality Carnaby's Black Cockatoo foraging habitat. Habitat for these species is available in retained vegetation on-site (57.53 ha), in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3). The clearing associated with the proposed action represents only 2.6% of Carnaby's Black Cockatoo habitat retained on-site and protected in the conservation areas listed above. Therefore the proposed action is unlikely to cause these species to decline.

Significant Impact Criterion	Comment
Will the action result in invasive species that are harmful to critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	Habitat contained in the adjacent areas of retained vegetation within the site may be at risk of establishment of invasive weed species through edge effects. However, given that the majority of this habitat has been subjected to previous disturbance (clearing for pine plantation); it is unlikely the development will result in any new invasive species becoming established. Weed species that may occur predominately affect the vegetation understorey and are unlikely to significantly affect the foraging and breeding habitat quality of the vegetation. Urban Resources will implement weed management and control measures throughout sand mining operations.
Will the action introduce disease that may cause the species to decline?	A dieback survey of the site has not been undertaken; however, the site has been subject to a range of previous disturbances such as clearing and pine plantation and related activities. Disturbance for the proposed action is therefore unlikely to introduce new plant diseases to the site.
Will the action interfere with the recovery of the species?	The Recovery Plan for Carnaby's Black Cockatoo outlines six broad management actions for a ten year period (DPaW 2013): • protect and manage important habitat: This includes identifying feeding and breeding habitat critical for the survival of this species • undertake regular monitoring: The recovery team will monitor population parameters, habitats, threats and status of Carnaby's Black Cockatoo • conduct research to inform management. Including undertaking research into the biology, ecology and conservation management of Carnaby's Black Cockatoo • manage other impacts. Monitor the impacts and implement strategies to reduce anthropogenic factors affecting Carnaby's Black Cockatoo, and support rehabilitation programs • engage with the broader community. Engage and involve people across the community in the conservation of Carnaby's Black Cockatoo • undertake Information and Communication Activities: Develop and distribute educational and guidance materials for decision makers, establish joint management agreements and provide for information sharing. The proposed action is unlikely to interfere with the recovery of Carnaby's Black Cockatoo given the limited clearing and given that there are extensive areas of potential foraging, breeding and roosting habitat close to the proposed action area in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3).

An impact assessment of the proposed action on Forest Red-tailed Black Cockatoo is detailed in **Table 9**, with reference to the Significant Impact Guidelines (DotE 2013).

Table 9 Assessment of potential impacts to Forest Red-tailed Black Cockatoo (Vulnerable) against significant impact criteria

Significant Impact Criterion	Comment
Will the action lead to a long-term decrease in the size of a population?	The proposed action area contains approximately 6.54 ha of very good quality Forest Red-tailed Black Cockatoo foraging habitat (Figure 2). While the local extent of foraging habitat will be reduced as a result of the proposed action, the proposed clearing will not lead to a long term decrease in the size of the Forest Red-tailed Black Cockatoo population due to: • no evidence of breeding or roosting has been recorded within the proposed action area • limited clearing of good quality foraging habitat (6.54 ha) and retention of vegetation on the site outside of the proposed action area • suitable alternative habitat will be retained on-site (17.84 ha; comprising 1.37 ha of very good quality foraging habitat) and is available in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3) • the nature of Forest Red-tailed Black Cockatoo populations, which are highly mobile with extensive ranges • the absence of any potential breeding or roosting trees within the proposed action area. On this basis, clearing is not expected to impact the sustainability of any Forest Red-tailed Black Cockatoo population.
Will the action reduce the area of occupancy of the species?	The proposed action will not significantly reduce the area of occupancy of Forest Red-tailed Black Cockatoo. Suitable habitat will be retained on-site (17.84 ha; comprising 1.37 ha of very good quality foraging habitat) and is available in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3). The clearing represents only 0.6% of Forest red-tailed Black Cockatoo habitat retained on-site and protected in the above reserves, located within a 5 km radius of the proposed action, and therefore is unlikely to significantly reduce the area of occupancy of Forest Red-tailed Black Cockatoo.

Significant Impact Criterion	Comment
Will the action fragment an existing population into two or more populations?	The proposed action area is bounded to the east and south by native vegetation, part of the historical Baldivis Explosives Facility to the west and residential development to the north. Forest Red-tailed Black Cockatoo are highly mobile and the clearing of 6.54 ha of Forest Red-tailed Black Cockatoo habitat required will not present a barrier to movement across the region.
Will the action adversely affect habitat critical to the survival of a species?	The proposed action area contains 6.54 ha of very good quality foraging habitat for Forest Red-tailed Black Cockatoo. However, there are no known breeding or roosting sites within the proposed action area. Suitable Forest Red-tailed Black Cockatoo foraging habitat occurs in long-term conservation areas located in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3). The proposed clearing represents a small portion (0.6%) of the overall habitat available to the species reserved in the conservation areas listed above and retained on-site, within a 5 km radius of the site; and is therefore not considered critical to the survival of the species.
Will the action disrupt the breeding cycle of a population?	There is no breeding habitat with the proposed action area, therefore no Forest Red-tailed Black Cockatoo breeding has been observed or recorded in the proposed action area. The clearing of this area will therefore not contribute to an increase in competition for nest hollows. On this basis the action will not disrupt the breeding cycle of a population. The proposed action is also unlikely to disrupt the breeding cycle of Forest Red-tailed Black Cockatoo populations due to the small size of the proposed clearing and the proximity of the proposed action area to reserved areas containing alternate foraging vegetation.
Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The action will remove approximately 6.54 ha of very good quality Forest Red-tailed Black Cockatoo foraging habitat. Habitat for the species is available in retained vegetation on-site (17.84 ha; comprising 1.37 ha of very good quality foraging habitat), in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3). The clearing associated with the proposed action represents only 0.6% of Forest Red-tailed Black Cockatoo habitat retained on-site and protected in the conservation areas listed above. Therefore the proposed action is unlikely to cause these species to decline.
Will the action result in invasive species that are harmful to critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	Habitat contained in the adjacent areas of retained vegetation within the site may be at risk of establishment of invasive weed species through edge effects. However, given that the majority of this habitat has been subjected to previous disturbance (clearing for pine plantation); it is unlikely the development will result in any new invasive species becoming established. Weed species that may occur predominately affect the vegetation understorey and are unlikely to significantly affect the foraging and breeding habitat quality of the vegetation. Urban Resources will implement weed management and control measures throughout operations of the proposed action.
Will the action introduce disease that may cause the species to decline?	A dieback survey of the site has not been undertaken; however, the site has been subject to a range of previous disturbances such as clearing and pine plantation and related activities. Disturbance for the proposed action is therefore unlikely to introduce new plant diseases to the site.
Will the action interfere with the recovery of the species?	The proposed action is unlikely to interfere with the recovery of Forest Red-tailed Black Cockatoos given the limited clearing and given that there are extensive areas of potential foraging, breeding and roosting habitat, within 5 km of the proposed action, in the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)(refer to Figure 3).

3.1 (e) Listed migratory species

Description

A number of listed migratory species were identified using the DotE Protected Matters Search Tool as having the potential to occur within the vicinity of the proposed action and 3 km buffer area (DotE 2015a; Attachment B). An assessment of the likelihood of occurrence of each of the listed migratory species identified by the DotE Protected Matters Search Tool is presented in **Table 10**.

Table 10 Listed migratory species identified in a protected matters search of the proposed action area

Species Name	Likelihood of occurrence	Comment
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Unlikely	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. This species is potentially a very occasional summer visitor to the south west but is entirely aerial and largely independent of terrestrial habitats. This species has not been recorded within 5 km of the site based on Birdata – Atlas Distribution Maps (BirdLife Australia 2015) and therefore this species is considered unlikely to occur within the proposed action area.
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle	Unlikely	The White-bellied Sea-Eagle is mostly recorded in coastal lowlands. Birds have been recorded at or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, saltmarsh and sewage ponds. They also occur at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats for the White-bellied Sea-Eagle include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban areas. The White-bellied Sea-Eagle generally forages over large expanses of open water. However, the White-bellied Sea-Eagle will also forage over open terrestrial habitats (such as grasslands). The proposed action area does not contain habitat suitable for this species. Therefore this species is considered unlikely to occur within the proposed action area.
Merops ornatus Rainbow Bee-eater	Likely	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. Habitat is likely to be present within the proposed action area and the species is known to be present in the general area.
Migratory Wetlands Species		
Ardea alba (Ardea modesta) Great Egret, White Egret, Eastern Great Egret	Unlikely	The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). The species usually frequents shallow waters. The species is unlikely to be present within the proposed action area as the area does not comprise wetlands. The species may be present as a vagrant within adjacent wetlands but unlikely to be permanently reliant on these due to their poor quality.
Ardea ibis Cattle Egret	Unlikely	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions; however, this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. The Cattle Egret uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation. The species is unlikely to be present within the proposed action area as the area does not comprise wetlands.
Pandion cristatus Eastern Osprey	Unlikely	The Eastern Osprey occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas and they require extensive areas of open fresh, brackish or saline water for foraging. This species has not been recorded within 5 km of the proposed action area based on Birdata – Atlas Distribution Maps (BirdLife Australia 2015) and therefore this species is considered unlikely to occur within the proposed action area.
Rostratula benghalensis (sensu lato) Painted Snipe	Unlikely	See *Rostratula australis* (Australian Painted Snipe) in Table 6.

Source: DotE 2015a, DotE 2015b, Attachment B

Nature and extent of likely impact

The Rainbow Bee-eater may be present within the proposed action area based on habitat present and the proximity of the proposed action area to wetlands (within the site and surrounding areas including Anstey Swamp and Paganoni Swamp). The wetland areas within the proposed action area contain suitable habitat that will not be impacted by the proposed action and other suitable habitat is available at Anstey Swamp and Paganoni Swamp. As habitat suitable for this species is protected locally and within the proposed action area, this species is unlikely to be significantly impacted by the proposed action.

3.1 (f) Commonwealth marine area

Description

The proposed action will not be taken within or adjacent to Commonwealth marine areas.

Nature and extent of likely impact

N/A.

3.1 (g) Commonwealth land

Description

The proposed action will not be taken on, or adjacent to, Commonwealth land.

Nature and extent of likely impact

N/A.

3.1 (h) The Great Barrier Reef Marine Park

Description

The proposed action is not located within or nearby the Great Barrier Reef Marine Park.

Nature and extent of likely impact

N/A.

3.1 (i) A water resource, in relation to coal seam gas development and large coal mining development

Description

The proposed action will not impact upon a water resource in relation to coal seam gas development.

Nature and extent of likely impact

N/A.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	**Is the proposed action a nuclear action?**	X	No.
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	X	No.
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	X	No.
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		

3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	X	No.
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))

3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	X	No.
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))

3.3 Other important features of the environment

3.3 (a) Flora and fauna

A search of the Department of Parks and Wildlife (Parks and Wildlife) database identified a total of 17 Declared Rare (DRF) and Priority (P) flora listed under the WC Act as having the potential to occur within the proposed action area (Strategen 2015a). A total of 41 native vascular plant taxa from 34 plant genera and 18 plant families were recorded during 2015 survey including six introduced (weed) species (Strategen 2015a). No Threatened flora species pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2014) or Priority flora species as listed by Western Australian Herbarium (1998) were recorded within the Survey area (Strategen 2015a). Two Priority flora species, *Dillwynia dillwynioides* and *Schoenus capillifolius* were recorded by Bennett (2006); however, these species were recorded in wetlands which do not form part of the proposed action area. The location of these species and other known locations of Threatened and Priority Flora species in the area are shown in Figure 4.

In addition to EPBC Act listed fauna species that are recorded or likely to occur within the proposed action area, a further three conservation significant fauna species may utilise the proposed action area at times. These species are protected under the WC Act and are identified in **Table 11** (Strategen 2015a).

Table 11 Other conservation significant fauna that may occur within the proposed action area

Species Name	Status	Description and likelihood of occurrence
Reptiles		
Ctenotus gemmula (Jewelled Ctenotus)	Priority 3	This species occurs on pale sands with heath and Banksia spp. or mallee woodlands. This species may occur within the areas of remnant banksia woodland within the proposed action area.
Neelaps calonotos (Black-striped Snake)	Priority 3	This species occupies dunes and sand plains with heath or eucalyptus or banksia woodlands. This species may occur within the proposed action area.
Mammals		
Isoodon obesulus fusciventer (Southern Brown Bandicoot, Quenda)	Priority 5	This species occurs on sandy soils with low ground cover and prefers areas that are regularly burnt. Highest densities occur in association with wetlands and damplands. This species may occur within the proposed action area.

3.3 (b) Hydrology, including water flows

The proposed action is located within the Stakehill Mound groundwater subregion of the Perth Basin (GHD 2014). The subregion covers an area of approximately 150 km^2 and occurs within the superficial formations flow system that is recharged directly by rainfall infiltration (Golder Associates 2010). It is estimated that the average thickness of the aquifer is approximately 20 m with a minimum transmissivity of approximately 1000 m^2/day (Golder Associates 2010).

Groundwater levels beneath the proposed action area fluctuate by approximately 1 m annually. Levels are generally at their maximum in September/October following winter, and minimum in April/May (Golder Associates 2010). Levels are generally less than 3.25 m Australian Height Datum (AHD) beneath the proposed action area. Groundwater beneath the proposed action area is expected to flow east towards Serpentine River (Strategen 2015b).

Rainfall is expected to infiltrate quickly due to the high permeability of the local sands. Surface water is not expected to flow from the proposed action area in the 1 in 100-year Average Return Interval event. The proposed action area is considered unlikely to receive runoff from the land adjacent to the west, given that this land is comprised of Tamala Limestone sands also with high infiltration rates.

If, during high rainfall events, there is surface water flow across the proposed action area, surface water would be expected to follow the natural topography to the east towards Kwinana Freeway and Serpentine River. The wetlands east of the proposed action area, adjacent to the Serpentine River, are subject to seasonal inundation (Golder Associates 2006).

Surface water management infrastructure is expected to already be present along Kwinana Freeway and would convey any flows from the proposed action area (if any) to Serpentine River. Management measures are proposed to be implemented during mining operations and decommissioning to control surface run-off and minimise erosion.

3.3 (c) Soil and Vegetation characteristics

The proposed action is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). The Swan Coastal Plain comprises five major geomorphological systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson et al. 1994). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward & McArthur 1980; Semeniuk 1990; Gibson et al.1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils.

The Rockingham Mapsheet in the Perth Metropolitan Region 1:50,000 Environmental Geology Series describes the geology across the majority of the proposed action area as 'Bassendean Sand' which comprises predominately of light grey sand at the surface, becoming yellow with depth, fine to medium grained, sub-rounded, moderately well sorted sand of aeolian origin (Gozzard 1983).

The Swan Coastal Plain 2 subregion is dominated by *Banksia* or *Eucalyptus gomphocephala* (Tuart) on sandy soils, *Casuarina obesa* on outwash plains and paperbark (Melaleuca) in swampy areas (Mitchell et al. 2002).

The proposed action area occurs within the Drummond Botanical Subdistrict which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and Tuart, *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils (Beard 1990).

The proposed action area occurs at the interface between the Serpentine River and Karrakatta System 6 vegetation complexes as mapped by Heddle et al. (1980). These complexes can be described as:

- Serpentine River – closed scrub of *Melaleuca* spp. and fringing woodland of *Eucalyptus rudis* and *M. rhaphiophylla* along streams
- Karrakatta – predominantly open forest of *Eucalyptus gomphocephala – E. marginata – C. calophylla* and woodland of *E. marginata – Banksia* spp.

Five native vegetation units have been identified within the Survey area (Figure 5; Strategen 2015a). The Baldivis Explosives Reserve forms part of the proposed action area, however this area was not surveyed due to access restrictions. Vegetation to be disturbed within the Explosives Reserve was observed from the boundary. The vegetation type was inferred from these observations and a review of aerial photography. A high level of confidence on this inference exists.

Vegetation units are described in detail in Attachment C.

3.3 (d) Outstanding natural features

There are no outstanding features in the vicinity of the proposed action.

3.3 (e) Remnant native vegetation

The proposed action area supports approximately 30.83 ha of native vegetation. Vegetation condition varies across the proposed action area from completely degraded to very good using the Keighery (1994) Bushland Condition Scale (Strategen 2015a). The majority of the vegetation within the proposed action area is good (approximately 24.29 ha) with the remaining vegetation very good (approximately 6.54 ha). The remaining areas predominantly consist of cleared areas associated with the Baldivis Explosives Facility.

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

The topography of the proposed action area is influenced by a north-south ridge located along the western boundary and a gentle slope towards the banks of the Serpentine River in the east (Golder Associates 2006). The proposed action area remains relatively consistent with the pre-plantation topography and elevations vary between approximately 2 m and 13 mAHD.

3.3 (g) Current state of the environment

The majority of the proposed action area was observed to be in various states of natural regeneration following clearing of historical pine plantations from 2004 (approx.) (Strategen 2015a). The vegetated strip of land which runs along the western boundary of the proposed action area represented a different vegetation structure which is primarily a Jarrah-Banksia woodland which is relatively undisturbed by the historical pine plantation. The remaining areas predominantly consist of cleared areas associated with the Baldivis Explosives Facility.

Approximately 74 % of the proposed action area supports some remnant native vegetation; however the remaining 26 % is cleared. A total of six introduced (weed) species were recorded throughout the Survey area during the flora and vegetation

assessment (Strategen 2015a). No Declared Plant species pursuant to Section 22 of the BAM Act were recorded within the proposed action area.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

There are no Commonwealth Heritage Places or sites listed on State Register of Heritage Places (Heritage Council State Heritage Office 2015) or the City of Rockingham Municipal heritage inventory (City of Rockingham 2012) within the proposed action area.

The Baldivis Tramway Reserve is approximately 22 km in length and 20-70 m in width that traverses the City of Cockburn, Kwinana and Rockingham. The Baldivis Tramway Reserve starts at Baldivis Road and traverse this road in a north-south direction and ends at Stakehill Road which is immediately north of the proposed action area (ERM 2000).

The City of Rockingham has identified the Baldivis Tramway Reserve as an important area for conservation and recreation values and it was included on the register held by the Heritage Counsel of Western Australia as a significant heritage area (ERM 2000); however, it has not been registered on the State Register of Heritage Places as a heritage site.

3.3 (i) Indigenous heritage values

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System (DAA 2015) conducted on 24 April 2015 of the Karnup locality found one Registered Aboriginal Site, and one Other Heritage Places within the proposed action area.

In addition to the database search, an indigenous cultural heritage survey was conducted by Big Island Research Pty Ltd (Big Island) in March 2013 to inform the Baldivis (housing) Development Project and included the proposed action area (Big Island 2013).

The Registered Aboriginal Heritage Site (ID: 3582; Legacy ID: S02407) identified as Serpentine River is a Ceremonial, Mythological Site and covers the entire proposed action area. This site is not protected and there are no gender restrictions; however, the exact location of the site is restricted.

Site 28186 (Other Heritage Places) Nyitting Booya Binja was also identified within the proposed action area. It covers the southeast corner of the proposed action area and is registered as an Artefacts/Scatter. The site location is restricted; therefore, the exact location is unknown.

To ensure no heritage artefacts are disturbed, Urban Resources would engage a heritage consultant to undertake a site walkover prior to any disturbance of the proposed action area. Urban Resources would also implement heritage management procedures to ensure no inadvertent disturbance of any unknown heritage sites.

3.3 (j) Other important or unique values of the environment

A north-south running chain of seasonally damp and inundated wetlands occur to the east of the proposed action area. The wetlands are isolated from each other by sparse areas of regrowth following pine plantation clearing, range from 0.3 to 3.1 ha in size and comprise predominately of remnant paperbark. All wetlands within Crown Reserve 37090 were assessed in 2006 to have been in a degraded state and substantially invaded by weeds (BCE 2006). A recent inspection of these wetlands in May 2015 confirmed that the 2006 findings are still valid and the wetlands are degraded (Strategen 2015a, Attachment C).

Wetlands located within Crown Reserve 37090 are ephemeral sumplands (i.e. only seasonally inundated) and include both Resource Enhancement and Conservation Category wetlands as determined by DER (Strategen 2010). A minimum 50 m buffer will be maintained around the wetlands during mining activities.

3.3 (k) Tenure of the action area (eg freehold, leasehold)

The proposed action is located within Crown Reserves 37090 and Part Reserve 38575 (part of the former Baldivis Explosives Facility) within Mining Tenement M70/1262 currently held by Eclipse. Urban Resources propose to mine within the tenement as part of a sub-lease arrangement.

3.3 (l) Existing land/marine uses of area

The proposed action comprises regrowth areas following historical pine plantations and the Baldivis Explosives Facility within Mining Tenement M70/1262.

3.3 (m) Any proposed land/marine uses of area

The proposed action area is anticipated to be used as a Parks and Recreation Reserve following the cessation of mining operations.

4 Measures to avoid or reduce impacts

The proposed action will result in the clearing of 6.54 ha of very good quality Carnaby's Black Cockatoo foraging habitat, within which there is 6.54 ha of very good quality Forest Red-tailed Black Cockatoo foraging habitat. Removal of potential foraging habitat is not considered to pose a significant threat to Carnaby's Black Cockatoo or Forest Red-tailed Black Cockatoo species; given the small area of disturbance, potential on-site rehabilitation of the banksia woodland vegetation on the western boundary of the proposed action area, retention of vegetation within Crown Reserve 37090 (outside of the proposed action area) and the extent of surrounding protected areas.

Urban Resources will implement environmental management measures designed to address any potential environmental impacts associated with proposed clearing activities undertaken as part of the proposed action. Some of the environmental management measures to be implemented include the following:

- clearing to stay within approved footprint by clearly delineated clearing footprint boundaries
- access to non-operational areas will be restricted to authorised personnel and only on the designated haul road, unless in case of emergency
- land clearing to take place in stages to allow for local migration of fauna into adjacent areas
- no clearing to be undertaken within 50 m of the naturally vegetated geomorphic wetlands within the proposed action area
- designated vehicle routes (haul road) and appropriate speed limits to be enforced to minimise fauna vehicle interactions
- include in inductions fauna awareness and environmental awareness training sessions
- installing relevant signage on roads and entry points to the mine noting presence of fauna.

Urban Resources commit to undertaking a targeted conservation significant flora survey during Spring prior to the commencement of clearing activities. This survey will target *C. huegelii* which has the potential to occur outside of the wetland areas and may not have been recorded during the May 2015 survey due to timing constraints.

Urban Resources are investigating revegetation of the banksia woodland vegetation on the western boundary of the proposed action area to recreate black cockatoo foraging habitat.

5 Conclusion on the likelihood of significant impacts

5.1 Do you THINK your proposed action is a controlled action?

X	No, complete section 5.2
	Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

The proposed clearing of 6.54 ha of very good quality Carnaby's Black Cockatoo foraging habitat, within which there is 6.54 ha of very good quality Forest Red-tailed Black Cockatoo foraging habitat is unlikely to significantly impact these black cockatoo species.

Key reasons for this conclusion are:

- the small scale of clearing of good quality black cockatoo foraging habitat
- survey results showing the proposed action area does not contain breeding or roosting habitat or trees which could potentially be used by black cockatoos for roosting or breeding purposes in the future
- there are extensive areas of potential foraging, breeding and roosting habitat close to the proposed action area within the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha)
- areas of black cockatoo foraging habitat will be retained on-site (57.53 ha suitable for Carnaby's Black Cockatoo and 17.84 ha suitable for Forest Red-tailed Black Cockatoos)
- the clearing represents 2.6% of the habitat retained on-site and protected in the nearby reserves.

Vegetation will be retained within Crown Reserve 37090 (outside of the proposed action area) in addition to extensive areas of potential foraging, breeding and roosting habitat close to the proposed action area within the Baldivis Tramway Reserve (64 ha) to the north of Stakehill Road, in Karnup Nature Reserve to the north (1.5 km; 11.5 ha), Anstey Swamp to the west (3.5 km; 285 ha) and Paganoni Swamp to the south (3.8 km; 706 ha).

The Rainbow Bee-eater may be present within the proposed action area based on habitat present and the proximity of the proposed action area to wetlands (within the site and surrounding areas including Anstey Swamp and Paganoni Swamp). The wetland areas within the proposed action area contain suitable habitat that will not be impacted by the proposed action and other suitable habitat is available at Anstey Swamp and Paganoni Swamp. As habitat suitable for this species is protected locally and within the proposed action area this species is unlikely to be significantly impacted by the proposed action.

The predicted environmental impact resulting from the proposed action is not expected to be significant at a national, regional or local scale and can be adequately managed through implementation of environmental management measures.

The proposed action is therefore not considered likely to have a significant impact on any black cockatoo species or other matter of national environmental significance and therefore not a controlled action.

5.3 Proposed action IS a controlled action

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
	Wetlands of international importance (sections 16 and 17B)
	Listed threatened species and communities (sections 18 and 18A)
	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)

	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

6 Environmental record of the responsible party

NOTE: If a decision is made that a proposal needs approval under the EPBC Act, the Environment Minister will also decide the assessment approach. The EPBC Regulations provide for the environmental history of the party proposing to take the action to be taken into account when deciding the assessment approach.

		Yes	No
6.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** Urban Resources ensures all projects are implemented in accordance with relevant environmental approvals, sought in consultation with local, state and Commonwealth government as required. All projects are managed in accordance with management commitments, detailed as part of their environmental approvals. Urban Resources also maintains relationships with key stakeholders, ensuring consultation is undertaken throughout the environmental approvals processes and throughout project operation and closure. Urban Resources undertakes mining activities in accordance with the Operations Controls Environmental procedures that ensures all operations are conducted to an agreed environmental standard in accordance with operational controls.	Y	
6.2	**Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?** **If yes, provide details**		N
6.3	**If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?** **If yes, provide details of environmental policy and planning framework** Urban Resources operate in accordance with the Urban Resources Integrated Management System which details the Urban Resources Environmental Policy. the Environmental Policy details some of the key initiatives being implemented, including: • Identification of all environmental aspects and impacts such as: sensitive habitats, minimisation of land disturbance and rehabilitation of disturbed areas to as near as practicable their original condition. • Development and implementation of operational procedures for activities that have the potential to impact on the environment such as salvaging and re-using topsoil, waste management and hazardous substance management. • Increasing environmental awareness of employees, subcontractors and suppliers through education and training programs. • Establishing procedures to identify the potential for and to respond to emergencies or incidents that may have adverse environmental impact. • Continual improvement in the prevention of pollution. • Establish measurable objectives and targets. Urban Resources also implements an Environmental Management System, which was developed and certified in accordance with ISO14001:2004; a Safety Management System, that complies with the requirements of AS/NZS 4801:2001 and a Quality Management System which complies with the requirements of ISO 9001:2008.	Y	
6.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?**	Y	

Provide name of proposal and EPBC reference number (if known)		
EPBC 2015/7439 – Urban Resources Pty Ltd/Mining/Shire of Serpentine Jarrahdale/WA/Sand quarry, Lot 102 King Road, Oldbury, WA EPBC 2014/7261 – Urban Resources Pty Ltd/Commercial Development/Kwinana/Industrial Development 105 Sayer Road, Hope Valley, WA		

7 Information sources and attachments

(For the information provided above)

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Mitchell D, Williams K & Desmond A 2002, 'Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)', in *A biodiversity audit of Western Australia's 53 Biogeographical Subregions in 2002*, eds Department of Conservation and Land Management, Perth, pp. 606-623.

Semeniuk V 1990, 'The geomorphology and soils of Yoongarillup Plain, in the Mandurah-Bunbury coastal zone, southwestern Australia: a critical appraisal', *Journal of the Royal Society of Western Australia*, vol. 73, pp. 1-7.

Strategen 2010, *Karnup (Baldivis Explosives Reserve) Development Land Wetland values and buffer assessment*, draft report prepared for LandCorp by Strategen, Leederville WA 6007, January 2010.

Strategen 2015a, *Karnup Sand Mining Project - Environmental Investigations*, report prepared for Urban Resources, May 2015.

Strategen 2015b, *Karnup Sand Mining Project - Mining Proposal Karnup Sand Mine (M70/1262)*, report prepared for Urban Resources, May 2015.

Western Australian Herbarium 1998-, *FloraBase – the Western Australian Flora*, [Online], Government of Western Australia, available from: http://florabase.dpaw.wa.gov.au/ [15 May 2015].

7.2 Reliability and date of information

Information regarding the presence of MNES was obtained through an EPBC Act Protected Matters Search of the proposed action area, conducted in May 2015. This is in addition to a Level 1 flora and vegetation and black cockatoo habitat assessment (Strategen 2015a) comprising surveys conducted across the proposed action area during 2015.

Conservation significant flora species potentially occurring on the Survey area that may have been missed due to the survey timing are likely to be the three Threatened orchids; *Caladenia huegelii*, *Drakaea elastica* and *Drakaea micrantha* which are all diminutive in stature and are at their most visible when in flower. Both Drakaea species are likely to be restricted to wetland/damp areas and thus are highly unlikely to be impacted by the proposed action. *C. huegelii* has the potential to occur outside of these wetland areas and may not have been recorded during the flora and vegetation survey due to timing constraints. Urban Resources commit to undertaking a targeted conservation significant flora survey during Spring prior to the commencement of clearing activities.

7.3 Attachments

Figure 1: Regional location

Figure 2: Black cockatoo habitat within the Survey area

Figure 3: Carnaby's Black Cockatoo habitat retained on-site and protected within 5 km of the proposed action area

Figure 4: Threatened and Priority flora, TECs and PECs within 5 km of the proposed action area

Figure 5: Vegetation types within the Survey area

Attachment A Coordinates of the proposed action area

Attachment B DotE EPBC Act Protected Matters Search Report

Attachment C Karnup Sand Mining Project Environmental Investigations

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Figure 1: Regional location
	GIS file delineating the boundary of the referral area (section 1)		
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Figure 2: Black cockatoo habitat within the Survey area
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)		
	copies of any completed assessments to meet state or local government approvals		

and outcomes of public consultations, if available (section 2.6)		
copies of any flora and fauna investigations and surveys (section 3)	✓	Attachment C: Karnup Sand Mining Project Environmental Investigations
technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	✓	Attachment C: Karnup Sand Mining Project Environmental Investigations
report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		

8 Contacts, signatures and declarations

NOTE: Providing false or misleading information is an offence punishable on conviction by imprisonment and fine (s 489, EPBC Act).

Under the EPBC Act a referral can only be made by:

- the person proposing to take the action (which can include a person acting on their behalf); or
- a Commonwealth, state or territory government, or agency that is aware of a proposal by a person to take an action, and that has administrative responsibilities relating to the action[1].

Project title: Karnup Sand Mining Project (the proposed action)

8.1 Person proposing to take action

This is the individual, government agency or company that will be principally responsible for, or who will carry out, the proposed action.

If the proposed action will be taken under a contract or other arrangement, this is:

- the person for whose benefit the action will be taken; or
- the person who procured the contract or other arrangement and who will have principal control and responsibility for the taking of the proposed action.

If the proposed action requires a permit under the Great Barrier Reef Marine Park Act[2], this is the person requiring the grant of a GBRMP permission.

The Minister may also request relevant additional information from this person.

If further assessment and approval for the action is required, any approval which may be granted will be issued to the person proposing to take the action. This person will be responsible for complying with any conditions attached to the approval.

If the Minister decides that further assessment and approval is required, the Minister must designate a person as a proponent of the action. The proponent is responsible for meeting the requirements of the EPBC Act during the assessment process. The proponent will generally be the person proposing to take the action[3].

1. Name and Title:	Stephen Elliott, Manager
2. Organisation (if applicable):	Urban Resources Pty Ltd
3. EPBC Referral Number (if known):	
4: ACN / ABN (if applicable):	47 121 043 034
5. Postal address	PO Box 739 Como Western Australia 6952
6. Telephone:	08 9368 1299
7. Email:	stephen@urbanresources.com.au
8. Name of designated proponent (if not the same person at item 1 above and if applicable):	
9. ACN/ABN of designated proponent (if not the same person	

[1] *If the proposed action is to be taken by a Commonwealth, state or territory government or agency, section 8.1 of this form should be completed. However, if the government or agency is aware of, and has administrative responsibilities relating to, a proposed action that is to be taken by another person which has not otherwise been referred, please contact the Referrals Gateway (1800 803 772) to obtain an alternative contacts, signatures and declarations page.*

[2] *If your referred action, or a component of it, is to be taken in the Great Barrier Reef Marine Park the Minister is required to provide a copy of your referral to the Great Barrier Reef Marine Park Authority (GBRMPA) (see section 73A,* EPBC Act*). For information about how the GBRMPA may use your information, see http://www.gbrmpa.gov.au/privacy/privacy_notice_for_permits.*

[3] *If a person other than the person proposing to take action is to be nominated as the proponent, please contact the Referrals Gateway(1800 803 772) to obtain an alternative contacts, signatures and declarations page.*

named at item 1 above):

COMPLETE THIS SECTION ONLY IF YOU QUALIFY FOR EXEMPTION FROM THE FEE(S) THAT WOULD OTHERWISE BE PAYABLE

I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

□ an individual; OR

□ a small business entity (within the meaning given by section 328-110 (other than subsection 328-119(4)) of the *Income Tax Assessment Act 1997*); OR

□ not applicable.

If you are small business entity you must provide the Date/Income Year that you became a small business entity:

Note: You must advise the Department within 10 business days if you cease to be a small business entity. Failure to notify the Secretary of this is an offence punishable on conviction by a fine (regulation 5.23B(3) *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth)).

COMPLETE THIS SECTION ONLY IF YOU WOULD LIKE TO APPLY FOR A WAIVER

I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations. Under sub regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made:

□ not applicable.

Declaration

I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct.
I understand that giving false or misleading information is a serious offence.
I agree to be the proponent for this action.
I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.

Signature 

Date 28/07/2015

8.2 Person preparing the referral information (if different from 8.1)

Individual or organisation who has prepared the information contained in this referral form.

Name	Dale Newsome
Title	Senior Principal
Organisation	Strategen Environmental Consultants
ACN / ABN (if applicable)	32 056 190 419
Postal address	PO Box 243, Subiaco WA 6904
Telephone	08 9380 3100
Email	d.newsome@strategen.com.au
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.

Signature  Date 28/07/15

FIGURES

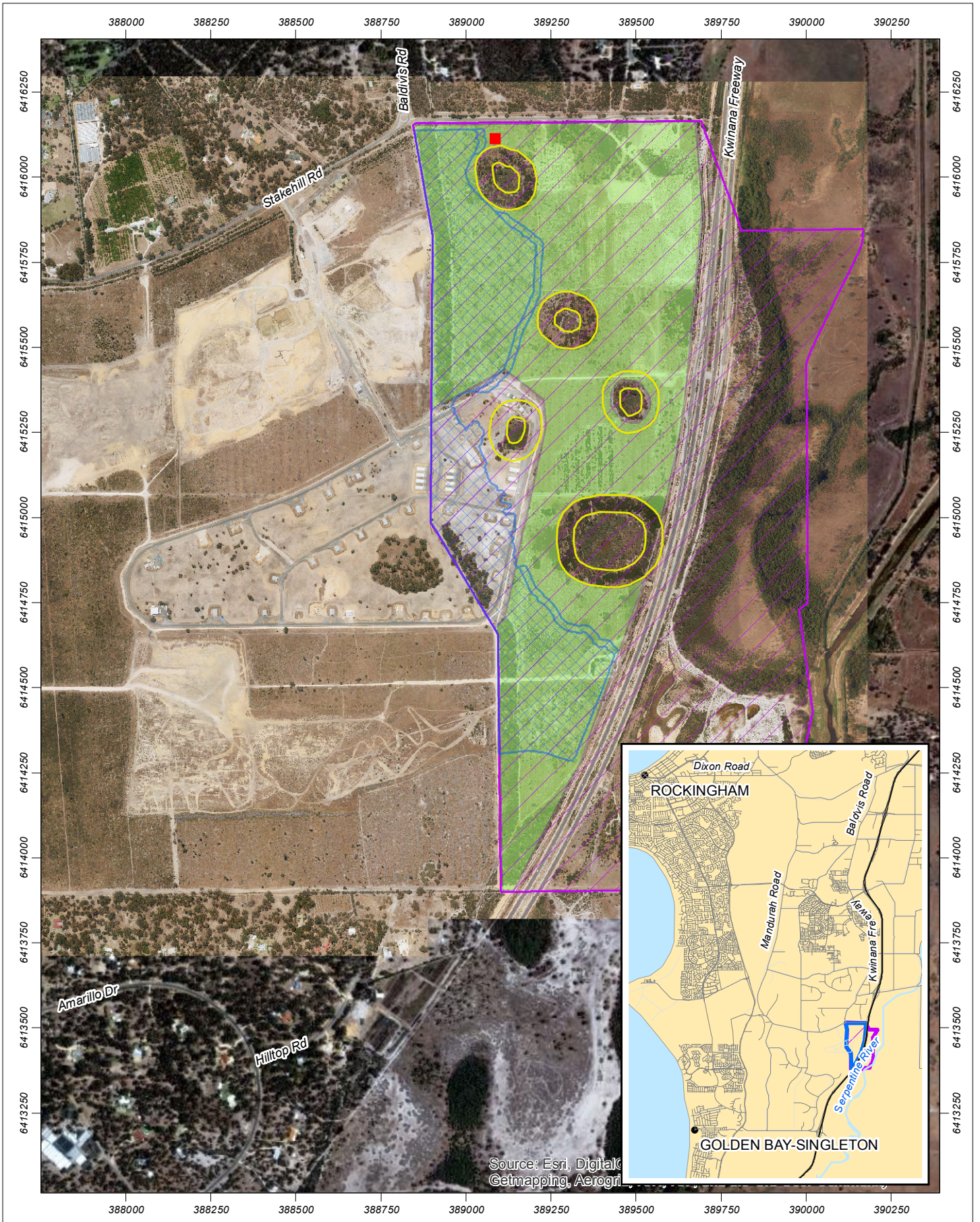

Figure 1: Regional location

Scale 1:15,000 at A4

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 25/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

Legend

- Site compound boundary
- 50m wetland buffer
- Proposed action area
- Tenement M70/1262
- Survey area

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info@strategen.com.au
www.strategen.com.au

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R005\RevA\URE15096_01_R005_RevA_F001.mxd

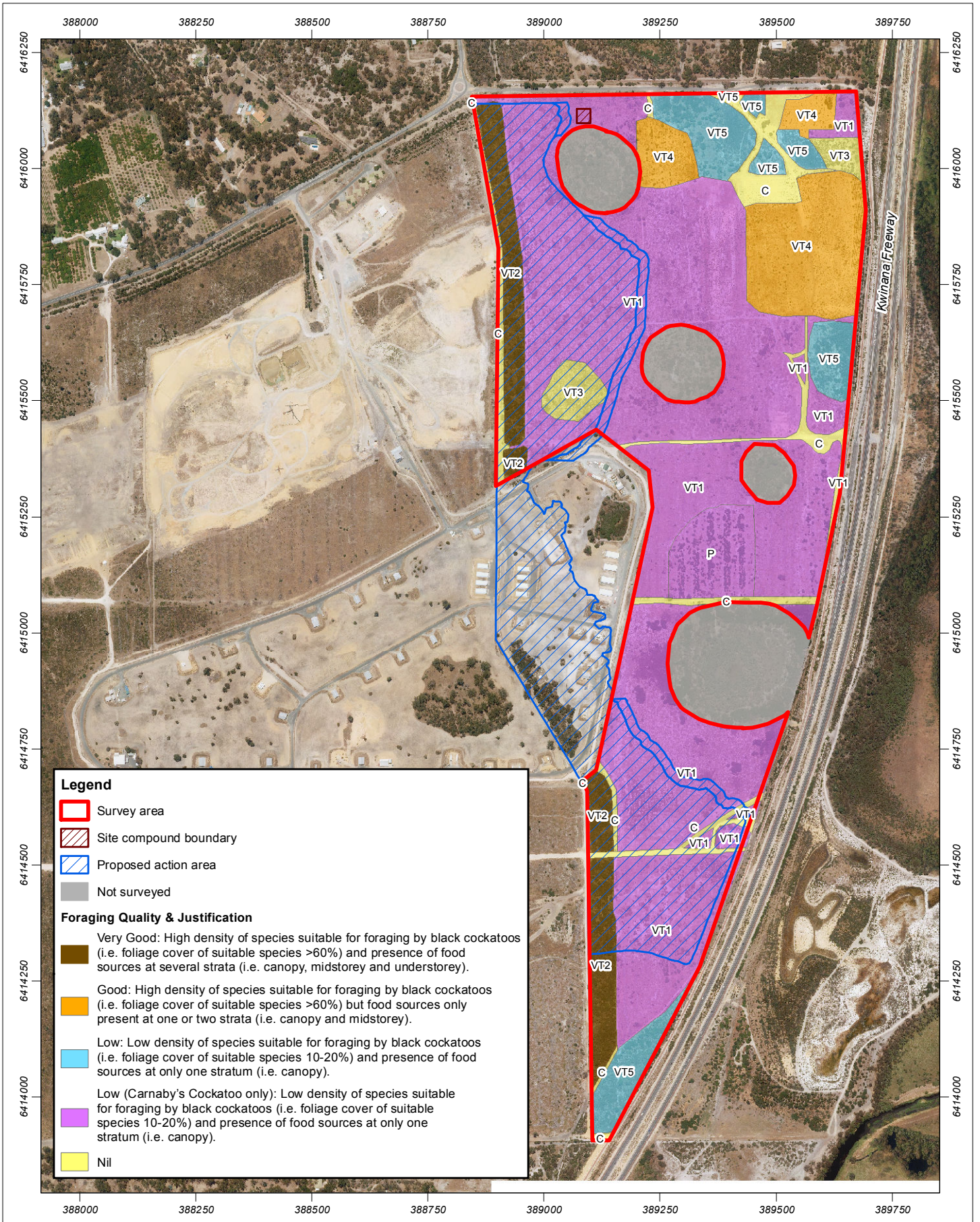

Figure 2: Black cockatoo foraging habitat within the Survey area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 26/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R005\RevA\URE15096_01_R005_RevA_F002.mxd

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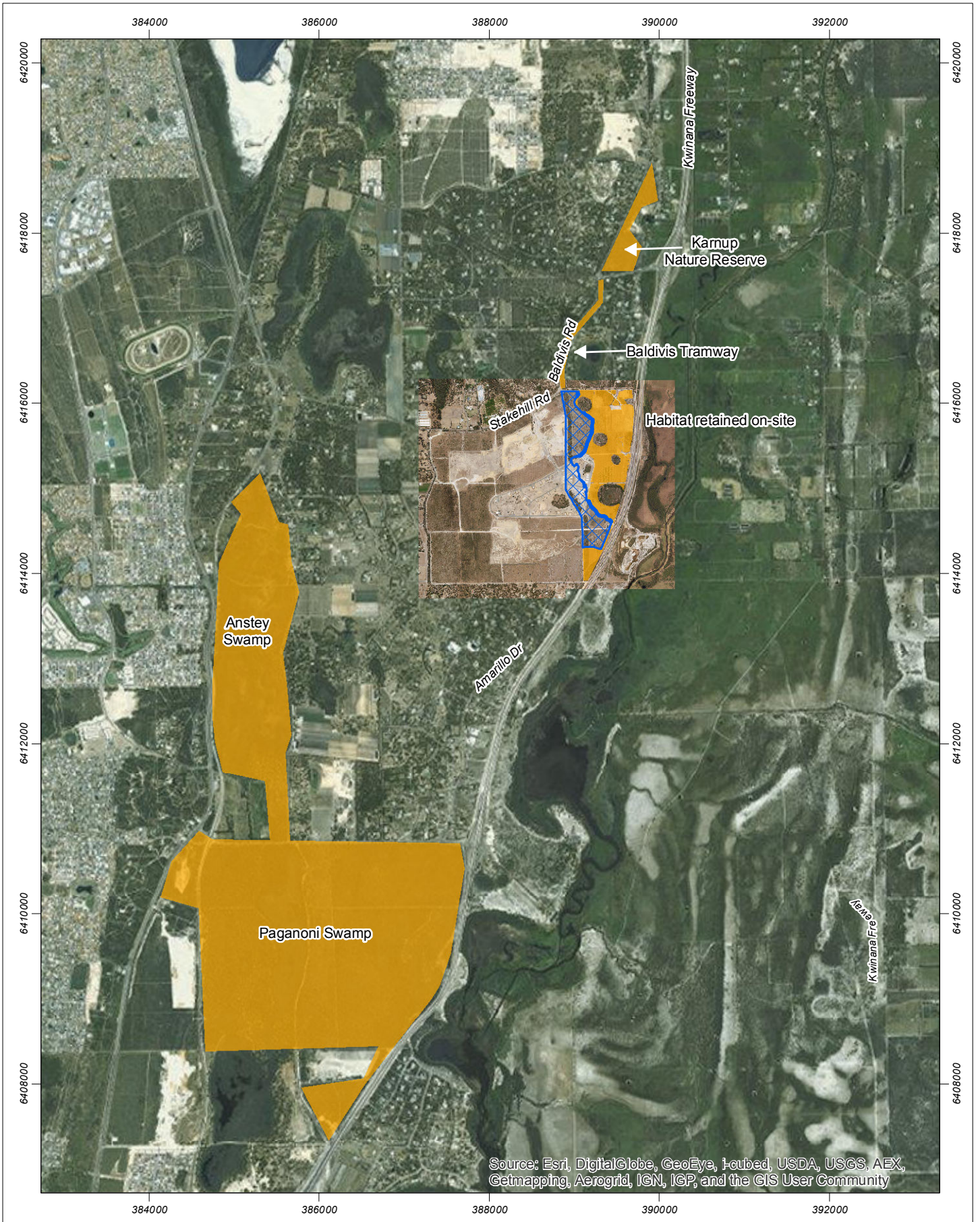

Figure 3: Carnaby's Cockatoo habitat retained on-site and protected within 5 km of the proposed action area

Scale 1:60,000 at A4

0 500 1,000 1,500 2,000 m

N

Legend

- Proposed action area
- Cockatoo habitat

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 25/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

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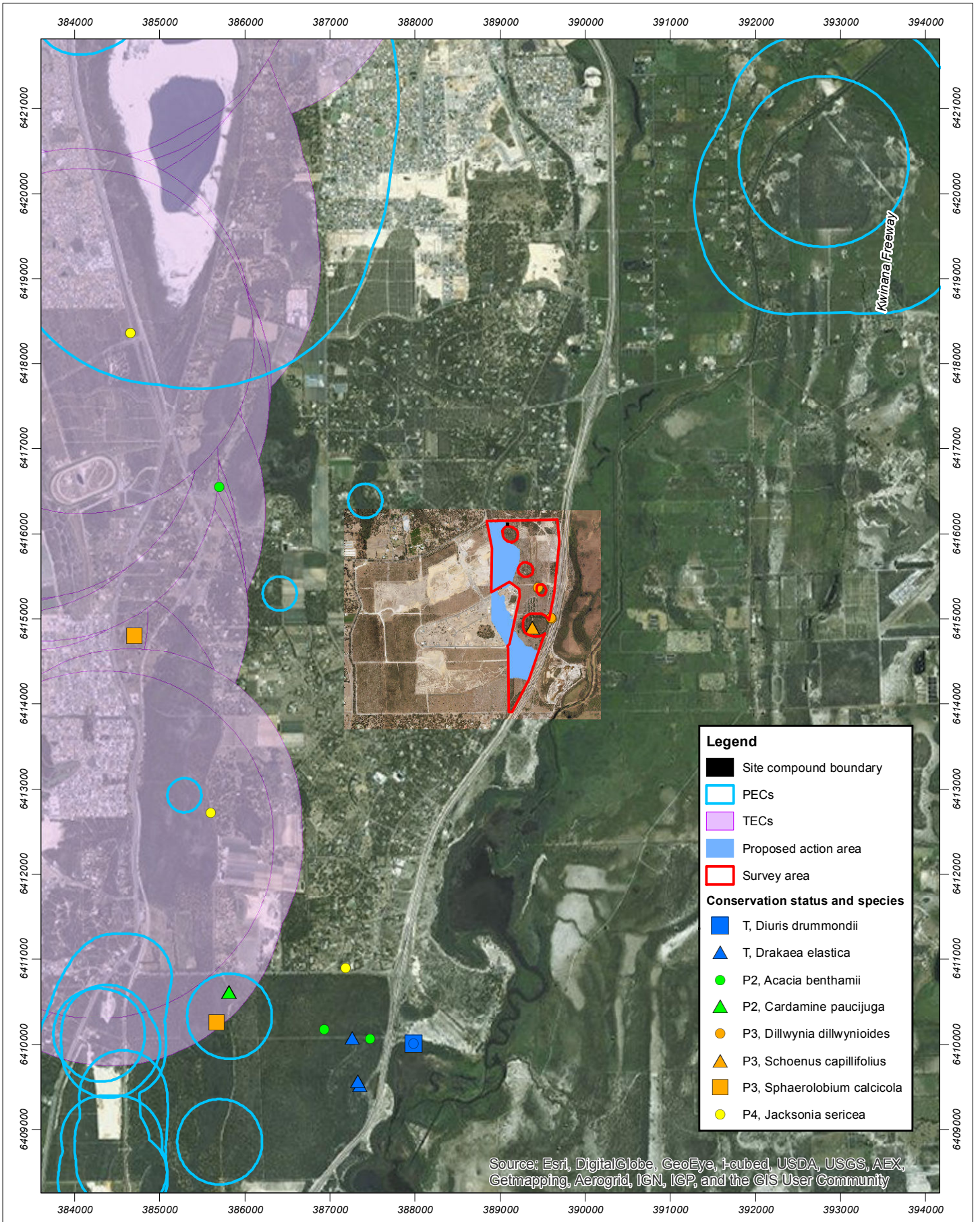

Figure 4: Threatened and Priority flora, TECs and PECs within 5 km of the proposed action area

Scale 1:60,000 at A4

0 0.5 1 1.5 2 km

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 24/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: : ESRI online, approx. 2010. TEC/PEC & Flora: DPAW 2015.

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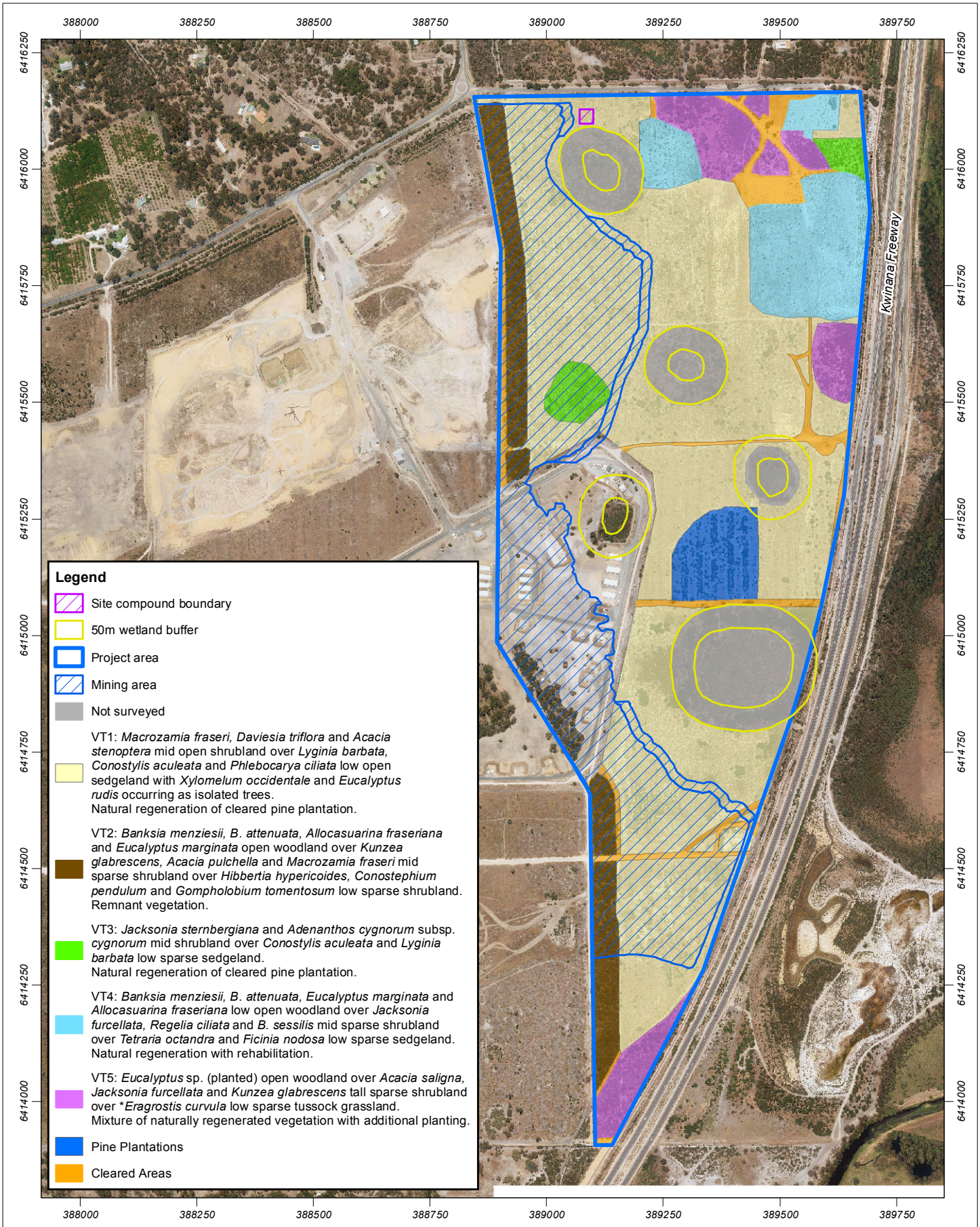

Figure 5: Vegetation types within the Survey area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/07/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

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ATTACHMENT A
Coordinates of the proposed action area

ID	Long	Lat
0	115.8204	-32.3862
1	115.8205	-32.3866
2	115.8199	-32.3873
3	115.8212	-32.3885
4	115.8223	-32.3893
5	115.8222	-32.3906
6	115.8208	-32.393
7	115.8198	-32.3932
8	115.8194	-32.3936
9	115.8198	-32.3942
10	115.8202	-32.394
11	115.821	-32.3958
12	115.8213	-32.3964
13	115.8216	-32.3978
14	115.8216	-32.3978
15	115.8245	-32.4001
16	115.8245	-32.4001
17	115.823	-32.403
18	115.8207	-32.4028
19	115.8207	-32.3996
20	115.8187	-32.3966
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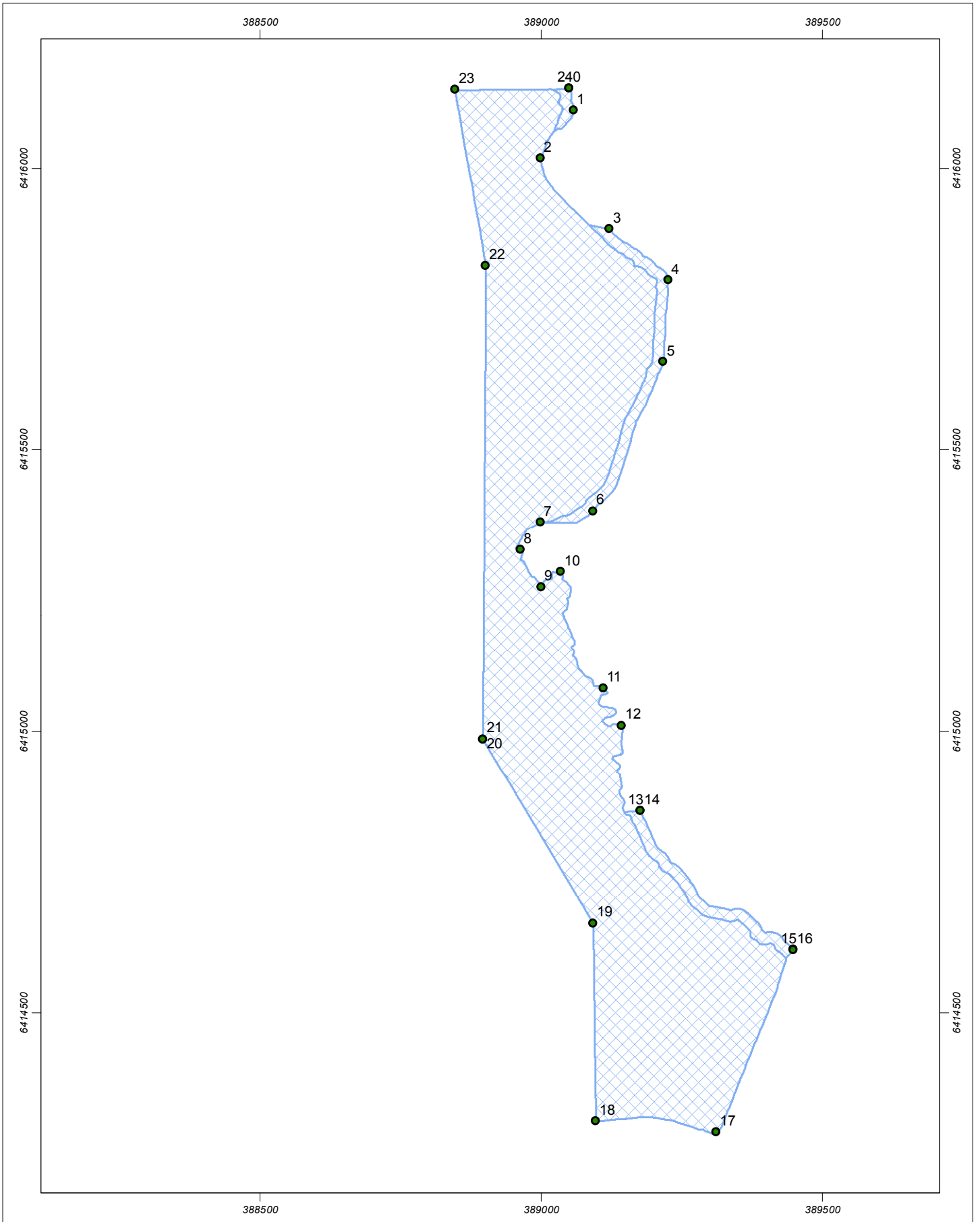
22	115.8188	-32.389
23	115.8183	-32.3862
24	115.8204	-32.3862



Proposed action area coordinates

Scale 1:9,069 at A4

0 100 200 300 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 24/06/2015

Author: JCrute

Legend

- Coordinate points
- Proposed action area

STRATEGEN

info@strategen.com.au
www.strategen.com.au

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Geology 1:50,000: DMP 2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\Working\URE15096_01 SK011 Mine area coordinates.mxd

ATTACHMENT B
DotE EPBC Act Protected Matters Search Report

Australian Government
Department of the Environment

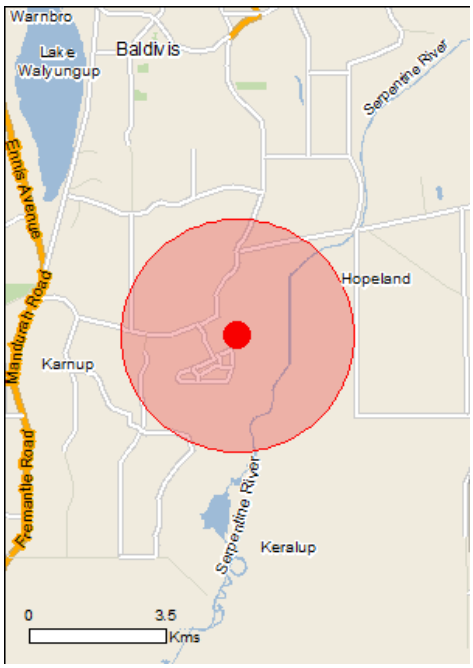
EPBC Act Protected Matters Report

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.

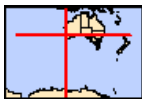
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/05/15 13:12:47



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 3.0Km



Summary

Matters of National Environmental 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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	7

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

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.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Peel-yalgorup system	Upstream from Ramsar

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to 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 likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed 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 likely to occur within area
Migratory Terrestrial Species		
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
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

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
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to 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
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

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, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		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		

Name	Status	Type of Presence
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
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to 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
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 reichardtii 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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

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 and National Heritage properties, Wetlands of International and National 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 resolutions.

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 information sources.

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.

Coordinates

-32.39 115.82286

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
-Geoscience Australia
-CSIRO
-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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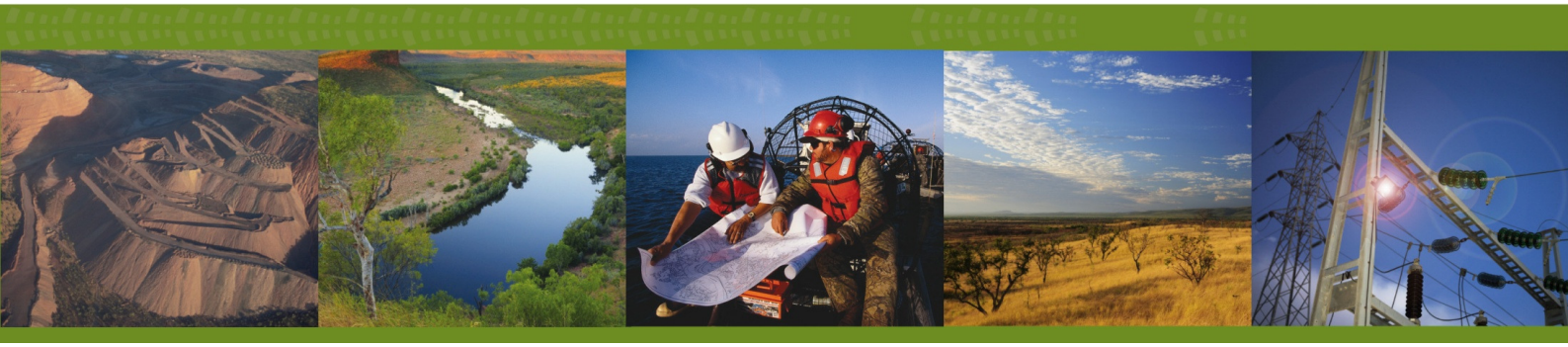
ATTACHMENT C
Karnup Sand Mining Project Environmental Investigations



Karnup Sand Mining Project

Environmental Investigations

Prepared for
Urban Resources
by Strategen

June 2015

STRATEGEN
environmental consultants

Karnup Sand Mining Project

Environmental Investigations

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June 2015

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Client: Urban Resources

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary draft Report	Rev A	For review by client	D Panickar, E Congear / D Newsome	Electronic	5 June 2015
Draft Report	Rev B	For review by client	D Newsome	Electronic	22 June 2015
Final Draft Report	Rev C	For review by client	D Newsome	Electronic	23 June 2015
Final Report	Rev 0	For review by client	D Newsome	Electronic	30 June 2015

Filename: URE15096_01 R004 Rev 0 - 30 June 2015

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1. Introduction

1.1 Background

Urban Resources Pty Ltd proposes to operate the Karnup Sand Mining Project located between Stakehill Road and the Kwinana Freeway in Karnup, approximately 48 km south of Perth, Western Australia (the Project; Figure 1). The Project involves the mining of 1 553 800 m^3 of sand from the Project area. The Project area is defined as the portion of M70/1262 that is west of the Kwinana Freeway boundary, as outlined by Figure 1. Urban Resources will rehabilitate the landscape post mining to a form suitable for the future land parks and recreation use as proposed by LandCorp.

The proposed mining area occurs within Mining Tenement M70/1262 comprising remnant native woodland vegetation, historical pine plantations and natural regeneration in areas which were previously cleared. Wetland areas which occur within M70/1262 do not fall into the proposed mining area and therefore will not be impacted by the Project.

The proposed mining will require clearing of native vegetation which could contain species of, or habitat for conservation significant flora as well as Threatened species of black cockatoos. A flora, vegetation and black cockatoo habitat assessment was deemed necessary to determine the environmental values of the potential clearing area.

1.2 Scope

Strategen was commissioned to undertake a flora and vegetation assessment and black cockatoo habitat assessment by Urban Resources within the western portion of M70/1262 in May 2015 (the Survey area; Figure 4).

Wetland areas were not included within the area surveyed as they will not be impacted by the proposed mining.

1.3 Legislative context

This assessment has been conducted with reference to the following Australian and Western Australian legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Wildlife Conservation Act 1950* (WC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State.

1.3.1 Conservation significant flora and ecological communities

Threatened species are listed under the EPBC Act at the Australian Government level and under the WC Act at the State level (Appendix 4). Priority species are listed by the Department of Parks and Wildlife (Parks and Wildlife) and include species of 'significant conservation value' (Appendix 4).

Threatened Ecological Communities (TECs) are listed under both the EPBC Act and EP Act (Appendix 4). Priority Ecological Communities (PECs) are listed by Parks and Wildlife and include species of significant conservation value (Appendix 4).

1.3.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the EP Act, and include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed threatened species
- TECs.

1.3.3 Protection of native vegetation

Native vegetation is defined under the EP Act as "indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation".

This definition of native vegetation does not include vegetation that was intentionally sown, planted or propagated unless wither of the following apply:

(a) the vegetation was sown, planted or propagated as required under the EP Act or another written law

(b) the vegetation is of a class declared by regulation to be included in this definition.

Native vegetation can only be cleared with a clearing permit, unless for some circumstances where exemptions apply pursuant to the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations). Clearing permits issued pursuant to the Regulations may be issued as area permits or purpose permits. Exemptions for clearing under Regulation 5 of the Regulations do not apply within ESAs.

1.3.4 Introduced species

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as declared pests under the BAM Act are classified under three categories:

1. C1 Exclusion: Pests assigned under this category are not established in Western Australia, and control measures are to be taken to prevent them entering and establishing in the State.
2. C2 Eradication: Pests assigned under this category are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
3. C3 Management: Pests assigned under this category are established in Western Australia, but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area that is currently free of that pest.

Under the BAM Act, land managers are required to manage populations of declared pests as outlined under the relevant category.

1.3.5 Regulatory guidance

The flora and vegetation survey component of this investigation has been designed to address the recommendations of the EPA as described in the following guidance:

- EPA Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000)
- EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)
- EPA Position Statement No. 10 *Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region* (EPA 2006)
- EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004).

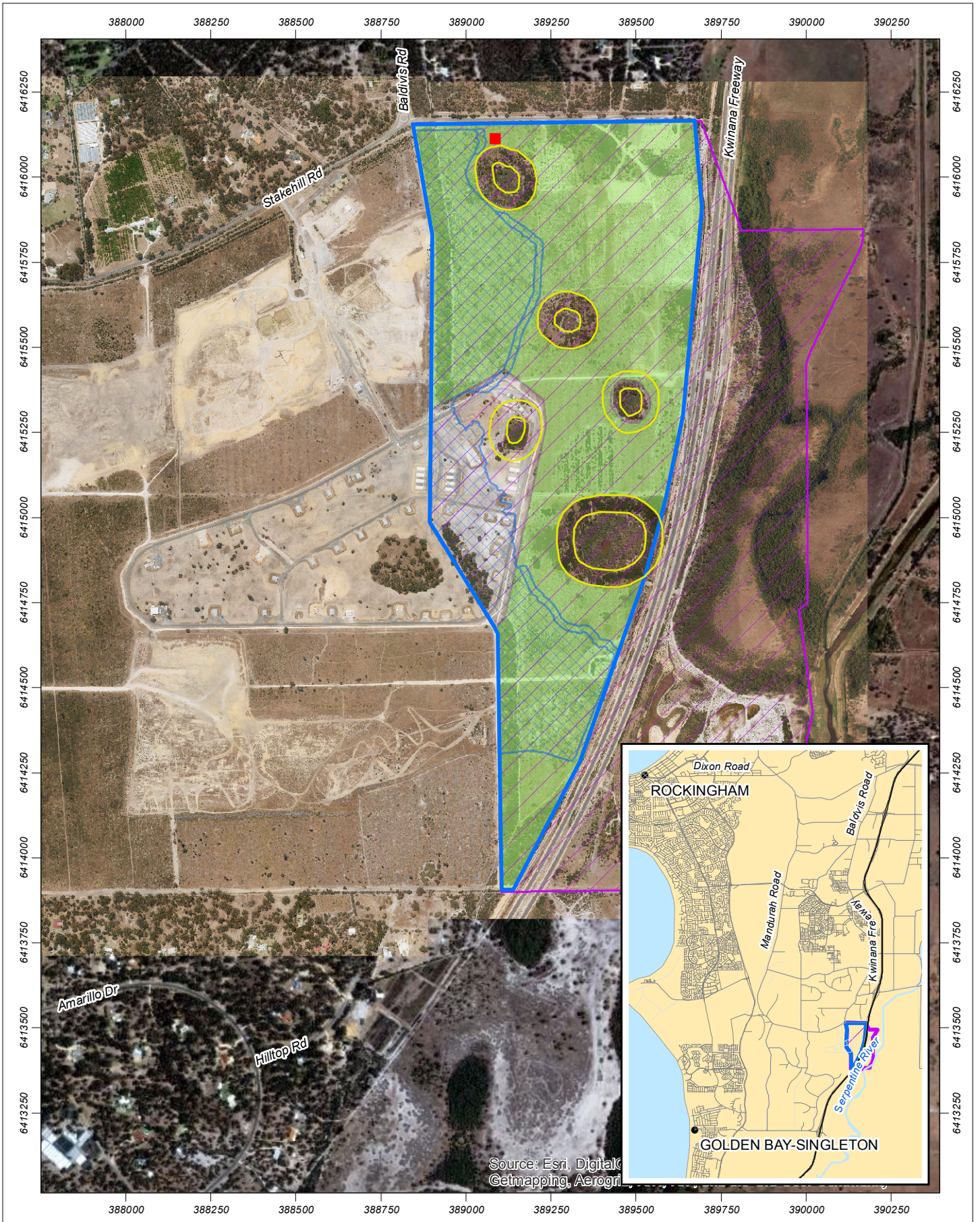

Figure 1: Regional location of the Project

Scale 1:15,000 at A4

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

Legend

- Site compound boundary
- 50m wetland buffer
- Project area
- Mining area
- Tenement M70/1262
- Survey area

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Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R004\RevC\URE15096_01_R004_RevC_F001.mxd

1.4 Environmental setting

1.4.1 Soils and topography

The Survey area is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). The Swan Coastal Plain comprises five major geomorphological systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson et al. 1994). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward & McArthur 1980; Semeniuk 1990; Gibson et al.1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils. The Survey area itself is situated predominately on Bassendean sand.

1.4.2 Climate

The Karnup locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Medina Research Station (Station No. 9194) provides average monthly climate statistics for the Karnup locality (Figure 2). Average annual rainfall recorded at Medina since 1983 is 752.5 mm (BoM 2015). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between December and March, with average monthly maximums ranging from 28.2℃ in December to 31.5℃ in February (BoM 2015). Lowest temperatures occur between June and September, with average monthly minimums ranging from 8.2℃ in July and August to 9.2℃ in September (BoM 2015).

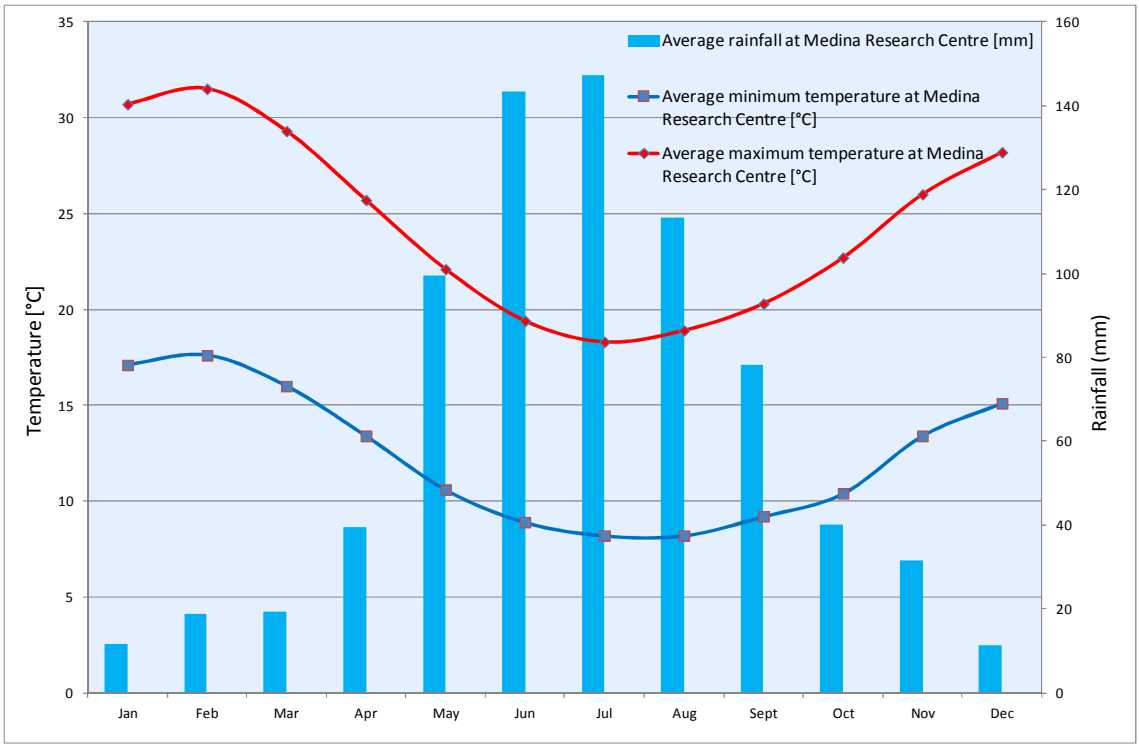

Figure 2: Mean monthly climatic data (temperature and rainfall) for Medina Research Centre

1.4.3 Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981); System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DotE 2015a).

IBRA subregion

The Survey area occurs within the Swan Coastal Plain 2 IBRA subregion which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

Beard (1990) Botanical Subdistrict

The Survey area occurs within the Drummond Botanical Subdistrict which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils (Beard 1990).

System 6 mapping

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle *et al.* (1980). This is the primary source of information used to calculate potential impacts of proposals to clear native vegetation on the Swan Coastal Plain. The Survey area occurs at the interface between the Serpentine River and Karrakatta vegetation complexes. These complexes can be described as:

- Serpentine River – closed scrub of *Melaleuca* spp. and fringing woodland of *Eucalyptus rudis* and *M. rhaphiophylla* along streams
- Karrakatta – predominantly open forest of *Eucalyptus gomphocephala – E. marginata – C. calophylla* and woodland of *E. marginata – Banksia* spp.

2. Objectives

The general aim of this survey was to undertake an environmental investigation of the Survey area. The objectives were to:

- conduct a desktop survey for Threatened and Priority flora which have been identified as being present in or around the Survey area
- collect and identify the vascular plant species present within the Survey area
- search areas of suitable habitat for Threatened and/or Priority flora
- define and map the native vegetation communities present within the Survey area
- provide recommendations on the local and regional significance of the vegetation communities
- identify habitat for Threatened species of black cockatoos within the Survey area
- prepare a report summarising the findings.

3. Methods

3.1 Desktop Assessment

A desktop assessment was conducted using Florabase, Parks and Wildlife, and Department of the Environment (DotE) databases to identify the possible occurrence of TECs, PECs, Threatened and Priority flora, and conservation significant fauna species potentially occurring within the Survey area. Reports that document regional flora, vegetation and fauna within the surrounds of the Survey area were also reviewed prior to the field assessment.

A database search request was also submitted to the Threatened Communities Branch of Parks and Wildlife to identify any potential TECs or PECs within 5 km of the Survey area.

3.2 Field assessment

3.2.1 Flora and vegetation

Assessment of flora and vegetation within the Survey area was undertaken by an experienced ecologist from Strategen and senior ecologist from Mattiske Consulting on 1 May 2015 (Table 1). Five vegetation mapping sites were surveyed and the entire site was traversed on foot to record changes in vegetation structure and type (Appendix 1; Appendix 2). The field survey was conducted according to standards set out in Guidance Statement 51 (EPA 2004).

Table 1: Personnel

Name	Project involvement	Flora collection permit
Mr. D. Panickar Strategen (Experienced Ecologist)	Planning, fieldwork, data interpretation and report preparation	SL010993
Mr. J. Cargill Mattiske Consulting (Senior Ecologist)	Fieldwork and plant identification	SL011297

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the Survey area. Vegetation mapping sites were determined from aerial photographs and opportunistic sites were selected in the field where a change in vegetation structure or composition was observed.

Flora and vegetation was described and sampled systematically at each survey site and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum
- presence of significant trees.

For each vascular plant species, the average height and percent cover (both live and dead material) were recorded.

All plant specimens collected during the field surveys were dried and fumigated in accordance with the requirements of the Western Australian Herbarium. The plant species were identified through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

3.2.2 Black cockatoo habitat assessment

Desktop assessments identified the potential presence of all three species of Threatened species of black cockatoos (Forest Red-tailed Black-Cockatoos [FRTBC], Baudin's Black-Cockatoos [BBC] and Carnaby's Black-Cockatoos [CBC]) within the Survey area. A foraging and significant tree assessment was undertaken simultaneously with the flora and vegetation assessment to quantify the value of the Survey area as potential habitat for black cockatoos.

Foraging assessment

The Survey area was traversed on foot to record any flora species with the potential to provide a food source for black cockatoos. Data from this assessment were combined with vegetation mapping units defined during the flora and vegetation assessment. Vegetation units were then assigned a foraging value based on the presence and quantity of potential food species and any evidence of foraging by black cockatoos.

Significant tree assessment

Significant trees are defined as trees of suitable species with a diameter at breast height (DBH) greater than 500 mm (> 300 mm for salmon gum and wandoo) (DSEWPaC [now DotE] 2012). Tree species which are considered to be potential breeding or roosting trees are outlined in Table 2. Trees with a DBH greater than 500 mm (or >300 mm for salmon gum and wandoo) are large enough to potentially contain hollows suitable for nesting black cockatoos, or have the potential to develop suitable hollows over the next 50 years. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds). The locations of such trees within the Survey area were recorded using a Global Positioning System (GPS) device. In addition to the location and DBH, the species of each tree was also recorded.

Table 2: Black cockatoo potential breeding tree species (Groom 2011, DSEWPaC 2012)

Scientific name	Common name	Breeding	Roosting
Corymbia calophylla	Marri	Yes	Yes
Corymbia maculata	Spotted Gum		Yes
Eucalyptus accedens	Powderbark	Yes	
Eucalyptus camaldulensis	River Red Gum		Yes
Eucalyptus citriodora	Lemon Scented Gum		Yes
Eucalyptus diversicolor	Karri	Yes	
Eucalyptus globulus	Tasmania Blue Gum		Yes
Eucalyptus gomphocephala	Tuart	Yes	Yes
Eucalyptus grandis	Flooded Gum, Rose Gum		Yes
Eucalyptus longicornis	Red Morrell	Yes	
Eucalyptus loxophleba	York Gum	Yes	
Eucalyptus marginata	Jarrah	Yes	Yes
Eucalyptus megacarpa	Bullich	Yes	Yes
Eucalyptus occidentalis	Swamp Yate	Yes	
Eucalyptus patens	Blackbutt	Yes	Yes
Eucalyptus robusta	Swamp Mahogany		Yes
Eucalyptus rudis	Flooded Gum	Yes	Yes
Eucalyptus salmonophloia	Salmon Gum	Yes	
Eucalyptus salubris	Gimlet	Yes	
Eucalyptus wandoo	Wandoo	Yes	Yes
Pinus pinaster	Pinaster, Maritime Pine		Yes
Pinus radiata	Monterey, Radiata Pine		Yes

3.3 Data analysis and vegetation mapping

Due to the degraded nature and uniform distribution of vegetation within the Survey area, quadrat data were grouped into a species by site matrix to delineate individual vegetation types (VTs) present within the Survey area. Aerial photography interpretation and field notes taken during the survey were then used to develop VT mapping polygon boundaries over the Survey area. These polygon boundaries were then digitised using Geographic Information System (GIS) software.

VT descriptions (though floristic in origin) have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI 2003), a system of describing structural vegetation units (based on dominant taxa). This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. For the purposes of this report, a VT is considered equivalent to a NVIS sub-association as described in ESCAVI (2003).

Vegetation condition was recorded at all quadrats, and also opportunistically within the Survey area during the field assessment where required. Vegetation condition was described using the vegetation condition scale for the South West Botanical Province (Keighery 1994). Vegetation condition polygon boundaries were developed using this information in conjunction with aerial photography interpretation, and were digitised as for vegetation type mapping polygon boundaries.

3.4 Flora and vegetation assessment limitations and constraints

Table 3 displays the evaluation of the flora and vegetation assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 3: Flora and vegetation assessment potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.**	The study has been undertaken in the Drummond Botanical Subdistrict on the Swan Coastal Plain which has been well studied and documented with ample literature available (Beard 1990).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.**	Due to the degraded nature and uniform distribution of vegetation within the Survey area, most life forms are likely to have been sampled adequately during the time of the survey.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a constraint.**	The proportion of flora surveyed was adequate. The entire site was traversed and all species observed were recorded in accordance with a Level 1 survey.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint**	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	**Not a constraint.**	Aerial photography of a suitable scale was used to map the Survey area. Sites were chosen from these aerials to reflect changes in community structure. Opportunistic sites were also used if differences were observed during on ground reconnaissance. Vegetation types were assigned to each site based on topography, soil type, presence/absence and percent foliage cover of vegetation.
Timing, weather, season, cycle.	**May be a constraint.**	Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2004). The field assessment was conducted in May and as such, some annual herb and forb species may not have been recorded during the assessment.
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint.**	The Survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the Survey area.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint.**	The entire site was traversed on foot and differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.**	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint.**	Existing tracks enabled adequate access to survey the vegetation within the Survey area. Where access was not available by car, the area was easily traversed by foot.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a constraint.**	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

4. Results

4.1 Desktop assessment results

4.1.1 Flora and vegetation

A total of 108 native vascular plant taxa from 40 plant families have the potential to occur within the vicinity of the Survey area (Parks and Wildlife 2007-). The majority of taxa were from within the *Cyperaceae* (15 taxa), *Myrtaceae* (9 taxa) and *Fabaceae* (8 taxa) families (Appendix 3).

Threatened and Priority Ecological Communities

A TEC is defined under the EP Act as an ecological community listed, designated or declared under a written law or a law of the Australian Government as Threatened, Endangered or Vulnerable. There are four State categories of TECs (DEC 2010)[1]:

- presumed totally destroyed (PD)
- critically endangered (CR)
- endangered (EN)
- vulnerable (VU).

A description of each of these TEC categories is presented in Appendix 4. TECs are gazetted as such (Parks and Wildlife 2014a) and some Western Australian TECs are listed as Threatened under the EPBC Act.

Under the EPBC Act, a person must not undertake an action that has or will have a significant impact on a listed TEC without approval from the Australian Government Minister for the Environment, unless those actions are not prohibited under the EPBC Act. A description of each of these categories of TECs is presented in Appendix 4. The current EPBC Act list of TECs can be located on the DotE (2015b) website.

Ecological communities identified as threatened, but not listed as TECs, are classified as Priority Ecological Communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. Parks and Wildlife categorises PECs according to their conservation priority, using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such ecological communities. Appendix 4 defines PECs (DEC 2010). A list of current PECs can be viewed at the Parks and Wildlife (2014b) website.

No TECs or PECs were identified as having the potential to occur within the Survey area (Figure 3). The closest PEC identified in proximity to the Survey area was SCP 25 (Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands) which had a buffer of approximately 1.3 km from the Survey area.

[1] The Department of Environment and Conservation is still listed as the author of all TEC and PEC databases and have been referred to as such in this document instead of the Department of Parks and Wildlife (Parks and Wildlife).

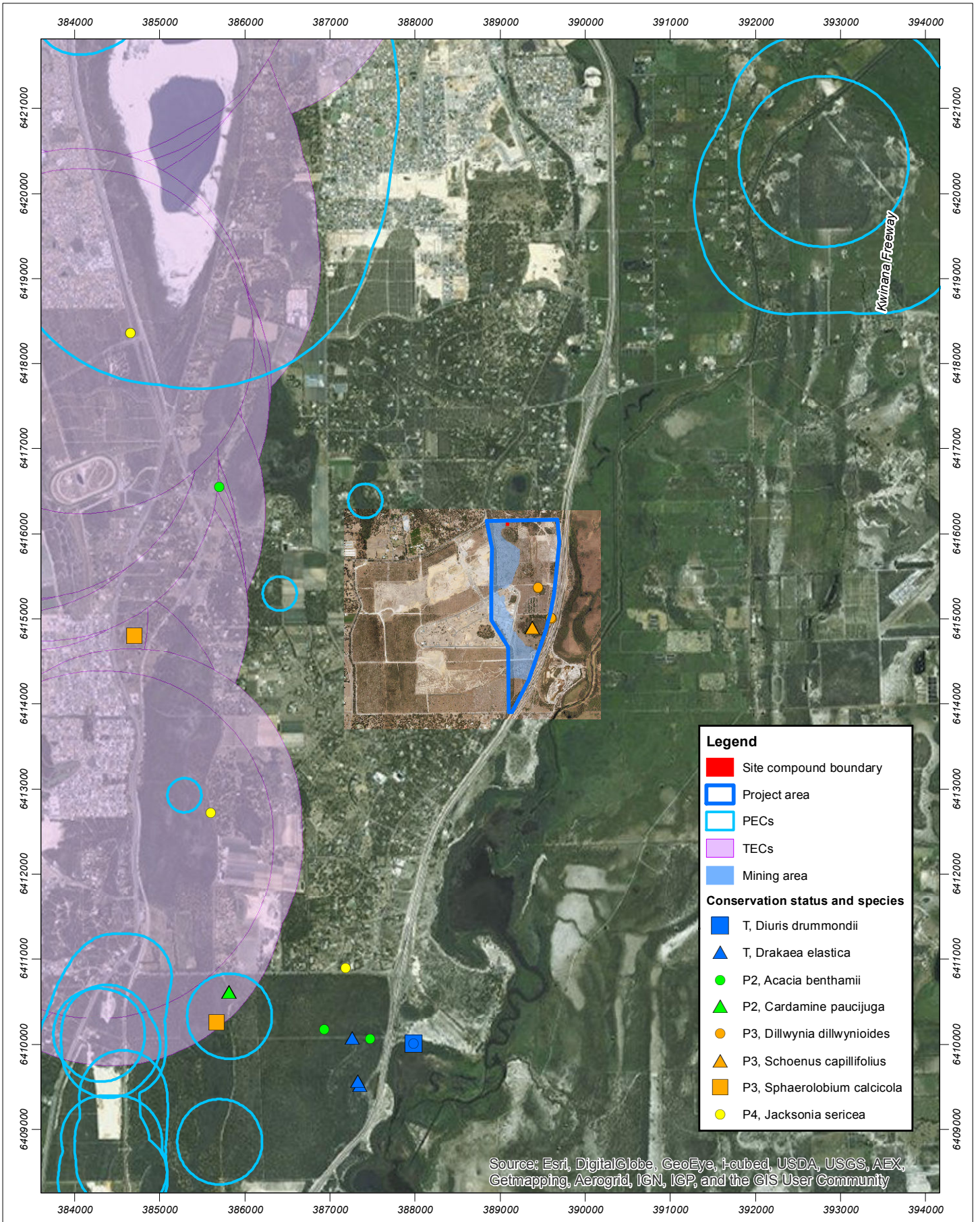

Figure 3: Location of Threatened and Priority Flora, TECs and PECs

Scale 1:60,000 at A4

0 0.5 1 1.5 2 km

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: : ESRI online, approx. 2010. TEC/PEC & Flora: DPAW 2015.

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Threatened and Priority flora

A desktop survey for Threatened and Priority flora that may potentially occur within the Survey area was undertaken using NatureMap (Parks and Wildlife 2007-), the Western Australian Herbarium (Western Australian Herbarium 1998-), and the DotE Protected Matters Search Tool (DotE 2015c).

Flora within Western Australia that is considered to be under threat may be classed as either Threatened flora or Priority flora. Where flora has been gazetted as Threatened flora under the WC Act, the taking of such flora without the written consent of the Minister is an offence. The WC Act defines "to take" flora as to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora are considered to be species which are potentially under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Parks and Wildlife categorises Priority flora according to their conservation priority using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such species. Priority flora species are regularly reviewed and may have their priority status changed when more information on the species becomes available. Appendix 4 defines levels of Threatened and Priority flora (Western Australian Herbarium 1998-).

At the national level, the EPBC Act lists Threatened species as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Appendix 4 defines each of these categories of Threatened species. The EPBC Act prohibits an action that has or will have a significant impact on a listed Threatened species without approval from the Australian Government Minister for the Environment. The current EPBC Act list of Threatened flora may be found on the DotE (2015d) website.

Table 4 shows the Threatened and Priority flora potentially occurring within the Survey area. The desktop assessment identified ten Threatened flora and three Priority flora species that have the potential to occur within the area. Of these, based on specific habitat requirements, three Threatened flora species (*Caladenia huegelii, Drakaea elastica* and *Drakaea micrantha*) and four Priority flora species (*Cardamine paucijuga, Sphaerolobium calcicola, Dillwynia dillwynioides* and *Jacksonia sericea*) were considered to have the potential to occur. Figure 3 shows occurrences of *Dillwynia dillwynioides* and *Schoenus capillifolius* within wetlands in proximity to the Survey area (Bennett 2006). As the proposed mining will not occur within wetland areas, these occurrences will not be impacted by the Proposal.

Table 4: Threatened and Priority flora potentially occurring within the Survey area

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Andersonia gracilis	**Threatened** - Endangered	Threatened	A slender shrub to 50 cm tall with few, spreading branches. Flowers are pink to pale mauve. Habitat for this species occurs within seasonally damp, black sandy clay flats near swamps (Western Australian Herbarium 1998-, DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining.
Caladenia huegelii	**Threatened** – Endangered	Threatened	A slender orchid from 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils in low mixed Banksia, Allocasuarina and Jarrah woodlands (Western Australian Herbarium 1998-, DotE 2015e).	**Possible –** Preferred soil type/habitat occurs within the Survey area.
Centrolepis caespitosa	**Threatened** – Endangered	Priority 4	A diminutive, densely tufted, glabrous annual herb. Flowers are red/brown and are singular. Habitat for this species is relatively unknown. Brown et al. (1998) identified that this species occurs within winter-wet claypans dominated by low shrubs and sedges.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining. It is worth noting that Parks and Wildlife have removed this species from its Threatened flora listing and is now classed as Priority 4.
Darwinia foetida	**Threatened** – Critically Endangered	Threatened	An erect, spreading shrub to 70 cm tall. Green flowers, visible from October to November. Habitat for this species occurs within wet/winter-damp clay under Myrtaceous shrubland (DotE 2015e).	**Highly unlikely –** Preferred habitat does not occur within the Survey area as wetland areas will not be impacted by the proposed mining. Additionally, both Western Australian Herbarium (1998-) and DotE (2015e) list this species' distribution to be highly restricted within the Muchea area (approximately 70 km north of Perth).
Diuris drummondii	**Threatened** – Vulnerable	Threatened	A perennial orchid to 105 cm tall. Often forms dense colonies with individuals displaying between three and eight widely spaced yellow flowers. Habitat for this species occurs in low-lying depressions in peaty and sandy clay swamps (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining.
Diuris micrantha	**Threatened** – Vulnerable	Threatened	A slender orchid to 60 cm tall. Yellow flowers with reddish-brown markings measuring 1.3 cm across. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area– wetland areas will not be impacted by the proposed mining.
Diuris purdiei	**Threatened** – Endangered	Threatened	A slender orchid to 45 cm tall. Unusually flattened flowers, marked with brown blotches on their under surface. Habitat for this species occurs in areas subject to winter inundation within dense heath with scattered Myrtaceous trees (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Drakaea elastica	**Threatened** – Endangered	Threatened	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. Habitat for this species is within bare patches of white sand over dark sandy loams on damp areas (DotE 2015e).	**Possible –** Preferred soil type/habitat occurs within the Survey area.

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Drakaea micrantha	**Threatened** – Vulnerable	Threatened	A tuberous, terrestrial orchid to 30 cm tall. Silvery-grey heart shaped leaf with prominent green veins. Red and yellow singular flower. Habitat for this species occurs within cleared, open sandy patches (Brown et al. 1998).	**Possible –** Preferred soil type/habitat occurs within the Survey area.
Lepidosperma rostratum	**Threatened** – Endangered	Threatened	A rhizomatous sedge to 30 cm in diameter. Stems are circular in cross section and flowers are spike-like and up to 4 cm long. Habitat for this species occurs in sandy soils among low heath comprised of *Banksia telmatiaea* and *Calothamnus hirsutus* in winter-wet swamps.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Synaphea stenoloba	**Threatened** – Endangered	Threatened	A caespitose shrub to 45 cm tall. Yellow flowers visible from August to October. Habitat for this species occurs within loamy soils in low lying areas that are seasonally inundated (DotE 2015e).	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Acacia benthamii	Not listed	Priority 2	A shrub to 1 m tall. Flowers are yellow and visible from August to September (Western Australian Herbarium 1998-). Habitat for this species is typically on limestone breakaways.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area.
Cardamine paucijuga	Not listed	Priority 2	A slender, erect annual herb to 0.4 m tall. Flowers are white and visible from September to October (Western Australian Herbarium 1998-). Habitat for this species occurs in a broad range of settings.	**Possible –** Preferred soil type/habitat could occur within the Survey area.
Sphaerolobium calcicola	Not listed	Priority 3	A slender, multi-stemmed, scandent or erect shrub to 1.5 m tall. Flowers are orange-red and visible in June or from September to November (Western Australian Herbarium 1998-). Habitat for this species occurs in a broad range of settings.	**Possible –** Preferred soil type/habitat could occur within the Survey area.
Dillwynia dillwynioides	Not listed	Priority 3	A decumbent or erect, slender shrub to 1.2 m tall. Flowers are red and yellow/orange and visible in August to December (Western Australian Herbarium 1998-). Habitat for this species is in winter-wet depressions and sandy soils.	**Possible –** Preferred soil type/habitat occurs within the Survey area.
Schoenus capillifolius	Not listed	Priority 3	A semi-aquatic, tufted, annual grass-like herb to 5 cm tall. Flowers are green and visible from October to November (Western Australian Herbarium 1998-). Habitat for this species is in brown mud in claypans.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Stylidium longitubum	Not listed	Priority 3	An erect annual herb to 12 cm tall. Flowers are pink and visible from October to December (Western Australian Herbarium 1998-). Habitat for this species occurs in sandy clay in seasonal wetlands.	**Unlikely –** Preferred soil type/habitat does not occur within the Survey area – wetland areas will not be impacted by the proposed mining.
Jacksonia sericea	Not listed	Priority 4	A Low spreading shrub to 0.6 m tall. Flowers are orange and visible from December to February (Western Australian Herbarium 1998-). Habitat for this species occurs in calcareous and sandy soils.	**Possible –** Preferred soil type/habitat occurs within the Survey area.

4.1.2 Black cockatoo habitat

All three species of Threatened black cockatoos occurring in Western Australia were identified as having the potential to occur within the Survey area based on a desktop survey for Threatened fauna (DotE 2015c; Appendix 3). Table 5 displays the current conservation status for the three identified species within the Survey area. Desktop surveys also identified the presence of Jarrah-*Banksia* woodland within the Survey area which may provide both foraging and breeding habitat for black cockatoos.

Table 5: Threatened species of black cockatoos potentially occurring within the Survey area

Species		Conservation status	
Common name	Scientific name	EPBC Act	WC Act
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	Endangered	Threatened
Baudin's Black-Cockatoo	*Calyptorhynchus baudinii*	Vulnerable	Threatened
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii* naso	Vulnerable	Threatened

Foraging and breeding habits of black cockatoos

Carnaby's Black-Cockatoos feed on the seeds, nuts and flowers, of a variety of native and introduced plant species and insect larvae (DotE 2015e). Food plants generally occur within proteaceous genera such as *Banksia, Dryandra, Hakea* and *Grevillea*, though are known to forage on eucalypt species in woodland areas. Carnaby's black cockatoos have also adapted to feeding on exotic species such as pines and cape lilac and weeds such as wild radish and wild geranium (DotE 2015e). Carnaby's black cockatoos usually breed between July and December in the hollows of live or dead eucalypts; primarily in Salmon Gum and Wandoo, but also within Jarrah, Marri and other eucalypt species (Johnstone 2010a). Hollows are usually at least 2 m above ground, sometimes over 10 m and the depth of the hollow vary from 0.25 m to 6 m (DotE 2015e). The Western Australian Department of Parks and Wildlife (Parks and Wildlife), renewed the Carnaby's Cockatoo Recovery Plan in 2013, clearly mapping the distribution of likely breeding and non-breeding areas in south-west WA for CBC (Parks and Wildlife 2013). Based on this map, the Survey area is situated within the CBC breeding range.

Baudin's Black-Cockatoos primarily occur in eucalypt forests and forage at all strata levels within the forests with a tendency to favour areas containing Marri (Johnstone and Kirkby 2008, DotE 2015e). Breeding generally occurs in the Jarrah, Marri and Karri forests of the southwest of Western Australia in areas averaging more than 750 mm of rainfall annually (DotE 2015e). As with the other two species of Threatened black cockatoos in Western Australia, breeding habitat also occurs in former woodland or forest that has been reduced to isolated trees (DotE 2015e).

Forest Red-tailed Black-Cockatoos depend primarily on Marri and Jarrah trees for both foraging and nesting. The seeds of both eucalypts are the favoured food source of the birds and hollows within live or dead individual trees are utilised for nesting purposes (Johnstone and Kirkby 1999). Breeding varies between years and occurs at times of Jarrah and Marri fruiting. These black cockatoos breed in woodland or forest, but may also breed in former woodland or forest that has been reduced to isolated trees (DotE 2015e).

4.2 Field survey results

4.2.1 Native flora

A total of 41 native vascular plant taxa from 34 plant genera and 18 plant families were recorded within the Survey area. The majority of taxa were recorded within the Fabaceae (8 taxa), Myrtaceae (6 taxa) and Proteaceae (5 taxa) families (Appendix 5). The relatively low number of plant genera recorded reflects the disturbed nature of the site.

4.2.2 Threatened and Priority flora

No Threatened flora species pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2014c) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the Survey area (Appendix 5).

4.2.3 Threatened and Priority Ecological Communities

No TECs as listed by Parks and Wildlife (2014a) or PECs as listed by Parks and Wildlife (2014b) were identified within the Survey area. The closest PEC identified in proximity to the Survey area was SCP 25 (Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands) which had a buffer of approximately 1.3 km from the Survey area (refer to section 4.1.1), but was not inferred to occur within the Survey area based on floristic composition.

4.2.4 Introduced (exotic) flora

A total of six introduced (exotic) taxa were recorded within the Survey area (Appendix 5):

- **Briza maxima*
- **Carpobrotus edulis*
- **Conyza sumatrensis*
- **Eragrostis curvula*
- **Hypochaeris glabra*
- **Lagurus ovatus.*

None of these species is a Declared Plant species in Western Australia pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2014).

4.3 Vegetation Types

Five native vegetation types (VTs) were defined and mapped within the Survey area (Appendix 1; Figure 4) and are summarised in Table 6. Areas containing pine plantations or cleared vegetation have not been counted as unique VTs. The flora and vegetation assessment and black cockatoo habitat assessment surveyed the majority of the Project area however did not include the Explosives Reserve Facility due to restricted access. The vegetation associated with this area has been inferred and a high level of confidence on this inference exists.

Total areas occupied within the Survey area by each of the identified VTs are set out in Table 7.

Table 6: Vegetation Types

Vegetation Type	Description
1	*Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* mid open shrubland over *Lyginia barbata, Conostylis aculeata* and *Phlebocarya ciliata* low open sedgeland with *Xylomelum occidentale* and *Eucalyptus rudis* occurring as isolated trees.
2	*Banksia menziesii, B. attenuata, Allocasuarina fraseriana* and *Eucalyptus marginata* open woodland over *Kunzea glabrescens, Acacia pulchella* and *Macrozamia fraseri* mid sparse shrubland over *Hibbertia hypericoides, Conostephium pendulum* and *Gompholobium tomentosum* low sparse shrubland. Including 1.02 ha inferred VT2 within Explosives Reserve.
3	*Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland.
4[1]	*Banksia menziesii, B. attenuata, Eucalyptus marginata* and *Allocasuarina fraseriana* low open woodland over *Jacksonia furcellata, Regelia ciliata* and *B. sessilis* mid sparse shrubland over *Tetraria octandra* and *Ficinia nodosa* low sparse sedgeland.
5	*Eucalyptus* sp. (planted) open woodland over *Acacia saligna, Jacksonia furcellata* and *Kunzea glabrescens* tall sparse shrubland over **Eragrostis curvula* low sparse tussock grassland.
P[2]	Pine plantation (*Pinus pinaster*).
C[2]	Cleared areas.

1 This vegetation type appears to be the result of rehabilitation activities.

2 Cleared areas and pine plantations have been mapped but are not counted as a unique VT.

4.3.1 Vegetation Type coverage

The total area mapped within the Survey area was 94.94 ha which includes cleared areas and pine plantations (Table 7). The dominant VT within the Survey area was VT 1 which can be broadly described as an open shrubland of *Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* with isolated *Xylomelum occidentale* and *Eucalyptus rudis* trees.

Table 7: Area (ha) covered by each VT within the Survey area

VT	Area (ha)	Percentage of the Survey area
1	59.37	62.53
2	7.91	8.33
3	2.02	2.12
4	9.36	9.85
5	7.11	7.50
Pine plantation	3.29	3.47
Cleared areas	5.88	6.20
TOTAL	**94.94**	**100.00**

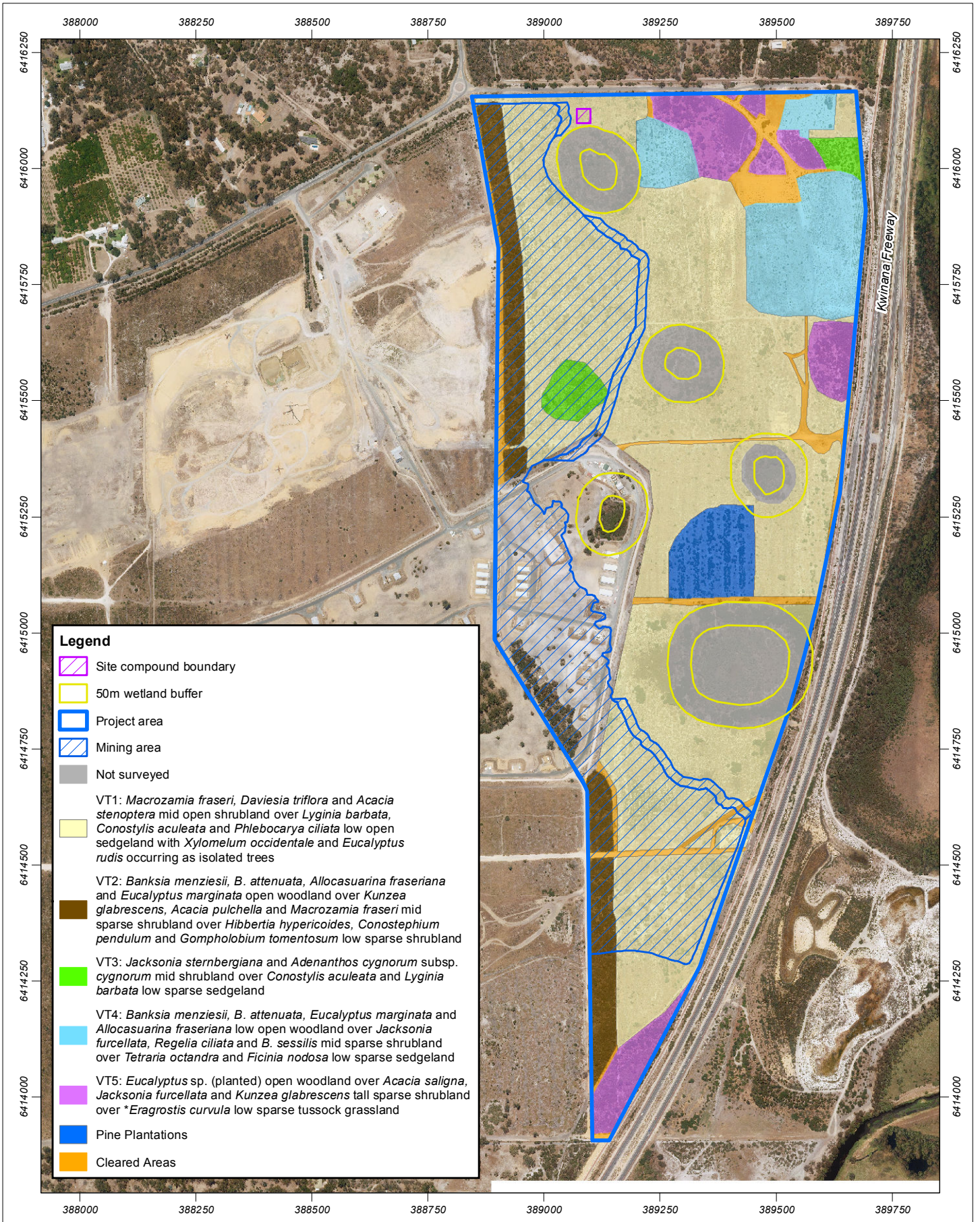

Figure 4: Vegetation types mapped within the Project area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

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4.4 Vegetation condition

The majority of the Survey area is in various stages of natural regeneration following the clearing of existing pine plantations from 2004 (approx.). Natural regeneration has been largely successful throughout majority of the Survey area and as such, vegetation condition within these areas was mapped as Good (Keighery 1994; Table 8). Vegetation condition throughout the remainder of the Survey area was mapped as follows:

- Very good: retained *Banksia* woodland in the vegetated strip on the western boundary of the Survey area
- Good: retained *Eucalyptus*/*Acacia* woodland along the southern boundary of the Survey area
- Completely Degraded: Cleared areas and pine plantations.

A summary of vegetation condition within the Survey area is displayed in Figure 5. Table 9 gives a numerical breakdown of the area occupied by each vegetation condition rating within the Survey area.

Table 8: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Table 9: Area (ha) covered by each vegetation condition rating category within the Survey area

Vegetation Condition	Area (ha)	Percentage of the Survey area
Excellent	-	-
Very Good	7.91	8.33
Good	77.86	82.01
Completely Degraded	9.17	9.66
Total	**94.94**	**100.00**

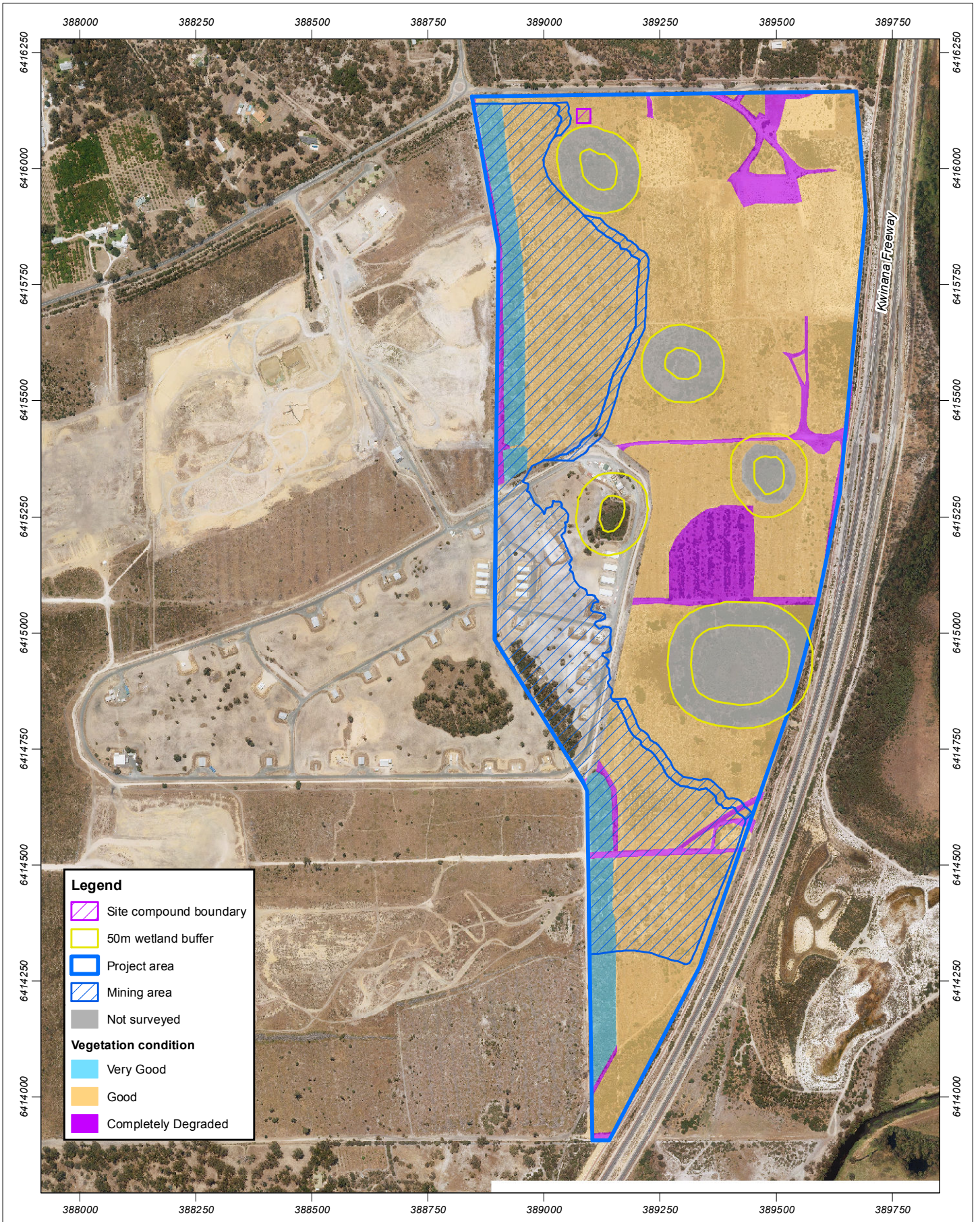

Figure 5: Vegetation condition mapped within the Project area

Scale 1:10,997 at A4

0 50 100 150 200 250 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 23/06/2015
Author: JCrute
Source: Aerial image: Landgate, flown 11/2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap_documents\R004\RevC\URE15096_01_R004_RevC_F005.mxd

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4.5 Black cockatoo habitat

4.5.1 Foraging assessment

The Survey area was divided into six different vegetation types (VTs) (including pine plantations) and cleared areas, as informed outlined in section 4.3. A summary of the value of each vegetation type as foraging habitat for black cockatoo species is presented in Table 10 (Groom 2011, Johnstone 2010b, Johnstone 2010c, Johnstone *et al.* 2011).

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black-cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area. Table 11 summarises the value of each vegetation type in terms of the quality of foraging habitat provided for black cockatoos.

The highest quality foraging habitat for black cockatoos was noted within VT 2 which contained high densities of black cockatoo food species including eucalypts and *Banksia* spp. at canopy and midstorey levels. The lowest quality foraging habitat for black cockatoos (not including cleared areas) was noted within VT 5 which contained limited potential food resources for all three species of black cockatoos (refer to footnote following Table 10) and in the pine plantation which provides limited food resources for CBC only.

Based on the results of the foraging assessment, the Survey area is considered to contain 7.91 ha of very good quality foraging habitat, 9.36 ha of good quality foraging habitat and 66.48 ha of low quality foraging habitat for CBC, BBC and FRTBC. The Survey area also contains an additional 3.29 ha of low quality foraging habitat for CBC only (within the pine plantation).

Signs of CBC foraging were observed in scattered occurrences within VT 2.

Table 10: Vegetation types and black cockatoo foraging species within the Survey area

Vegetation type	Description	Black cockatoo foraging species	Area (ha)
1	*Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* mid open shrubland over *Lyginia barbata, Conostylis aculeata* and *Phlebocarya ciliata* low open sedgeland with *Xylomelum occidentale* and *Eucalyptus rudis* occurring as isolated trees.	CBC – *E. rudis* BBC – Nil FRTBC – Nil.	59.37
2	*Banksia menziesii, B. attenuata, Allocasuarina fraseriana* and *Eucalyptus marginata* open woodland over *Kunzea glabrescens, Acacia pulchella* and *Macrozamia fraseri* mid sparse shrubland over *Hibbertia hypericoides, Conostephium pendulum* and *Gompholobium tomentosum* low sparse shrubland. Including 1.02 ha inferred VT2 within Explosives Reserve.	CBC – *B. menziesii, B. attenuata, A. fraseriana, E. marginata* BBC – *A. fraseriana, E. marginata* FRTBC – *A. fraseriana, E. marginata.*	7.91
3	*Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland.	CBC – Nil BBC – Nil FRTBC – Nil.	2.02
4	*Banksia menziesii, B. attenuata, Eucalyptus marginata* and *Allocasuarina fraseriana* low open woodland over *Jacksonia furcellata, Regelia ciliata* and *B. sessilis* mid sparse shrubland over *Tetraria octandra* and *Ficinia nodosa* low sparse sedgeland.	CBC – *B. menziesii, B. attenuata, B. sessilis, A. fraseriana, E. marginata, J. furcellata* BBC – *B. sessilis, A. fraseriana, E. marginata* FRTBC – *A. fraseriana, E. marginata.*	9.36

Vegetation type	Description	Black cockatoo foraging species	Area (ha)
5	*Eucalyptus* sp. (planted) open woodland over *Acacia saligna, Jacksonia furcellata* and *Kunzea glabrescens* tall sparse shrubland over **Eragrostis curvula* low sparse tussock grassland.	CBC – *A. saligna, J. furcellata, E.* sp. (planted)* BBC – *E.* sp. (planted)* FRTBC – *E.* sp. (planted)*.	7.11
P	Pine plantation (*Pinus pinaster*).	CBC – *P. pinaster* BBC – Nil FRTBC – Nil.	3.29
C	Cleared areas.	CBC – Nil BBC – Nil FRTBC – Nil.	5.88

*The *Eucalyptus* species present in this vegetation type was unable to be identified at the time of assessment. The species did not appear to be native to Western Australia and was likely planted in the Survey area. All three species of black cockatoos may forage on this species; however this is not likely to constitute significant foraging species for black cockatoos.

Table 11: Quality of black cockatoo foraging habitat within the Survey area

Vegetation type	Foraging quality	Justification
1	Low	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
2	Very good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
3	Nil	No suitable foraging species for black cockatoos present.
4	Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (i.e. canopy and midstorey).
5	Low	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Pine plantation	Low (CBC only)	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Cleared areas	Nil	Cleared areas - no vegetation present.

5. Discussion

Vegetation within the Survey area comprises five native VTs and a remnant pine plantation. Transitions between VTs were generally discontinuous, though occasionally abrupt with margins representing admixtures of more than one VT. This discontinuity is primarily due to changes in soil profile and topography, and presence of cleared areas. At a broad scale, the majority of the Survey area was observed to be in various states of natural regeneration following clearing of historical pine plantations with vegetation comprised of *Macrozamia fraseri, Daviesia triflora* and *Acacia stenoptera* open shrubland with emergent *Xylomelum occidentale* and *Eucalyptus rudis* trees. The linear strip of vegetation which runs along the western and southern boundaries of the Survey area represented a different vegetation structure which was primarily a Jarrah-*Banksia* woodland which was relatively undisturbed by the historical pine plantation.

The flora and vegetation assessment conducted within the Survey area was undertaken during autumn, outside the prime flowering time for majority of species within the area. Field reconnaissance involved traversing the majority of the Survey area, which ensures that an accurate representation of all VTs and potential conservation significant flora were obtained.

The number of native and exotic species recorded on the Survey area totalled 47 vascular plant taxa from 40 genera and 20 families. The relatively low number of plant genera recorded reflects the disturbed nature of the site. Six of these taxa were introduced (exotic species) which were present in moderate to high densities throughout the Survey area. No Declared Plant species pursuant to Section 22 of the BAM Act were recorded within the Survey area (DAFWA 2014).

No conservation significant species or ecological communities were recorded within the Survey area. Effort was made during the field assessment to look for areas of suitable habitat for conservation significant species but none were found, which is likely related to both the disturbed and regenerative nature of the Survey area and the time of year at which the survey was conducted. Given that the survey was conducted outside the prime flowering time for majority of the conservation significant species, there is a possibility that some of these species may occur on the Survey area – however majority of these are likely to be restricted to wetland areas which will not be impacted by the proposed mining.

Conservation significant flora species potentially occurring on the Survey area that may have been missed due to the survey timing are likely to be the three Threatened orchids; *Caladenia huegelii, Drakaea elastica* and *Drakaea micrantha* which are all diminutive in stature and are at their most visible when in flower. Both *Drakaea* species are likely to be restricted to wetland/damp areas and thus are highly unlikely to be impacted by the proposed mining. *C. huegelii* has the potential to occur outside of these wetland areas. Given the disturbed nature of the site and the relatively low number of plant genera recorded on the site it is considered unlikely that the species would be located.

All five native VTs appear to be well represented within the local area based on surrounding vegetation and are consistent with the vegetation expected to be found within the region. Levels of species diversity within each VT is likely to be a reflection of the regenerative nature of majority of the Survey area and impacts from historical pine plantations.

Vegetation condition within the Survey area ranged from Very Good to Completely Degraded (Keighery 1994), with majority of the Survey area (approximately 62%) mapped to be in “Good” condition.

Approximately 7.91 ha of very good quality foraging habitat, 9.36 ha of good quality foraging habitat and 66.48 ha of low quality foraging habitat for CBC, BBC and FRTBC was recorded within the Survey area. The Survey area also contains an additional 3.29 ha of low quality foraging habitat for CBC only (within the pine plantation). No potentially significant trees which could potentially be used by black cockatoos for roosting or breeding purposes in the future were recorded within the Survey area.

6. Recommendations

6.1 Black cockatoos

All three black cockatoo species with the potential to occur within the Survey area are classed as Threatened under the EPBC Act and impact to the breeding or foraging habitats of these species can require referral to, and possible assessment by, DotE.

The *Referral Guidelines for Three Threatened Black Cockatoo Species* (DSEWPaC 2012) assists in determining whether an action needs to be referred under the EPBC Act and has been used to identify whether an EPBC Act referral is recommended for the proposal.

Table 12 outlines the whether the proposal meets any of the trigger levels for referral. From the guidelines, a criterion that could be triggered is the clearing of more than 1 ha of good quality habitat; however, it is considered that no other criteria would be triggered. This indicates that the clearing of vegetation associated with the proposal may require referral under the EPBC Act.

Table 12: Assessment of the proposal against the black cockatoo Referral Guidelines

Referral trigger	Assessment of proposal against referral trigger	Significant impact triggered
High risk of significant impacts: referral recommended		
Clearing of any known nesting tree	No known nesting trees to be cleared.	No
Clearing or degradation of any part of a vegetation community known to contain breeding habitat	The Survey area does not contain breeding habitat or potentially significant trees which could potentially be used by black cockatoos for roosting or breeding purposes in the future.	No
Clearing or degradation of more than 1 ha of quality foraging habitat	Up to 6.54 ha of very good quality foraging habitat and 24.29 ha of low quality foraging habitat for all three species of black cockatoos may be cleared as a result of the proposal.	**Yes**
Clearing or degradation of a known night roosting tree	No known night roosting trees have been recorded within the Proposal Area.	No
Creating a gap of more than 4 km between patches of Black Cockatoo habitat	The Survey area is located in close proximity to a number of existing reserves within Rockingham Lakes Regional Park containing potential black cockatoo habitat including: • Anstey Swamp (4 km) • Paganoni Swamp (3.8 km). As such, the proposal will not create a gap of more than 4 km between patches of habitat.	No

6.2 Conservation significant flora

One conservation significant flora species, *Caladenia huegelii*, whilst unlikely due to disturbance, could potentially occur within the Survey area and may not have been recorded during the flora and vegetation survey due to timing constraints.

The abovementioned species is diminutive in stature and is most visible when in flower. A targeted spring survey in accordance with methodology outlined in DotE (2013) would determine if these species is present within the Survey area.

All other conservation significant flora species (listed in the survey report) are unlikely to occur within the Survey area. Most of these species should either have been visible during time of survey or have habitat requirements which do not occur within the Survey area (i.e. wetland areas).

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Appendix 1
Vascular plant taxa recorded by site and vegetation type

Species	Site					Legend
	1	2	3	4	5	VT1
Acacia pulchella var. *glaberrima*		x	x			VT2
Acacia saligna					x	VT3
Acacia stenoptera	x					VT4
Adenanthos cygnorum subsp. *cygnorum*			x	x		VT5
Allocasuarina fraseriana		x		x		
Banksia attenuata		x		x		
Banksia menziesii		x		x		
Banksia sessilis				x		
Brachyloma preissii		x				
**Briza maxima*	x	x	x			
Burchardia congesta		x				
**Carpobrotus edulis*	x	x	x	x	x	
Conostephium pendulum		x				
Conostylis aculeata subsp. *aculeata*	x	x	x			
**Conyza sumatrensis*				x		
Corymbia calophylla					x	
Dampiera linearis		x				
Dasypogon bromeliifolius	x	x				
Daviesia triflora	x	x				
Desmocladus flexuosus	x	x	x			
**Eragrostis curvula*		x		x	x	
Eucalyptus marginata		x		x		
Eucalyptus rudis	x					
Eucalyptus sp. (planted)				x	x	
Ficinia nodosa				x		
Gompholobium tomentosum	x	x	x			
Hemiandra pungens			x			
Hibbertia hypericoides		x				
**Hypochaeris glabra*	x			x		
Jacksonia furcellata				x	x	
Jacksonia sternbergiana			x	x		
Kennedia prostrata	x	x				
Kunzea glabrescens	x	x			x	
Lagenophora huegelii		x				
**Lagurus ovatus*					x	
Lechenaultia biloba	x					
Lepidosperma pubisquameum		x				
Lyginia barbata	x	x	x			
Macrozamia fraseri	x	x	x			
Olearia axillaris	x					
Patersonia occidentalis	x	x				
Phlebocarya ciliata	x					
Poaceae sp.	x		x			
Regelia ciliata				x		
Stylidium sp.	x					
Tetraria octandra		x		x		
Xylomelum occidentale	x					

* denotes introduced (exotic) species (Western Australian Herbarium 1998-)

Appendix 2
Photographic record of site and vegetation types

Plate 1: Site 01 (VT 1)

Plate 2: Site 02 (VT 2)

Plate 3: Site 03 (VT 3)

Plate 4: Site 04 (VT 4)

Plate 5: Site 05 (VT 5)

Plate 6: Pine plantation

Plate 7: Cleared areas

Appendix 3
Desktop assessment results (Parks and Wildlife 2007-, DotE 2015c)

NatureMap
Mapping Western Australia's biodiversity

URE15096.01_flora_3km

Created By Daniel Panickar on 11/05/2015

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115°49' 27" E,32°23' 07" S
Buffer	3km
Group By	Family

Family	Species	Records
Apiaceae	3	5
Araliaceae	3	5
Asparagaceae	3	3
Asteraceae	6	9
Campanulaceae	4	5
Casuarinaceae	1	1
Celastraceae	1	1
Centrolepidaceae	2	3
Colchicaceae	1	1
Commelinaceae	1	1
Crassulaceae	3	4
Cyperaceae	16	23
Dennstaedtiaceae	1	2
Dilleniaceae	1	1
Droseraceae	3	3
Ericaceae	4	6
Euphorbiaceae	1	2
Fabaceae	12	23
Geraniaceae	1	1
Goodeniaceae	3	4
Haemodoraceae	3	5
Haloragaceae	1	2
Hemerocallidaceae	1	1
Juncaceae	1	3
Lamiaceae	1	2
Lauraceae	1	2
Loganiaceae	1	1
Menyanthaceae	2	2
Myrtaceae	10	12
Orchidaceae	5	6
Orobanchaceae	1	1
Poaceae	8	8
Polygalaceae	1	1
Proteaceae	3	3
Ranunculaceae	1	2
Restionaceae	7	15
Rubiaceae	1	2
Scrophulariaceae	2	2
Selaginellaceae	1	1
Stylidiaceae	5	6
Thymelaeaceae	2	2
TOTAL	**128**	**182**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Apiaceae					
1.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
2.	6222	*Homalosciadium homalocarpum*			
3.	6289	*Xanthosia huegelii*			
Araliaceae					
4.	6229	*Hydrocotyle diantha*			
5.	19041	*Trachymene coerulea subsp. coerulea*			
6.	6280	*Trachymene pilosa (Native Parsnip)*			
Asparagaceae					
7.	1231	*Lomandra maritima*			
8.	14542	*Lomandra micrantha subsp. micrantha*			
9.	1318	*Thysanotus arbuscula*			
Asteraceae					
10.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
11.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
12.	8175	*Podolepis gracilis (Slender Podolepis)*			
13.	8182	*Podotheca angustifolia (Sticky Longheads)*			
14.	8224	*Siloxerus filifolius*			
15.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
Campanulaceae					
16.	9289	*Lobelia anceps (Angled Lobelia)*			
17.	7408	*Lobelia tenuior (Slender Lobelia)*			
18.	37440	*Monopsis debilis var. depressa*	Y		
19.	7389	*Wahlenbergia preissii*			
Casuarinaceae					
20.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
Celastraceae					
21.	4733	*Stackhousia monogyna*			
Centrolepidaceae					
22.	1117	*Aphelia cyperoides*			
23.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
Colchicaceae					
24.	1383	*Burchardia bairdiae*			
Commelinaceae					
25.	1162	*Cartonema philydroides*			
Crassulaceae					
26.	3137	*Crassula colorata (Dense Stonecrop)*			
27.	3140	*Crassula glomerata*	Y		
28.	15706	*Crassula natans var. minus*	Y		
Cyperaceae					
29.	741	*Baumea articulata (Jointed Rush)*			
30.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
31.	763	*Chorizandra enodis (Black Bristlerush)*			
32.	768	*Cyathochaeta avenacea*			
33.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
34.	20200	*Isolepis cernua var. setiformis*			
35.	917	*Isolepis marginata (Coarse Club-rush)*			
36.	921	*Isolepis producta*			
37.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
38.	940	*Lepidosperma pubisquameum*			
39.	945	*Lepidosperma squamatum*			
40.	955	*Mesomelaena pseudostygia*			
41.	980	*Schoenus capillifolius*		P3	
42.	986	*Schoenus efoliatus*			
43.	1018	*Schoenus subfascicularis*			
44.	1036	*Tetraria octandra*			
Dennstaedtiaceae					
45.	13758	*Histiopteris incisa*			
Dilleniaceae					
46.	5172	*Hibbertia stellaris (Orange Stars)*			
Droseraceae					
47.	3106	*Drosera macrantha (Bridal Rainbow)*			
48.	3114	*Drosera nitidula (Shining Sundew)*			
49.	3131	*Drosera stolonifera (Leafy Sundew)*			
Ericaceae					
50.	6323	*Astroloma ciliatum (Candle Cranberry)*			
51.	30142	*Brachyloma preissii subsp. obtusifolium*			
52.	30136	*Brachyloma preissii subsp. preissii*			
53.	6349	*Conostephium preissii*			
Euphorbiaceae					
54.	4582	*Adriana quadripartita (Bitter Bush)*			
Fabaceae					
55.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
56.	3688	*Aotus gracillima*			
57.	3845	*Daviesia triflora*			
58.	3863	*Dillwynia dillwynioides*		P3	
59.	3880	*Eutaxia virgata*			
60.	20473	*Gastrolobium ebracteolatum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
61.	10909	*Gompholobium confertum*			
62.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
63.	8564	*Lotus subbiflorus*	Y		
64.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
65.	4292	*Trifolium campestre (Hop Clover)*	Y		
66.	4295	*Trifolium dubium (Suckling Clover)*	Y		
Geraniaceae					
67.	4341	*Geranium solanderi (Native Geranium)*			
Goodeniaceae					
68.	7484	*Dampiera trigona (Angled-stem Dampiera)*			
69.	7538	*Goodenia pulchella*			
70.	7603	*Scaevola canescens (Grey Scaevola)*			
Haemodoraceae					
71.	11826	*Conostylis aculeata subsp. aculeata*			
72.	1472	*Haemodorum simplex*			
73.	1478	*Phlebocarya ciliata*			
Haloragaceae					
74.	34676	*Meionectes brownii (Swamp Raspwort)*			
Hemerocallidaceae					
75.	1276	*Caesia micrantha (Pale Grass Lily)*			
Juncaceae					
76.	1188	*Juncus pallidus (Pale Rush)*			
Lamiaceae					
77.	6886	*Mentha x piperita*	Y		Y
Lauraceae					
78.	11799	*Cassytha racemosa forma racemosa*			
Loganiaceae					
79.	16177	*Phyllangium paradoxum*			
Menyanthaceae					
80.	36160	*Liparophyllum capitatum*			
81.	36179	*Liparophyllum violifolium*			
Myrtaceae					
82.	20283	*Astartea scoparia*			
83.	5439	*Calytrix angulata (Yellow Starflower)*			
84.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
85.	20808	*Eucalyptus petiolaris*	Y		
86.	13273	*Melaleuca incana subsp. incana*			
87.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
88.	5952	*Melaleuca preissiana (Moonah)*			
89.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
90.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
91.	20135	*Taxandria linearifolia*			
Orchidaceae					
92.	15330	*Caladenia arenicola*			
93.	15419	*Microtis media subsp. media*			
94.	1660	*Microtis orbicularis (Dark Mignonette Orchid)*			
95.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
96.	1708	*Thelymitra fuscolutea (Chestnut Sun Orchid)*			
Orobanchaceae					
97.	15037	*Bartsia trixago*	Y		
Poaceae					
98.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
99.	17234	*Austrostipa compressa*			
100.	17240	*Austrostipa flavescens*			
101.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
102.	476	*Lolium perenne (Perennial Ryegrass)*	Y		
103.	11073	*Lolium x hybridum*	Y		
104.	635	*Sporobolus virginicus (Marine Couch)*			
105.	33101	*Vulpia myuros forma myuros*	Y		
Polygalaceae					
106.	4564	*Comesperma virgatum (Milkwort)*			
Proteaceae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
107.	1834	*Banksia menziesii (Firewood Banksia)*			
108.	2197	*Hakea prostrata (Harsh Hakea)*			
109.	2329	*Synaphea spinulosa*			
Ranunculaceae					
110.	2938	*Ranunculus trilobus (Buttercup)*	Y		
Restionaceae					
111.	17691	*Desmocladus fasciculatus*			
112.	16595	*Desmocladus flexuosus*			
113.	17838	*Dielsia stenostachya*			
114.	17841	*Hypolaena pubescens*			
115.	1085	*Lepyrodia glauca*			
116.	17679	*Meeboldina coangustata*			
117.	17694	*Meeboldina scariosa*			
Rubiaceae					
118.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
Scrophulariaceae					
119.	7054	*Dischisma arenarium*	Y		
120.	7055	*Dischisma capitatum (Woolly-headed Dischisma)*	Y		
Selaginellaceae					
121.	6	*Selaginella gracillima (Tiny Clubmoss)*			
Stylidiaceae					
122.	7677	*Levenhookia stipitata (Common Stylewort)*			
123.	7712	*Stylidium despectum (Dwarf Triggerplant)*			
124.	7717	*Stylidium divaricatum (Daddy-long-legs)*			
125.	7756	*Stylidium longitubum (Jumping Jacks)*		P3	
126.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
Thymelaeaceae					
127.	5252	*Pimelea lanata*			
128.	18117	*Pimelea rosea subsp. rosea*			

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.

Australian Government
Department of the Environment

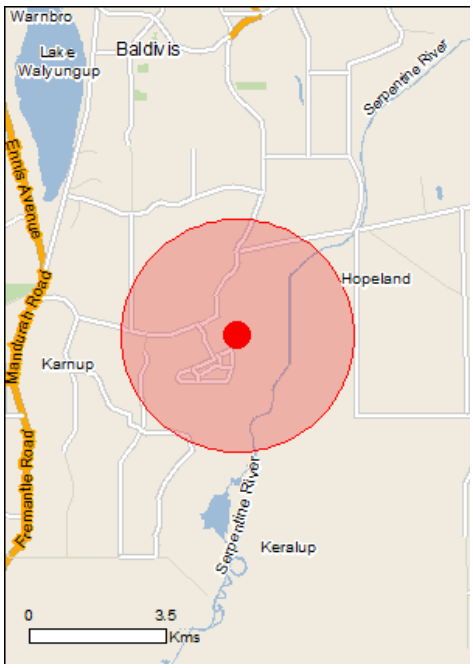
EPBC Act Protected Matters Report

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.

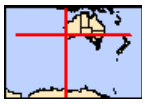
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/05/15 13:12:47



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 3.0Km



Summary

Matters of National Environmental 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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	7

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

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.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Peel-yalgorup system	Upstream from Ramsar

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to 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 likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed 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 likely to occur within area
Migratory Terrestrial Species		
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
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

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
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to 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
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

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, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		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		

Name	Status	Type of Presence
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
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to 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
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 reichardtii 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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

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 and National Heritage properties, Wetlands of International and National 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 resolutions.

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 information sources.

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.

Coordinates

-32.39 115.82286

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
-Geoscience Australia
-CSIRO
-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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Appendix 4
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australia (Western Australian Herbarium 1998-)

Under the *Wildlife Conservation Act* (1950), the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).

Priority Flora

Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Two: Poorly-known Species

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Three: Poorly-known Species

Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

Priority Four: Rare, Near Threatened and other species in need of monitoring

1. Rare: Species that are considered to be have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
2. Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: Conservation Dependent Species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies:

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria:

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
   (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
   (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
   (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
   (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
   (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
   (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply"
    (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
    (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
    (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. Rare.Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
2. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 5
Vascular plant taxa recorded within the Survey area

Family	Species
Aizoaceae	*Carpobrotus edulis*
Anarthriaceae	*Lyginia barbata*
Asteraceae	*Conyza sumatrensis*
	Hypochaeris glabra
	Lagenophora huegelii
	Olearia axillaris
Casuarinaceae	*Allocasuarina fraseriana*
Colchicaceae	*Burchardia congesta*
Cyperaceae	*Ficinia nodosa*
	Lepidosperma pubisquameum
	Tetraria octandra
Dasypogonaceae	*Dasypogon bromeliifolius*
Dilleniaceae	*Hibbertia hypericoides*
Ericaceae	*Brachyloma preissii*
	Conostephium pendulum
Fabaceae	*Acacia pulchella* var. *glaberrima*
	Acacia saligna
	Acacia stenoptera
	Daviesia triflora
	Gompholobium tomentosum
	Jacksonia furcellata
	Jacksonia sternbergiana
	Kennedia prostrata
Goodeniaceae	*Dampiera linearis*
	Lechenaultia biloba
Haemodoraceae	*Conostylis aculeata* subsp. *aculeata*
	Phlebocarya ciliata
Iridaceae	*Patersonia occidentalis*
Lamiaceae	*Hemiandra pungens*
Myrtaceae	*Corymbia calophylla*
	Eucalyptus marginata
	Eucalyptus rudis
	Eucalyptus sp. (planted)
	Kunzea glabrescens
	Regelia ciliata
Poaceae	*Briza maxima*
	Eragrostis curvula
	Lagurus ovatus
	Poaceae sp.
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia menziesii
	Banksia sessilis
	Xylomelum occidentale
Restionaceae	*Desmocladus flexuosus*
Stylidiaceae	*Stylidium* sp.
Zamiaceae	*Macrozamia fraseri*