

### 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: <ul style="list-style-type: none"> <li>• movement of material into final landform design</li> <li>• contouring and shaping of final landforms</li> <li>• spreading of overburden, topsoil and vegetative material</li> <li>• deep ripping of topsoil</li> <li>• assessing stability of final landform.</li> </ul>
Decontamination	Compliance with requirements of <i>Contaminated Sites Act 2003</i> including remediation	No contaminated sites (as defined by the <i>Contaminated Sites Act 2003</i> ) requiring ongoing management beyond five years post-closure. Compliance will be established through: <ul style="list-style-type: none"> <li>• inspection and reporting on any potentially contaminated areas</li> <li>• implementation of remediation program as required or removal and disposal of affected materials off-site via a licensed contractor</li> <li>• monitoring success of remediation program through monitoring of soil geochemistry and presence of hydrocarbons.</li> </ul>
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 <sup>2</sup> .	
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: <ul style="list-style-type: none"> <li>• movement of material into final landform design</li> <li>• contouring and shaping of final landforms</li> <li>• spreading of overburden, topsoil and vegetative material</li> <li>• deep ripping of topsoil</li> <li>• assessing stability of final landform</li> <li>• revegetation in accordance with the Rehabilitation Management Plan.</li> </ul>
Decontamination	Compliance with requirements of <i>Contaminated Sites Act 2003</i> including remediation	No contaminated sites (as defined by the <i>Contaminated Sites Act 2003</i> ) requiring ongoing management beyond five years post-closure. Compliance will be established through: <ul style="list-style-type: none"> <li>• inspection and reporting on any potentially contaminated areas</li> <li>• implementation of remediation program as required or removal and disposal of affected materials off-site via a licensed contractor</li> <li>• monitoring success of remediation program through monitoring of soil geochemistry and presence of hydrocarbons.</li> </ul>

<sup>2</sup> 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: <ul style="list-style-type: none"> <li>• decommissioning and removal of mine and ancillary infrastructure</li> <li>• treatment (or removal) of any localised soil contamination if required</li> <li>• movement of material into final landform design</li> <li>• contouring and shaping of final landforms</li> <li>• spreading of overburden, topsoil and vegetative material</li> <li>• deep ripping of topsoil</li> <li>• assessing stability of final landform</li> <li>• revegetation in accordance with the Rehabilitation Management Plan.</li> </ul>
	Construction of final landforms / rehabilitation	No contaminated sites (as defined by the <i>Contaminated Sites Act 2003</i> ) requiring ongoing management beyond five years post-closure. Compliance will be established through: <ul style="list-style-type: none"> <li>• inspection and reporting on any potentially contaminated areas</li> <li>• implementation of remediation program as required or removal and disposal of affected materials off-site via a licensed contractor</li> <li>• monitoring success of remediation program through monitoring of soil geochemistry and presence of hydrocarbons.</li> </ul>
Decontamination	Compliance with requirements of <i>Contaminated Sites Act 2003</i> 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: <ul style="list-style-type: none"> <li>• movement of material into final landform design</li> <li>• contouring and shaping of final landforms</li> <li>• spreading of overburden, topsoil and vegetative material</li> <li>• deep ripping of topsoil</li> <li>• revegetation in accordance with the Rehabilitation Management Plan.</li> </ul>

*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: <ul style="list-style-type: none"> <li>• surface stability</li> <li>• infiltration/runoff</li> <li>• nutrient cycling status</li> <li>• flora and vegetation</li> </ul>	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	<ul style="list-style-type: none"> <li>• Decommissioning and removal of infrastructure, plant and equipment.</li> <li>• Waste disposal.</li> <li>• Remediation of contamination:               <ul style="list-style-type: none"> <li>○ Survey program</li> <li>○ Remediation program</li> <li>○ Maintenance and monitoring.</li> </ul> </li> </ul>
Rehabilitation	<ul style="list-style-type: none"> <li>• Earthmoving and landscape forming.</li> <li>• Re-vegetation.</li> <li>• Post Closure management of surface water drainage and erosion.</li> <li>• Maintenance and monitoring programs.</li> </ul>
Project Management	<ul style="list-style-type: none"> <li>• Ongoing stakeholder consultation.</li> <li>• Administration support.</li> <li>• Office and accommodation facilities.</li> <li>• Specialist and consultant fees.</li> <li>• Legal requirements.</li> </ul>
Contingencies	<ul style="list-style-type: none"> <li>• Provision for potential delays, extreme events, unsuccessful rehabilitation or other external factors relevant to closure.</li> </ul>

#### 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 its 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	<p>A systems audit will be undertaken to ascertain the types of information to be captured and stored.</p> <p>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.</p>
Assign responsible person	<p>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.</p>
Record data	<p>Monitoring will be undertaken on a regular basis, with all data collected transferred into the electronic database as soon as practicable.</p> <p>Once data transfer is complete, hardcopy monitoring records will be filed.</p> <p>Records will be categorised according to feature and monitoring activity (e.g. 'revegetation').</p>
Quality Assurance and Quality Control	<p>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.</p> <p>This check will then be recorded as having taken place.</p>
Training	<p>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.</p>
Miscellaneous	<p>Non-regular events will also be recorded in the system. These will include, for example:</p> <ul style="list-style-type: none"> <li>• seed type, provenance and volume applied to rehabilitation areas</li> <li>• names and volumes of reports submitted to DMP</li> <li>• decommissioning dates</li> <li>• instances of personnel leaving and entering employment at the site.</li> </ul>

## 13. References

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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.
<b>Reasonably confident (RC)</b>	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.
<b>Low certainty/confidence (LC)</b>	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

**Appendix 3**  
**Authorisation from tenement holders**





Our ref: EC: 9.1 150306 Mining Lease Application for ML70/1262

6 March 2015

**Director General  
Department of Mines and Petroleum  
100 Plain Street  
East Perth WA 6004**

Dear Sir

**Mining Lease Application M70/1262**

Eclipse Resources Pty Ltd hereby authorises Urban Resources Pty Ltd to act for this company in all matters pertaining to Mining Lease Application M70/1262.

For your information Eclipse Resources and Urban Resources propose to enter into a sublease agreement pertaining to this proposed tenement.

Yours faithfully

A handwritten signature in black ink, appearing to read "R. A. D. Sippe".

R A D Sippe  
Executive Director

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# Karnup Sand Mining Project

Mine Closure Plan: Urban Resources  
Pty Ltd M70/1262

Prepared for  
Urban Resources  
by Strategen

June 2015



**STRATEGEN**  
environmental consultants



# Karnup Sand Mining Project

## Mine Closure Plan: Urban Resources Pty Ltd M70/1262

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Document ID: URE15096\_01 R001 Rev 0  
Submission date: 30 June 2015  
Mineral Field: South West

Strategen is a trading name of  
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June 2015



## ***Limitations***

### **Scope of services**

This report ("the report") has been prepared by Strategen Environmental Consulting Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

### **Reliance on data**

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

### **Environmental conclusions**

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

## **Client: Urban Resources**

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	For client review	D White, N Zago, E Congear / D Newsome	Electronic	9 June 2015
Final Report	0	For submission to DMP	E Congear / D Newsome	Electronic	30 June 2015

Filename: URE15096\_01 R001 Rev 0 - 30 June 2015

## Mine closure plan checklist

DMP has prepared a checklist for a Mine Closure Plan designed to ensure the proponent has submitted the required information. This will enable an efficient and accurate assessment without the need for the assessing officer to seek further information or clarification.

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
1	Has the checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of Checklist)	Y	Checklist page 2				
<b>Public availability</b>							
2	Are you aware that from 2015 all MCPs will be made publicly available?	Y					
3	Is there any information in this MCP that should not be publicly available?	N					
4	If "Yes" to Q3, has confidential information been submitted in a separate document/ section?						
<b>Cover Page, Table of Contents</b>							
5	Does the cover page include; <ul style="list-style-type: none"> <li>• project title</li> <li>• company name</li> <li>• contact details (including telephone and email addresses)</li> <li>• document ID and version number</li> <li>• date of submission (needs to match the date of this checklist)</li> </ul>	Y	Fly leaf				
<b>Scope and Purpose</b>							
6	State why the MCP is submitted (e.g. as part of a Mining Proposal, a reviewed MCP or to fulfil other legal requirements)			As part of the Mining Proposal			



No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
<b>Project Overview</b>							
7	Does the project summary include: <ul style="list-style-type: none"> <li>land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land/ reserve [including surrounding land] is being managed)</li> <li>location of the project</li> <li>comprehensive site plan(s)</li> <li>background information on the history and status of the project.</li> </ul>	Y	Section 2.1				
<b>Legal Obligations and Commitments</b>							
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?	Y	Section 3				
<b>Stakeholder Engagement</b>							
9	Have all stakeholders involved in closure been identified?	Y	Section 4				
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	Section 4				
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?	Y	Section 4				
<b>Post-mining land use(s) and Closure Objectives</b>							
12	Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?	Y	Section 5				


No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post-mining land use (including contaminated sites)?	Y	Section 5				
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DER as required under the <i>Contaminated Sites Act 2003</i> ?	N					
<b>Development of Completion Criteria</b>							
15	Does the MCP include a set of specific closure criteria and / closure performance indicators?	Y	Section 6				
<b>Collection and Analysis of Closure Data</b>							
16	Does the MCP include baseline data (including pre-mining studies and environmental data)?	Y	Section 7.1				
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	Section 7.2.5				
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?	-	-				
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?	Y	Section 8				
20	Does the MCP include information relevant to mine closure for each domain or feature?	Y	Section 8				

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
<b>Identification and Management of Closure Issues</b>							
21	Does the MCP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature?	Y	Section 8, Appendix 1				
22	Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?	Y	Section 8				
<b>Closure Implementation</b>							
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	Section 9				
24	Does the MCP include a closure work program for each domain or feature?	Y	Section 9.4				
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	Y	Section 2.1				
26	Does the MCP contain a schedule of research and trial activities?	Y	Section 9.4				
27	Does the MCP contain a schedule of progressive rehabilitation activities?	Y	Section 9.4				
28	Does the MCP include details of how unexpected closure and care and maintenance will be handled?	Y	Section 9.4				
29	Does the MCP contain a schedule of decommissioning activities?	Y	Section 9.4				
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	Section 9.4, Section 10				

No.	Checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
<b>Closure Monitoring and Maintenance</b>							
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	Section 10				
<b>Financial Provision for Closure</b>							
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	Section 11				
33	Does the MCP include a process to regular review of the financial provision?	Y	Section 11				
<b>Management of Information and Data</b>							
34	Does the mine closure plan contain a description of management strategies including systems, and processes for the retention of mine records?	Y	Section 11				

**Corporate Endorsement:**

I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of the Department of Mines and Petroleum.

Name: STEPHEN ELLIOTTSigned: Position: DIRECTORDate: 30/6/2015

(NB: The corporate endorsement must be given by tenement holder(s) or a senior representative authorised by the tenement holder(s), such as a Registered Manager or Company Director).





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# 1. Introduction

Urban Resources Pty Ltd (Urban Resources) proposes to operate the Karnup Sand Mining Project (the Project) on (pending) Mining Tenement M70/1262, located approximately 48 km south of Perth, Western Australia (Figure 1-1). Mining Tenement M70/1262 is currently held by Eclipse Resources Pty Ltd (Eclipse); however, Urban Resources propose to mine within the tenement as part of a sub-lease arrangement. The sand will be used predominantly in the construction industry.

The Project involves the mining of sand from 41.96 ha of the site to remove approximately 1 553 800 m<sup>3</sup> of sand over a 5 year period. The Project area will be mined down to 4.2 – 4.5 m AHD, 1.2 m above assessment groundwater level (AGL). Urban Resources will rehabilitate the land to a form suitable for the future land use as proposed by LandCorp, primarily parks and recreation with several protected wetlands and potentially some areas of urban development.

## 1.1 Scope and purpose of document

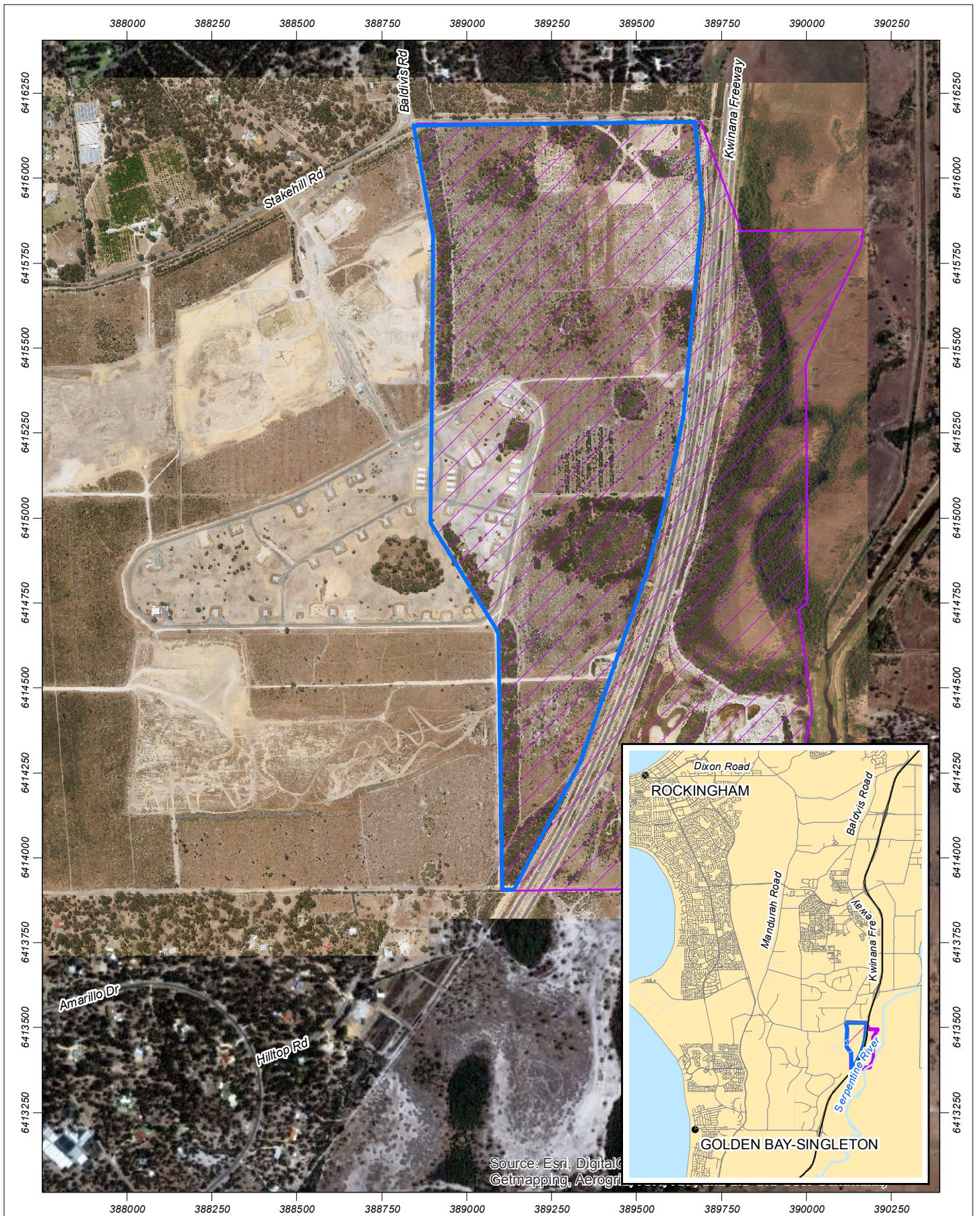
This plan has been prepared to comply with the provisions of the *Mining Act 1978*. It has been prepared in accordance with the *Strategic Framework for Mine Closure* (ANZMEC & MCA 2000) and conforms to the structure and content requirements outlined in *Guidelines for Preparing Mine Closure Plans* (DMP & EPA 2015). The planning content is based on *Leading Practice Sustainable Development in Mining* handbooks and *Planning for Integrated Mine Closure: Toolkit* (ICMM 2008).

This plan addresses the following aspects and is structured accordingly:

1. Summary of the Project (Section 2).
2. Identification of closure obligations and commitments (Section 3).
3. Collection and analysis of closure data, including a directory of existing baseline data (Section 5).
4. Stakeholder consultation (Section 4).
5. Post-mining land use and closure objectives (Section 5).
6. Identification and management of closure issues (Section 8).
7. Development of completion criteria (Section 6).
8. Financial provisioning processes (Section 11).
9. Closure implementation, including unexpected closure (Sections 9 and 9.4).
10. Closure monitoring and maintenance (Section 10).
11. Information management and reporting (Section 11).

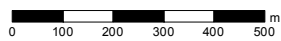
This plan has been prepared to accompany a Mining Proposal for the Karnup Sand Mining Project, as required for submission to the Department of Mines and Petroleum (DMP) under the provisions of the *Mining Act 1978*. The plan has been prepared based on the information available at the time of writing. The plan will be progressively amended during the life of the project through regular reviews, as more information becomes available, or if circumstances relating to mine closure change.





**Figure 1-1: Regional location of the Project**

Scale 1:15,000 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas

Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Aerial image background: ESRI approx. 2010.

**Legend**

- Project area
- Tenement M70/1262



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## 2. Project summary

### 2.1 Project location, land ownership and tenure

The Karnup Sand Mining Project is located in the City of Rockingham approximately 48 km south of Perth (Figure 1-1). The Project is located 14 km south east of Rockingham and 18 km north east of Mandurah. The Project area is defined as the portion of M70/1262 that is west of the Kwinana Freeway boundary, as outlined by Figure 2-1, and will include the mining area, haul road (located within Miscellaneous Tenement L70/160), site compound and undisturbed land. The Project area is located within the City of Rockingham.

The Project area comprises predominately regrowth vegetation and six small wetlands. The majority of the Project area was cleared and planted with pine trees between 1965 and 1974 before the pine trees were cleared after 2004. Wetlands located within the Project area are ephemeral sumplands (i.e. only seasonally inundated) and include both Resource Enhancement and Conservation Category wetlands as determined by the Department of Environment Regulation (DER) (Strategen 2010), and will not be mined.

A portion of the Project area is a vegetated linear corridor on the western boundary of the Project area, and is an area of remnant bushland that includes foraging habitat for Black Cockatoos.

The central portion of the Project area also contains part of the DMP Explosive Reserve Facility adjacent to the western Project area boundary. A portion of the Explosive Reserve Facility is contained within M70/1262 and the balance is located to the west of the Project area on M70/1046 (currently held by Holcim Australia Pty Ltd [Holcim]) and M70/1241 (currently held by Holcim). The Explosives Facility will be relocated at the end of 2016 to the McLarty Site within the Myalup State Forest Shire of Waroona and Shire of Harvey. Sand mining will be undertaken within the Explosives Reserve Facility area once it is decommissioned and removed.

M70/1262 is dissected by the Kwinana Freeway, forming the eastern Project area boundary. The surrounding land use is a combination of low density rural residential housing, market gardens and special rural lots that include activities such as horse agistment. A pedestrian underpass was also constructed under the Kwinana Freeway approximately 50 m south of the northern Project area boundary (Eclipse Resources 2009).

Mining tenements relevant to the Project are listed in Table 2-1 and presented in map form in Figure 2-2.

Table 2-1: Status of mining tenements

Tenement ID	Tenement name	Tenement area (ha)	Type	Owner
M70/1262	Eclipse Resources Pty Ltd	225 ha	Mining	Eclipse Resources Pty Ltd
L70/160	Holcim Australia Pty Ltd	1.9 ha	Miscellaneous	Holcim Australia Pty Ltd

The types of disturbance to occur on the site will include:

- excavation of sand
- construction of haul roads and access roads
- site compound
  - \* offices
  - \* ablutions
  - \* laydown/hardstand areas
  - \* generator and storage
- overburden and vegetative stockpiles.

Figure 2-2 presents the locations of the various types of disturbance to occur across the site.

The site and postal addresses are:

Site address: Stakehill Road  
Baldivis WA 6171

Postal address: c/- PO Box 739, Como, Western Australia 6152

The Project comprises the following major components:

- haul road and access tracks
- site compound area
- mining area.

The proposed mining area is adjacent to the western Project area boundary. A haul road will traverse the Project area from the active mining areas to Stakehill Road during Stage 1. Once Stage 1 is completed Holcim will construct a haul road within Miscellaneous Licence tenement L70/160 for use by both Holcim and Urban Resources staff and customers. Urban Resources will extend the haul road at an undefined time in the future to access and transport sand from Stages 2 and 3.

The site compound area will be comprised of limestone hardstand and include the following infrastructure:

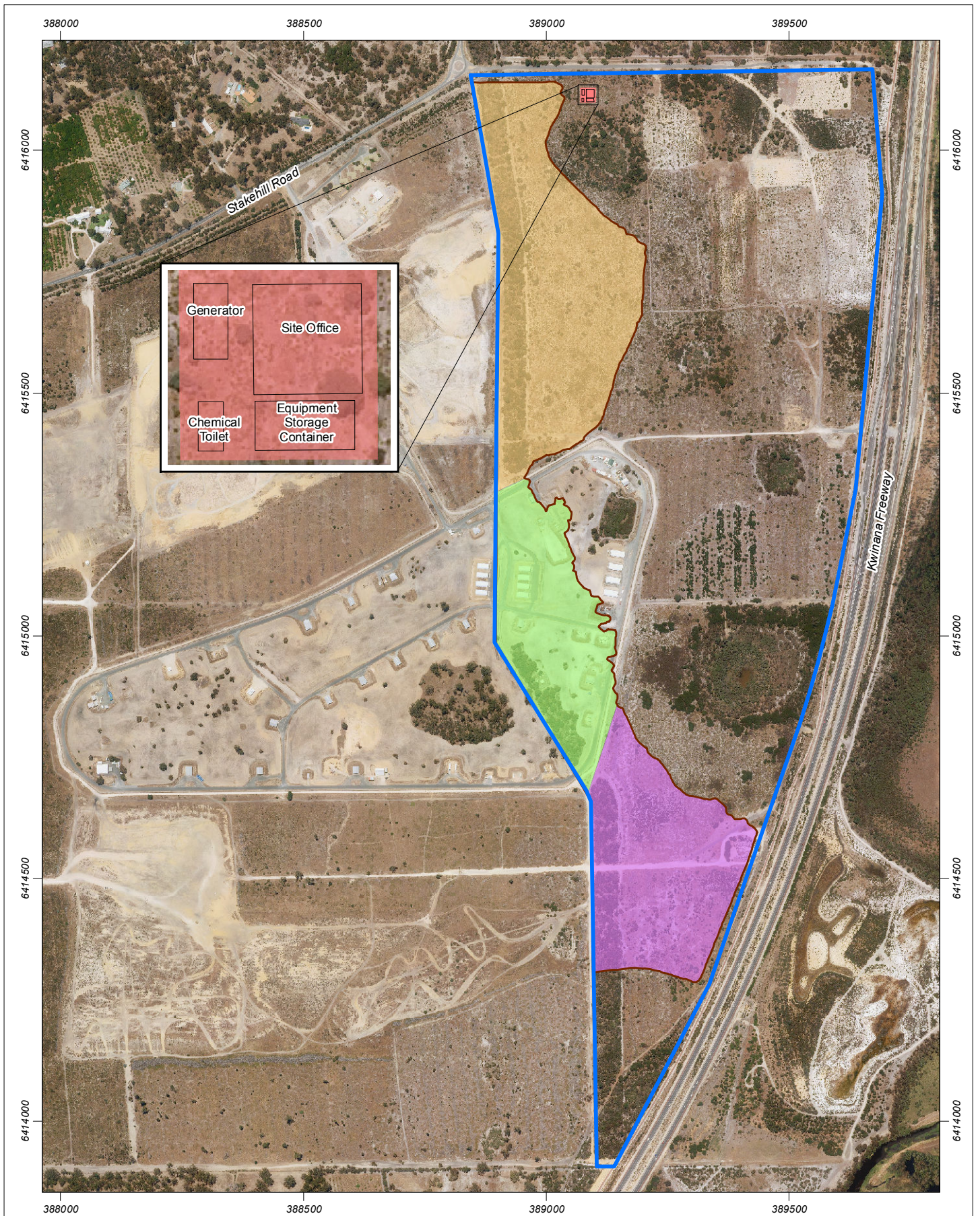
- site office and administration
- generator and storage
- refuelling pad and equipment storage.

As stated above, mining will be undertaken in areas of regrowth vegetation, vegetation on the western boundary of the Project area and the decommissioned Explosive Reserve Facility area.

For the purpose of closure planning, the site has been grouped into domains to enable better management and prioritisation of works going forward. The Project includes the following key domains:

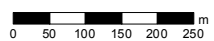
- infrastructure and ancillary areas
- mining area (in previously cleared and decommissioned explosives area)
- mining area (western boundary of the Project area to be potentially revegetated to Black Cockatoo foraging habitat—to be confirmed at a later date following discussions with LandCorp).





**Figure 2-1: Site plan – general layout**

Scale 1:10,500 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Tenement: DMP 2014.

Path: Q:\Consult\2015\URE\URE15096.01\ArcMap\_documents\I001\RevA\URE15096\_01\_R001\_RevA\_F002\_1.mxd

**Legend**

- Site compound boundary
- Project area
- Mine area

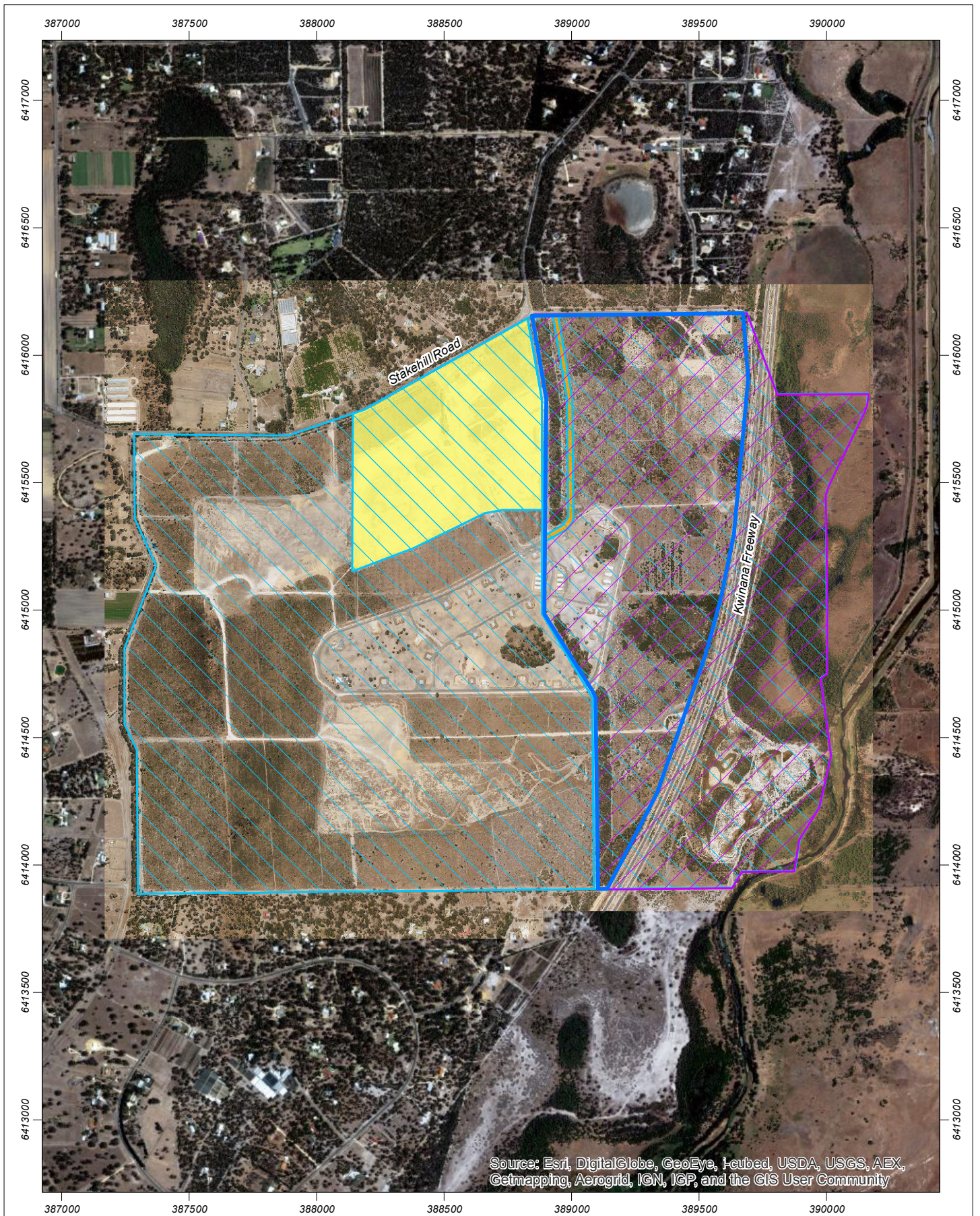
**Mining stages**

- Stage 1
- Stage 2
- Stage 3



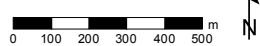
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**Figure 2-2: Mining tenements and disturbance types**

Scale 1:20,000 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas

Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Tenement: DMP 2014.

**Legend**

- |              |           |          |
|--------------|-----------|----------|
| Project area | M70/1262  | L 70/160 |
| M70/1241     | M 70/1046 |          |





### **3. Identification of closure obligations and commitments**

#### **3.1 Legal obligations register**

No legal obligations are established for the tenement or the Project to date. Permits are currently being sought for the project and the legal obligations will be updated into a register as they become available.

Urban Resources will develop the legal obligations register to record all site-specific conditions and commitments relevant to closure and rehabilitation. The register will include, when available, all legally binding conditions and commitments and/or legal obligations applicable under relevant State and Federal legislation. The Register will include safety obligations and non-legally binding commitments relevant to closure and rehabilitation.

Future revisions of closure objectives and completion criteria as described in this plan will be informed by the commitments and conditions.



## 4. Stakeholder consultation

### 4.1 Stakeholder consultation program

Stakeholder consultation has been undertaken by Urban Resources with respect to closure planning, with the objectives of:

- identifying relevant internal and external stakeholders
- identifying stakeholder issues, expectations and concerns
- enabling development of closure measures aligned to meeting reasonable stakeholder expectations
- assessing stakeholder issues and areas of concerns to ensure closure planning addresses these matters to the most reasonably practicable extent
- establishing collaborative relationships with stakeholders to assist with managing closure related expectations
- obtaining stakeholder feedback on proposed closure measures
- establishing a robust consultation approach to demonstrate that appropriate and effective consultation has been undertaken.

The consultation program was initiated in Q1 2015 that allowed Urban Resources to inform stakeholders on details of the project and to enable stakeholder comments to be considered in the preliminary engineering design. This provided the opportunity to modify the project in response to the issues raised and to consider these issues in the approvals process. Stakeholders have been engaged throughout development of this plan, and an ongoing dialogue will be maintained with stakeholders as the project progresses towards closure.

### 4.2 Identification of key stakeholders

Key external stakeholders consulted during preparation of this MCP include:

- City of Rockingham
- Department of Mines and Petroleum
- Department of Water
- Department of Parks and Wildlife
- LandCorp
- Holcim.

Key internal stakeholders consulted as part of the MCP preparation and planning include:

- Mine Manager
- Mine supervisor.

### 4.3 Stakeholder consultation register

The consultation program has included briefings with key stakeholders including an opportunity to comment on the proposed mining activities, particularly in relation to final land use.

Stakeholder consultation is presented in Table 4-1.

Table 4-1: Stakeholder consultation

Stakeholder Engagement Register 2015					
Date	Description of engagement	Stakeholder	Stakeholder comments / issue	Proponent response and/or resolution	Stakeholder response
18 May 2015	Meeting at City of Rockingham offices	City of Rockingham	Final land use Groundwater levels and final finished levels	Strategen to provide additional information as requested	Additional information relating to impacts on flora and fauna requested (Strategen survey report). The City to seek further information from the executive team once the proposed mine plan was finalised.
23 March 2015	Email correspondence	DMP	Final land use Groundwater levels and final finished levels	-	-
16 April 2015	Meeting at LandCorp offices	LandCorp	Final land use Groundwater levels and final finished levels Mining Agreement	Provide final mine plan and Mining Proposal to LandCorp for review / endorsement	Agreement on challenging final groundwater levels. Confirmation of proposed final land-use. Proposed schedule for presentation of proposed mine plan and submission of approvals documents

A consultation register is maintained by Urban Resources and proposes to continue consultation on closure issues with relevant stakeholders as project implementation progresses and the register will be updated accordingly and published in future amendments of this plan. This forms part of an overall consultation strategy designed to ensure all parties maintain communication on closure issues as planning develops and the measures become more defined.

#### 4.4 Stakeholder engagement strategy

Urban Resources will continue to implement the stakeholder consultation program throughout project planning, implementation and when closure and rehabilitation activities are in the near future. The program will be implemented to ensure that engagement of stakeholders is undertaken and maintained throughout operations, and that the interests and concerns of key stakeholders have been considered.

The program will be rolled out to key stakeholders and other interested parties as the Project progresses. Urban Resources will consult with stakeholders through meetings, briefings and phone conversations as required.

## 5. Post-mining land use and closure objectives

### 5.1 Post mining land use

Urban Resources proposes to develop agreed final landforms and post-mining land use(s) consistent with stakeholder expectations. The overall post-mining land use is expected to be zoned as Parks and Recreation to support the adjacent proposed LandCorp residential development. The area will contain open parklands with potentially a vegetated corridor on the western boundary of the Project area which will focus on providing food resources for Black Cockatoos. However, as closure planning is in its early phase, this expectation is provisional, and may be modified as planning progresses, including further consultation with key stakeholders. The key considerations will align to ensuring the post-mining land use is:

1. Relevant to the environment in which the mine will operate.
2. Achievable in the context of post-mining land capability.
3. Acceptable to key stakeholders.
4. Ecologically sustainable in the context of the local and regional environment.

The land use hierarchy as presented in the mine closure planning guidelines (DMP/EPA 2015) will provide a guide to determine post-mining land use(s) as follows:

1. "Natural" ecosystems will be reinstated as similar as possible to the original ecosystem.
2. An alternative land use with higher beneficial uses than the pre-mining land use will be developed.
3. The pre-mining land use will be reinstated.
4. An alternative land use will be developed with beneficial uses other than the pre-mining land use.

### 5.2 Closure planning objectives

The ANZMEC Strategic Framework on Mine Closure (ANZMEC 2000) advises that the objective of mine closure is to "*prevent or minimise adverse long-term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land-use based on an agreed set of objectives.*"

Urban Resources has adopted this principle as the closure planning objective for the Karnup Sand Mining Project.

Specific closure objectives for key closure outcomes have been developed in accordance with these broad objectives and are presented in Section 6.

## 6. Development of completion criteria

Completion criteria and associated performance indicators have been developed to define measurable rehabilitation and mine closure objectives. Completion criteria are effectively defined by EPA (2006) as “*Specific targets (defined by measured outcomes or milestones) are required for monitoring and reporting of rehabilitation projects.*”

Given the early stage of project implementation and closure planning, the completion criteria presented in this plan are indicative, based on a conservative estimate of closure performance and on the best available data. As project implementation proceeds, more information will become available and more comprehensive and detailed completion criteria will be progressively determined. This will be documented in amended plans following the three-yearly reviews required by the DMP/EPA (2015) guidelines.

Completion criteria as currently proposed for the Karnup Sand Mining Project are presented in Table 6-1. Table 6-1 presents objectives and criteria relevant to the key domains as well as general closure aspects.

The objectives and criteria presented with respect to the various domains take account of the potential post-closure land uses that might apply to each domain.

Table 6-1: Completion criteria for key domains

Aspect	Closure objective	Completion Criteria	Measurement Tools
Key domains			
Infrastructure	To ensure that all infrastructure not required to remain post-closure is removed, reused or recycled in accordance with approval requirements.	All infrastructure (including barriers, tracks, buildings and signs) to be removed unless retention is agreed in writing with relevant Government agencies and the local Shire.	Verification from Government agencies.
Mine area	To design and build a safe and stable mine area that can be integrated into surrounding areas.	All sites to be safe to access as determined by DMP. Any overburden/topsoil/vegetative material stockpiles will backfilled into mine void or respread on site.	Geotechnical investigations and audit. Soil monitoring.
	Topography and surface drainage are consistent with, and complementary to the overall landscape.	All constructed landforms and disturbed areas are to be stable and resistant to erosion, or at least comparable to naturally-occurring erosion in the area.  Drainage should be consistent with LandCorp's requirements for future land use.	
	The western boundary of the project area is to be revegetated to establish native vegetation suitable for Black Cockatoo foraging, and appropriate for the area and final land use.*	Flora and vegetation on the rehabilitated site is representative of the target ecosystem as defined by species richness, diversity, and density, weed species number and weed density targets to be developed.	Rehabilitation monitoring report.
General aspects			
Land use	To ensure that an agreed post-mining land use exists and has been communicated to all relevant stakeholders.	Land use and access agreements have been/will be finalised with LandCorp and conveyed to key stakeholders.	Verification from key stakeholders.
Contamination	To ensure that there is no significant contamination or risk of contamination to the existing soils and water resources of the project area.	No contaminated sites (as defined by the <i>Contaminated Sites Act 2003</i> ) requiring ongoing management beyond five years post-closure.	Contaminated sites inspections/ audits over LOM area. Final DER audit.
Topsoil	Maximise recovery and maintain quality of topsoil, and utilise direct return where practicable, to conserve soil structure, nutrients, seed, and soil biota.	Topsoil sources are appropriately utilised in rehabilitation and closure activities.	Rehabilitation progress reported in the Annual Environmental Report.
Fauna	Western boundary rehabilitated areas will provide fauna habitat and facilitate movement of fauna between rehabilitated areas and remnant vegetation.*	Key fauna habitat characteristics are present in rehabilitation, including vegetation structure, a diversity of flowering species and a developing litter layer.	Fauna habitat assessments. Flora and vegetation quadrat monitoring.
Wetlands	To ensure wetlands are maintained consistent with the pre-mining condition.	No disturbance within wetland buffer areas. Visual wetland monitoring shows no evidence of decreased wetland function.	Visual wetland monitoring.
Legal	To ensure that there is a low risk of occurrence of significant breaches of legal obligations and commitments following closure of the project.	Develop Mine Closure Plan consistent with DMP/EPA guidelines, updating every three years. Undertake stakeholder consultation throughout operations. Implement Mine Closure Plan.	Mine Closure Plan.

Aspect	Closure objective	Completion Criteria	Measurement Tools
Public health/ safety	Minimise hazards (including stability, subsidence) during rehabilitation and after closure.	Buildings and signage are removed. Excavations are filled. Mine voids are securely demarcated. Fencing and signage is erected regarding any residual safety issues. Rubbish is removed from the site, or encapsulated within waste rock dumps and landfills (if environmentally appropriate to do so).	Final risk assessment.
Visual amenity	To achieve rehabilitation and revegetation results that are compatible with the immediate and surrounding landscape.	Final landform will integrate with the surrounding landscape, as defined by design specifications to be developed.	Final landform audit with visual assessment.

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

## 7. Collection and analysis of closure data

This section of the plan provides:

- a summary of the most up-to-date available data on aspects of the physical and biological environment of the Project areas and surrounds, including chemical characterisation of mine materials
- an overview of the role of this plan regarding identification of information gaps and collection of new information to fill those gaps
- repositories of operational information such as spatial datasets and scheduling information.

Baseline and predictive assessments conducted to date are summarised below. This section presents available information and identifies where additional information will be collected throughout implementation of the project.

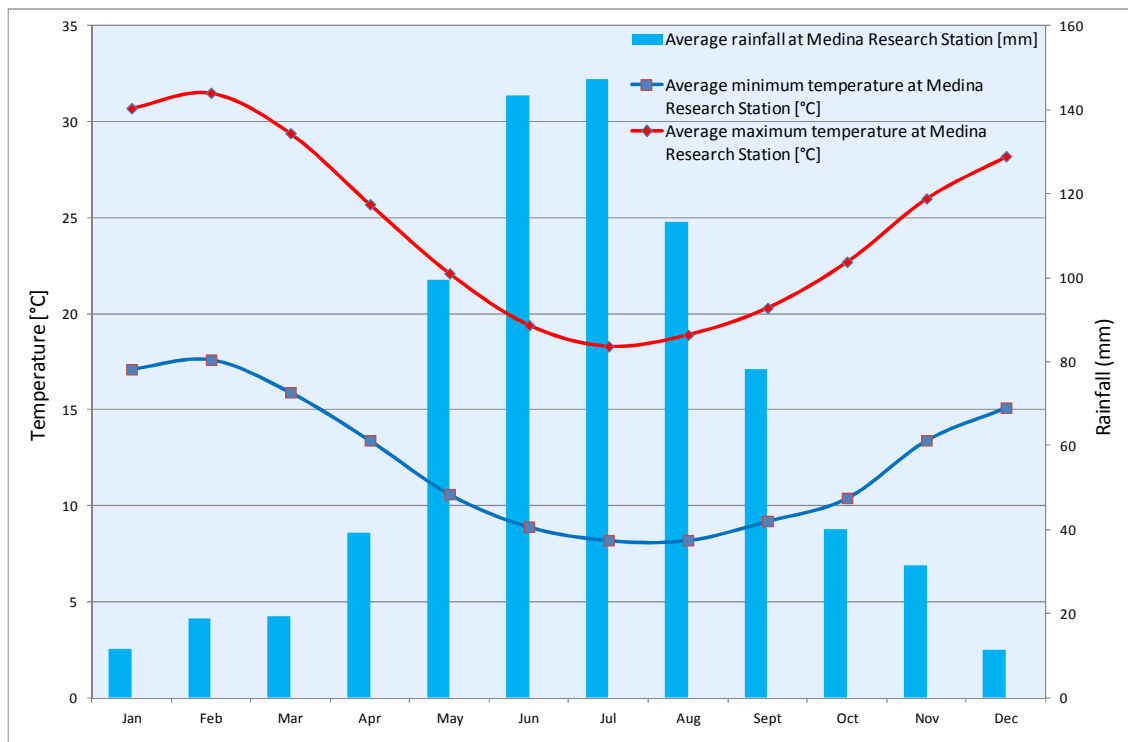
As rehabilitation and closure planning progresses, additional assessments relating to closure will be identified and implemented based on gaps in closure data. Closure domains, information gaps, and closure risks will be updated in each revision of this plan, as appropriate.

### 7.1 Baseline environmental data

#### 7.1.1 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 7-1).

Average annual rainfall recorded at Medina since 1983 is 753.4 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°C in December to 31.5°C in February (BoM 2015). Lowest temperatures occur between June and September, with average monthly minimums ranging from 8.2°C in July to 9.2°C in September (BoM 2015).



Source: BoM (2015)

Figure 7-1: Mean monthly climate characteristics

### 7.1.2 Geology

The Rockingham Mapsheet in the Perth Metropolitan Region 1:50,000 Environmental Geology Series describes the geology across the majority of the Project area as 'Bassendean Sand' (Figure 7-2) 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 underlying geology at six pockets in the Project area is described as 'Peaty Clay' comprising dark grey and black peaty clay with variable organic content and some sand in places, of lacustrine origin (Gozzard 1983). These pockets are associated with the six wetlands present in the Project area.

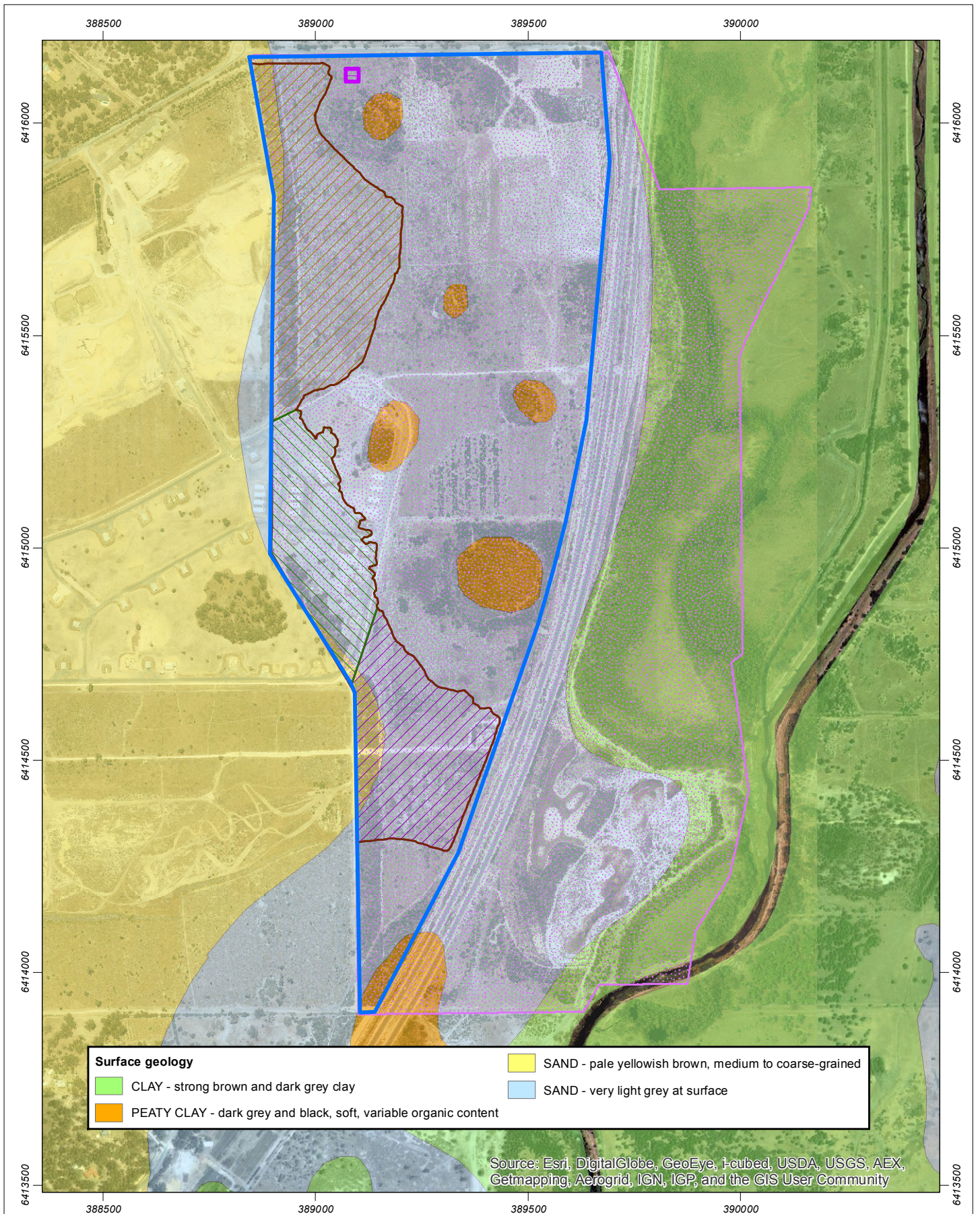
Two small slithers of 'Sand derived from Tamala Limestone' occur within the Project area adjacent to the western boundary which is described as pale yellowish brown, medium to coarse-grainer, sub angular quartz, trace of feldspar, moderately sorted, or residual origin (Gozzard 1983).

The balance of M70/1262 and the low lying land adjacent to the Serpentine River east of the Project Area is described as 'Guildford Formation clay' and comprises a strong brown and dark grey clay, plastic in places, soft when wet, with variable silt content and of alluvial origin (Gozzard 1983). The geology to the west of the Project area is described as 'Sand derived from Tamala Limestone'.

### 7.1.3 Topography

The topography of the Project area is influenced by a north-south ridge located along the western Project area boundary and a gentle slope towards the banks of the Serpentine River in the east (Golder Associates 2006). The Project area remains relatively consistent with the pre-plantation topography and elevations vary between approximately 2 m and 13 m Australian Height Datum (AHD) (Figure 7-3).





**Figure 7-2: Geology of the Project area**

Scale 1:12,000 at A4

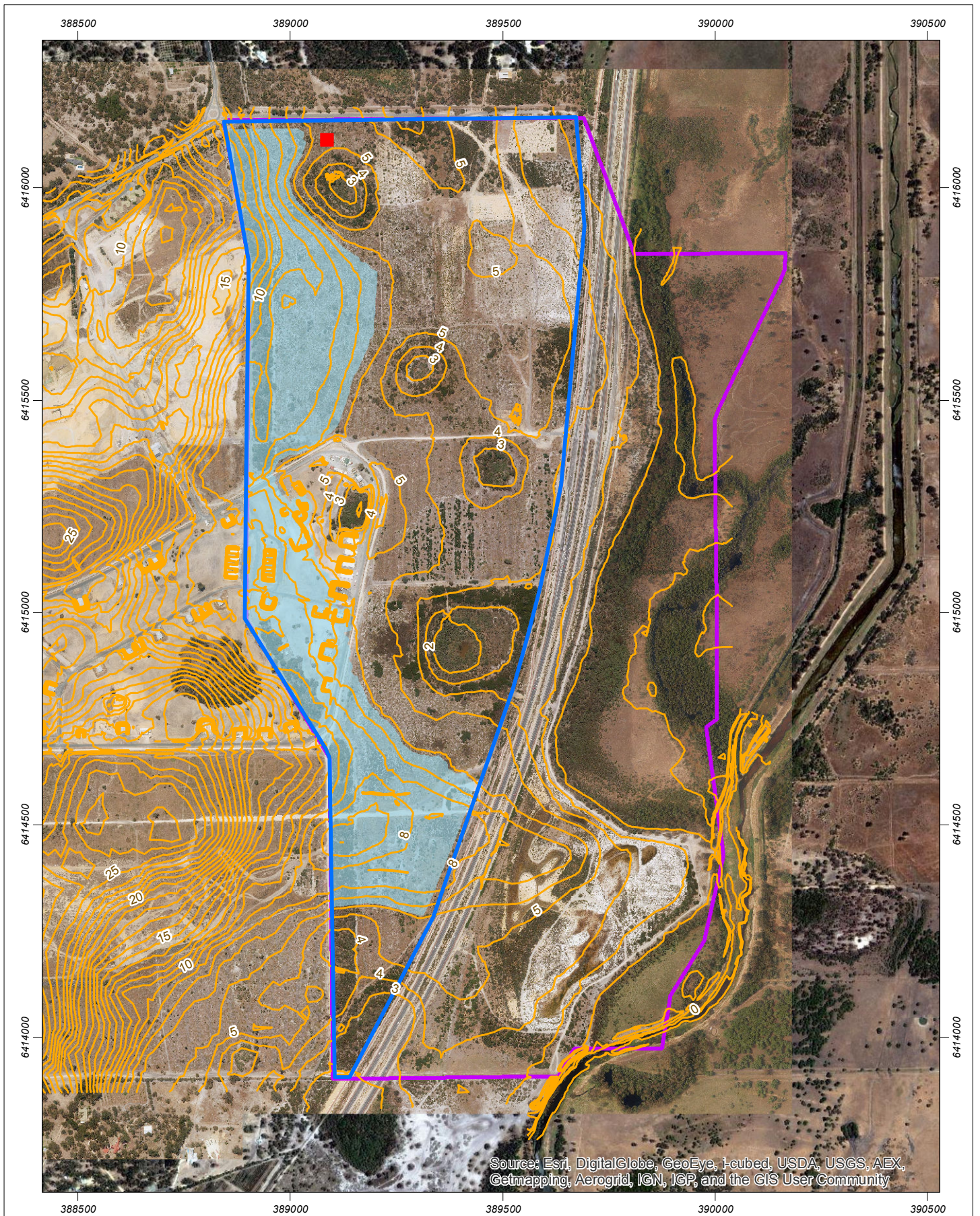
Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015  
 Author: JCrute  
 Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Geology 1:50,000: DMP 2014.

**Legend**

- |  |                        |  |                   |  |         |
|--|------------------------|--|-------------------|--|---------|
|  | Site compound boundary |  | Mine area         |  | Stage 1 |
|  | Project area           |  | Tenement M70/1262 |  | Stage 2 |
|  |                        |  |                   |  | Stage 3 |

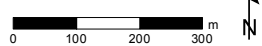






**Figure 7-3: Topography of the Project area**

Scale 1:12,000 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas

Date: 5/06/2015

Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Contours: Client 2015.

**Legend**

- Surface elevation (mAHD)
- Site compound boundary
- Project area
- Mine area
- Tenement M70/1262





## 7.1.4 Hydrogeology

### *Regional groundwater*

The Project area is located within the Stakehill Mound groundwater subregion of the Perth Basin (GHD 2014). The subregion covers an area of approximately 150 km<sup>2</sup> 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<sup>2</sup>/day (Golder Associates 2010).

### *Groundwater levels and flow direction*

Golder Associates undertook monthly groundwater level monitoring of the Project area and surrounds between March 2007 and March 2010 (Golder Associates 2010) and further quarterly groundwater monitoring was undertaken by Strategen between April 2013 and January 2014 (Strategen 2014).

Groundwater levels beneath the Project 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).

Groundwater levels for the Project area reflect the Assessment Groundwater Level (AGL) set through the Karnup District Water Management Strategy (DWMS) (GHD 2014). This document and the associated AGL has been approved by the Department of Water and the City of Rockingham. The AGL is proposed to be used to set finished levels for future urban development in the Karnup district. Data from the Project area was used in calibrating the AGL model (GHD 2014). The AGL has been set to represent a peak groundwater level under a wet rainfall scenario (GHD 2014), condition that have not been reflected in groundwater monitoring undertaken for the Project area. As such, the AGL is considered a conservative groundwater level for the area and is above water levels recorded on site (Strategen 2014).

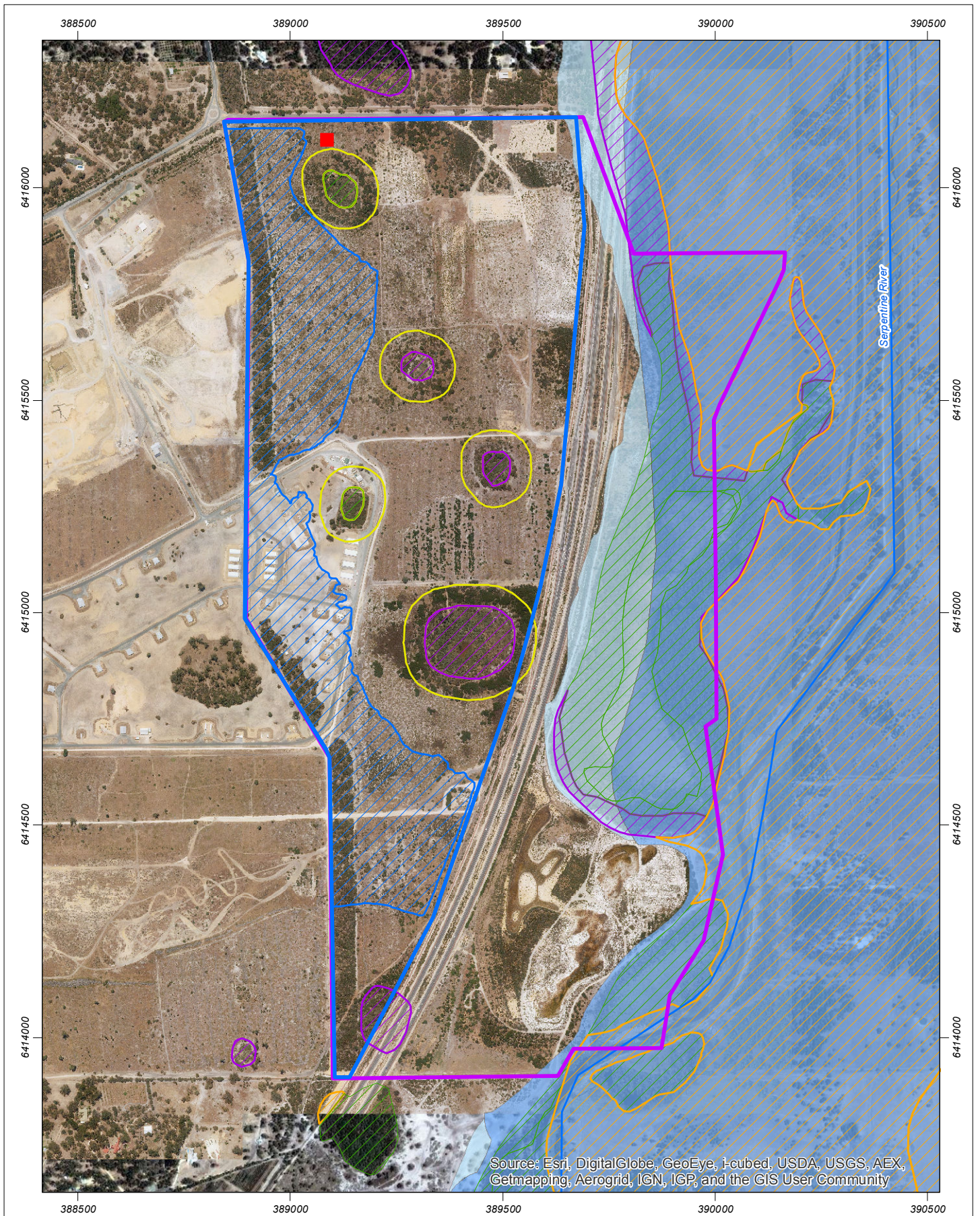
The AGL is outlined in Figure 7-5 and is generally less than 3.25 mAHD beneath the Project area. Based on the AGL contours there appears to be a groundwater saddle present beneath the Project area with groundwater to the east of this saddle flowing east towards Serpentine River, while groundwater west of the saddle flows in a westerly direction towards the Indian Ocean.

### *Groundwater quality*

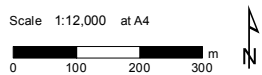
Strategen undertook four quarterly groundwater monitoring events (monitoring of levels and quality) between April 2013 and January 2014 at two bores within and five bores surrounding the Project area (Strategen 2014). Monitoring demonstrated groundwater pH beneath the site and surrounds varies between 6.1 and 7.7 pH units and is generally within the ANZECC and AARMCANZ (2000) guideline values for slightly disturbed ecosystems of 6.5 to 8.5 pH units. Groundwater below the Project area and surrounds is generally fresh with electrical conductivity (EC) values varying between 0.20 mS/cm and 2.89 mS/cm. EC levels were generally within the ANZECC and AARMCANZ (2000) guideline values for slightly disturbed ecosystems in south-west Australia of 0.3-1.5 mS/cm (Strategen 2014).

Median nutrient concentrations were generally below the ANZECC & ARMCANZ (2000) guidelines and are considered comparatively low in the context of the broader Peel-Harvey catchment (Strategen 2014). Concentrations of heavy metals below the Project area and surrounds generally met ANZECC & ARMCANZ (2000) guideline values and is considered to be consistent with concentrations observed in the southern suburbs of Perth (Strategen 2014).





**Figure 7-4: Surface water and wetlands of the Project area**



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015  
 Author: JCrute

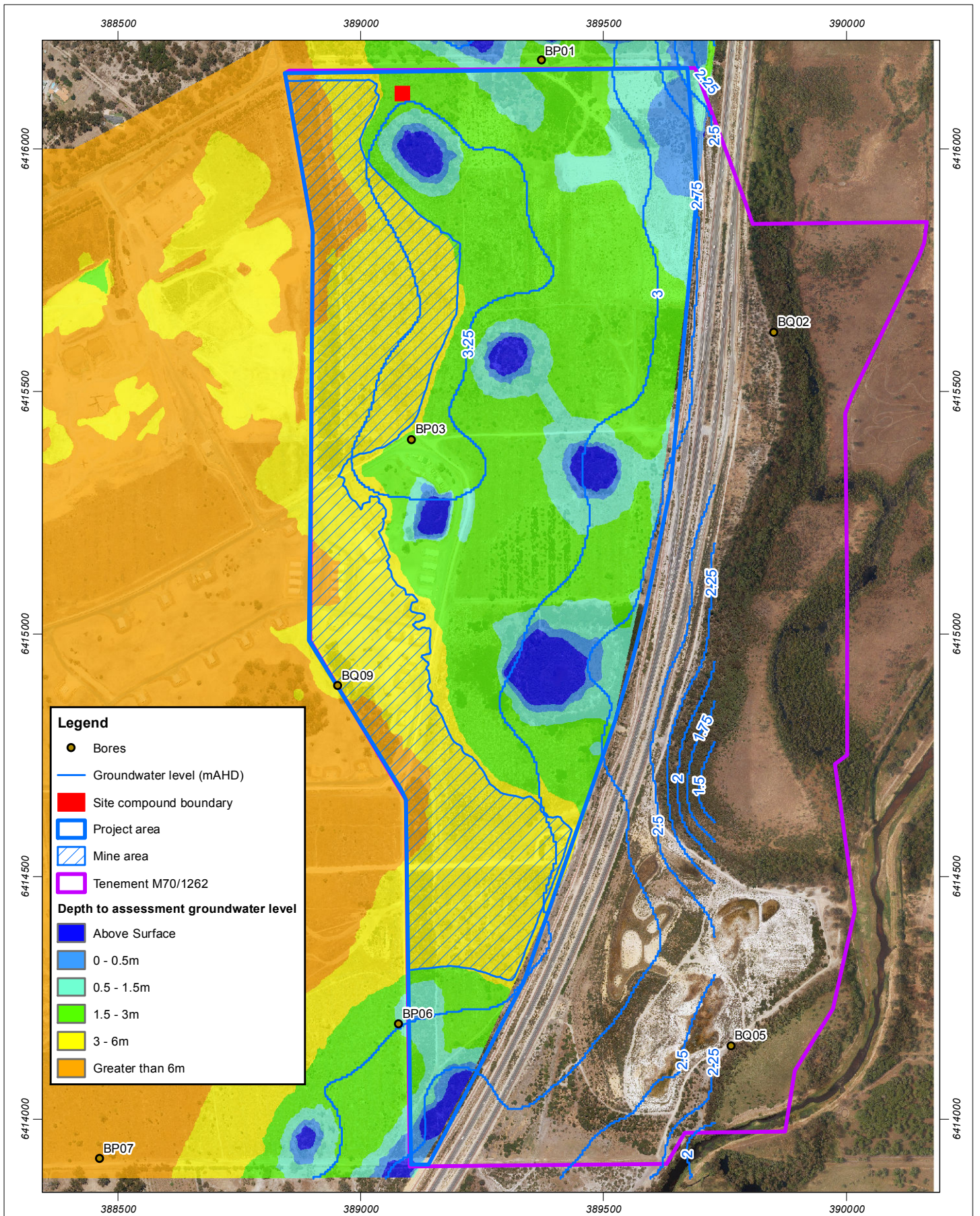
Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Wetlands: DPAW 2014. Flood: DoW 2014.

**Legend**

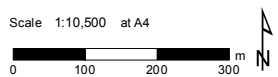
- River
- Site compound boundary
- Project area
- Mine area
- Floodway
- Flood fringe
- 50m wetland buffer
- Tenement M70/1262
- Conservation
- Multiple Use
- Resource Enhancement







**Figure 7-5: Groundwater of the Project area**



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015  
 Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. GW data: LandCorp 2014.





### 7.1.5 Hydrology

The Project area lies in the catchment of the Serpentine River which flows the Peel-Harvey Estuary approximately 20 km south of the Project area. A small portion of the Project area near the north-eastern boundary is located within the 1 in 100-year Average Return Interval (ARI) floodway and flood fringe of Serpentine River (Figure 7-4); however, this part of the Project area will not be disturbed by the Project.

Rain falling on the Project area is expected to infiltrate due to the high permeability of the local sands. Surface water is not expected to flow from the Project area in the 1 in 100-year ARI event. The Project 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 Project area, surface water would be expected to characteristically follow the natural topography to the east towards Kwinana Freeway and Serpentine River. The wetlands in and east of the Project Area, adjacent to the Serpentine River, are subject to seasonal inundation (Golder Associates 2006). Surface water management infrastructure is already present along Kwinana Freeway and would convey any flows from the Project area (if any) to Serpentine River.

#### *Wetlands*

A north-south running chain of seasonally damp and inundated wetlands occur in the eastern portion of the Project 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 (Figure 7-4). All wetlands within the Project area were assessed in 2006 to have been in a degraded state and substantially invaded by weeds (Bancroft & Bamford 2006). A recent inspection of these wetlands in May 2015 confirmed that the 2006 findings are still valid and the wetlands are degraded (Strategen 2015).

Wetlands located within the Project area are ephemeral sumplands (i.e. only seasonally inundated) and include both Resource Enhancement and Conservation Category wetlands as determined by DER (Strategen 2010). These wetlands are considered to represent an expression of local groundwater levels.

### 7.1.6 Landform and soils

The Project 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 Project area is characterised predominately by Bassendean Sand (Figure 7-2). Mining will target these Bassendean Sands that are predominately light grey at the surface before becoming yellow at depth and of aeolian origin.

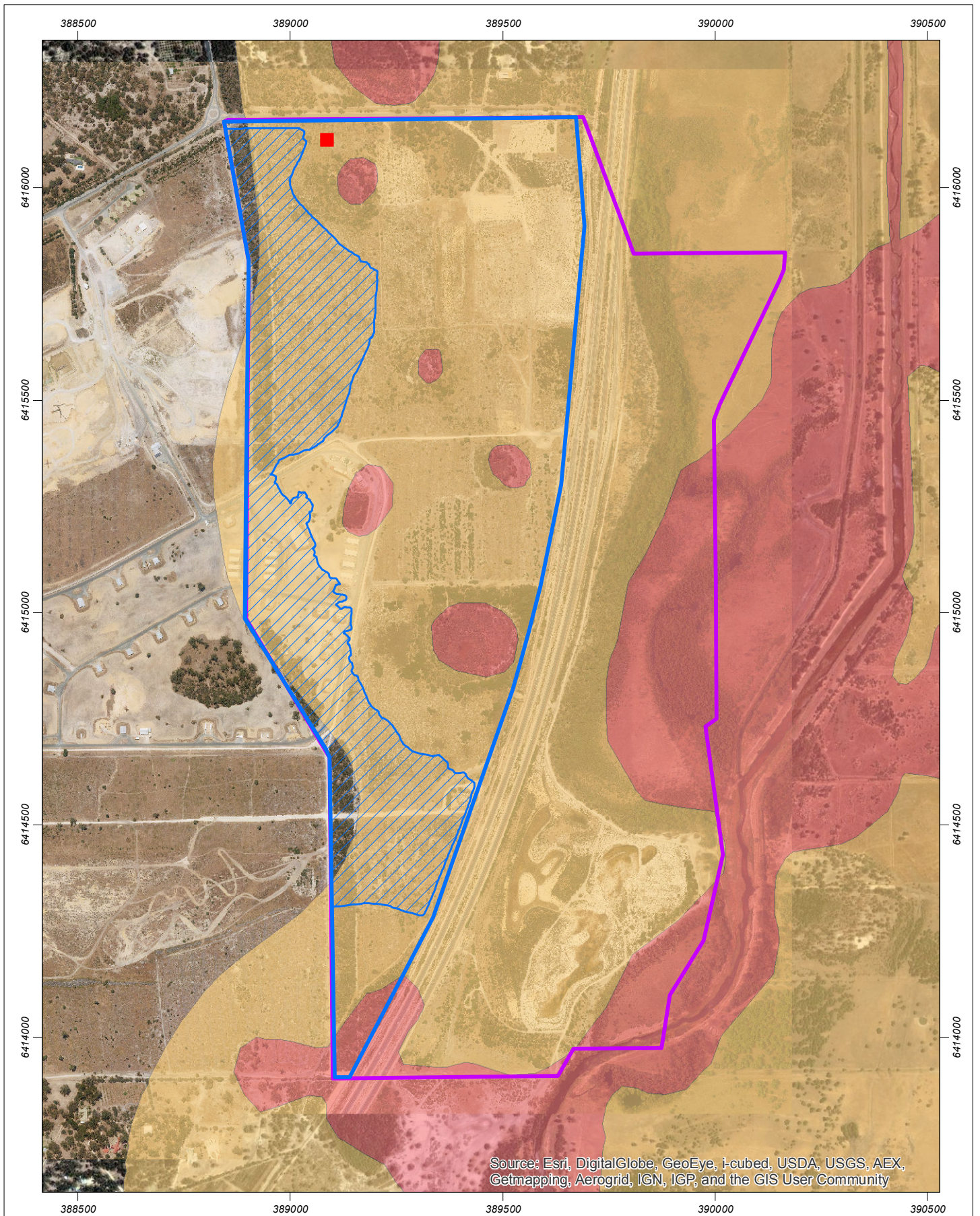
#### *Acid sulfate soils*

Acid Sulfate Soils (ASS) are naturally occurring soils, sediments and peats that contain iron sulfide or sulfide oxidation products. When ASS are disturbed and exposed to oxidising conditions, the iron sulfides can oxidise to produce sulfuric acid, iron precipitates and low pH groundwater with elevated concentrations of dissolved metals such as aluminium, iron and arsenic. Although ASS are typically benign when undisturbed in the natural environment as they are in an anoxic state, the dewatering, excavation and/or stockpiling of ASS that lies below the naturally occurring watertable may promote the oxidation of these soils and the occurrence of these adverse environmental impacts (DoE 2003).

A search of the WA Atlas ASS Swan Coastal Plain risk map (Landgate 2015) (search conducted 21 April 2015) located six areas classified as Class 1 (High to Moderate risk of ASS occurring within 3 m of natural soil surface) within the Project area associated with the 'Peaty Clay' underlying the wetlands (Figure 7-6). The majority of the balance of the Project area is classified as Class 2 (Moderate to Low risk of ASS occurring within 3 m of natural soil surface) associated with the mapped 'Bassendean Sand'; however, there are two slithers of land adjacent the western Project area that is mapped as having nil ASS risk and are associated with the mapped 'Sand derived from Tamala Limestone' (Figure 7-6).

The mining area is mapped as either have a Class 2 or nil risk of ASS being encountered within the top 3 m of natural soil surface (Figure 7-6).





**Figure 7-6: Acid Sulfate Soil mapping of the Project area**

Scale 1:12,000 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015  
 Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. ASS: DER 2014.

**Legend**

- Site compound boundary
  - Project area
  - Mine area
  - Tenement M70/1262
- ASS risk category**
- High to moderate risk
  - Moderate to low risk





### 7.1.7 Flora and vegetation

The Project area occurs within the Swan Coastal Plain 2 'Interim Biogeographic Regionalisation for Australia' 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).

The majority of the Project area was identified to be in various stages of natural regeneration following the clearing of existing pine plantations from approximately 2004 (Strategen 2015). Five native vegetation types (VTs), in addition to cleared areas and residual pine plantation, were defined and mapped within the Project area (Figure 7-7):

1. VT 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 (natural regeneration of cleared pine plantation).
2. VT 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 (remnant vegetation).
3. VT 3: *Jacksonia sternbergiana* and *Adenanthos cygnorum* subsp. *cygnorum* mid shrubland over *Conostylis aculeata* and *Lyginia barbata* low sparse sedgeland (natural regeneration of cleared pine plantation).
4. VT 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 (natural regeneration with rehabilitation).
5. VT 5: *Eucalyptus* sp. (planted) open woodland over *Acacia saligna*, *Jacksonia furcellata* and *Kunzea glabrescens* tall sparse shrubland over *Eragrostis curvula* low sparse tussock grassland (mixture of naturally regenerated vegetation with additional planting).

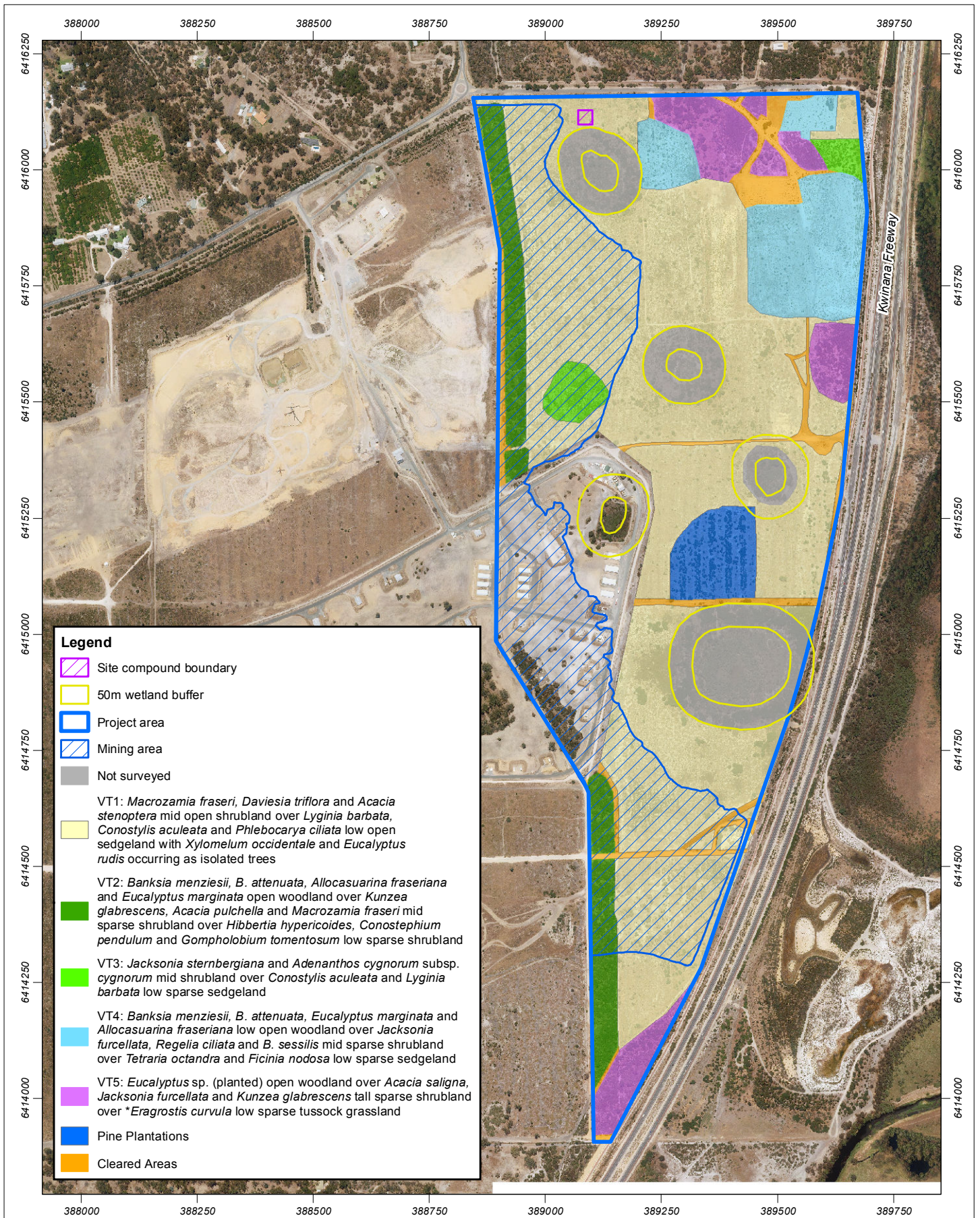
Vegetation condition within areas of natural regeneration was identified as Good and retained *Banksia* woodland on the western boundary of the Project area was identified as Very Good (Strategen 2015).

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were identified as having the potential to occur within the Project area.

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 in the Project area based on specific habitat requirements (Strategen 2015).

No Threatened flora species pursuant to Schedule 1 of the WC Act (as listed by the Department of Parks and Wildlife) or Priority flora species (as listed by Western Australian Herbarium) were recorded within the Project area (Strategen 2015).





**Figure 7-7: Vegetation types mapped within the Project area**

Scale 1:10,997 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015  
 Author: JCrute  
 Source: Aerial image: Landgate, flown 11/2014.



### 7.1.8 Terrestrial fauna

A desktop fauna assessment was conducted using a series of databases including NatureMap and the EPBC Protected Matters Search Tool. Bamford Consulting Ecologists undertook a fauna survey of an area encompassing some parts of the Project area and adjacent wetlands (Bancroft & Bamford 2006). It should be noted that in 2006, the majority of the Project area would have been occupied by pine plantation. During the most recent assessment undertaken by Strategen in 2015, the Project area comprised remnant native woodland vegetation, historical pine plantations and natural regeneration in areas which were previously cleared (Strategen 2015).

A desktop assessment of the likelihood of conservation significant (Threatened or Priority) species occurring within the Project area was undertaken based on results presented by Bancroft & Bamford (2006). The conservation status of each species was updated based on current listings provided by Parks and Wildlife (2007, 2014) and Department of the Environment (2015a, 2015b). Likelihood of occurrence was also updated (where required) based on the change in vegetation within the Project area between 2006 and 2015.

The only conservation significant fauna species considered to have suitable habitat present within the Project area and therefore a likely to occur are three species of Black Cockatoo (Carnaby's, Forest Red-tailed and Baudin's) and the Rainbow Bee-eater (Strategen 2015). The habitat most likely to support the Rainbow Bee-eater is associated with wetland areas that will not be impacted by the Project. Threatened native mammals and ground-dwelling birds are unlikely to occur due to lack of suitable habitat and presence of introduced predators and competitors (cat footprints were observed and the area is home to a large number of goats). Migratory birds have the potential to utilise the Project area for habitat due to the presence of wetlands, but are unlikely to be present for prolonged periods of time (Strategen 2015).

### 7.1.9 Social environment

#### *Aboriginal heritage*

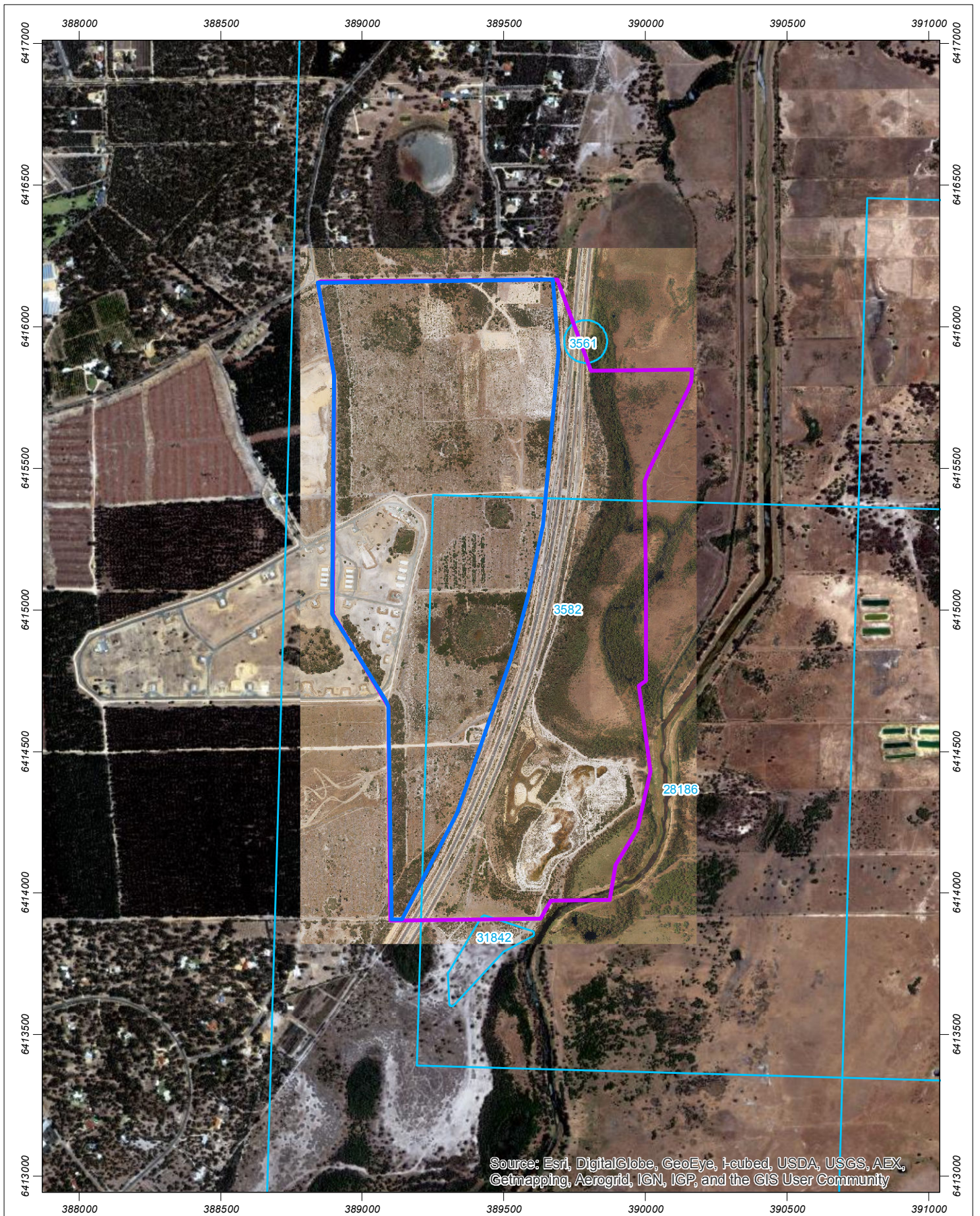
A search of the Department of Aboriginal Affairs (DAA) *Aboriginal Heritage Inquiry System* (DAA 2015) was conducted on 24 April 2015 of the Karnup locality found one Registered Aboriginal Site and one Other Heritage Places within the Project area (Figure 7-8).

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 Project 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 Project 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 Project area. It covers approximately 50% of the Project area and is registered as an Artefacts/Scatter. The site location is restricted; therefore, the exact location is unknown. Site 31842 Keralup Artefact Scatter 3 was identified fringing the southern boundary of M70/1262 and outside the Project area. Site 31842 is outside the Project area and is registered as an Artefacts/Scatter. There is no gender, file or access restrictions. Site ID 3561 (Legacy ID: S02444), Karnup, is also registered as an Artefacts/Scatter site and borders the north-eastern boundary of the Project area. This site consists of approximately thirty "low quality artefacts" covering an area of 60 m x 5 m (Big Island 2013).

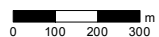
None of the identified Sites are considered to have the potential to be impacted by the Project. All sites are known or are likely to occur outside of the Project area. Site 28186, however the Site is mapped over a wide area and the Project area is not situated centrally to the mapped area and therefore it is unlikely that the Site intersects with the Project Area. Additionally Site 28186 is registered as an Artefacts/Scatter. Areas of the Project area proposed to be disturbed have previously been disturbed by clearing, pine plantation and clearing of the pine plantation again, including removal of stumps and roots.





**Figure 7-8: Aboriginal heritage sites within the Project area**

Scale 1:18,000 at A4



Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 5/06/2015  
 Author: JCrute

Source: Aerial image: Landgate, flown 11/2014. Background aerial image: ESRI online, approx. 2010. Heritage: DIA 2012.

**Legend**

- Project area
- Tenement M70/1262
- Aboriginal heritage sites





### *European heritage*

There are no 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 Project 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 Project 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. The Baldivis Tramway Reserve does not occur within the Project area.

The Geogrup Lakes Area (Place No. 16083, also known as the Serpentine River Wetlands) is registered on the Register of Heritage Places (Heritage Council State Heritage Office 2015) and may occur to the east of the Project area adjacent to the Serpentine River as the site is described as occurring from Barragup to Karnup but the heritage site outline is not defined.

### *Other social receptors*

#### Residents

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.

#### Kwinana Freeway and local traffic

The Kwinana Freeway is a major state transport route providing access to the Perth CBD and major roads between Perth and Pinjarra, and intersects Mining Tenement M70/1262 but is located outside the Project area.

## **7.2 Assessment of closure related issues**

From a consideration of the environmental data described in the foregoing sections, the collected data has been analysed to enable understanding of the issues and identification of knowledge gaps relevant to mine closure planning and implementation. The results of this analysis are presented in the following sections as relevant to the various environmental factors discussed in the previous sections.

### **7.2.1 Water resources**

There are not expected to be any direct impacts to groundwater by the Project that will result post-closure as there will be no dewatering activities or groundwater abstraction for water supply to facilitate mining.

Due to the sandy nature of the soils of the Project area, there is expected to be minimal stormwater runoff from the mine area as the Bassendean Sands have a high hydraulic conductivity and rainfall infiltrates rapidly. Flooding is not considered an issue in the mine areas due to the high infiltration capacity of the sands and the relatively high clearance to the groundwater table (greater than 1 m) in the area to be mined.

During operations the mine area will be designed, constructed and operated to avoid disruption of surface water flows and ensure that potential contaminants are not released to the environment.

### *Gaps and future data collection*

There are not expected to be any direct impacts to groundwater as a result of the Project following the completion of mining activities, as there will be no dewatering activities or groundwater abstraction for water supply to facilitate mining. Adequate sand will be retained on the site (i.e. 1.2 m above AGL) to ensure that waterlogging and inundation will not occur after rainfall events as a result of the Project. Groundwater flow directions will not be affected by the Project and therefore no further investigations relating to groundwater are required.

There are not anticipated to be any impacts to the wetlands as a result of mining. The mining operations have been designed to ensure a minimum of 1.2 m above AGL is maintained, to facilitate the Parks and Recreation final land use.

Urban Resources will construct the final landforms by backfilling of overburden material to ensure a safe and stable landform compatible with the surrounding areas. Surface water flows, including surface water interactions with the surrounding wetlands will be considered during final landform planning and design.

To ensure no impacts to the wetlands, Urban Resources will not disturb areas within the 50 m buffer between mining areas and the wetland. Urban Resources will undertake visual monitoring of the wetland to observe wetland function and any potential impacts that may have resulted due to mining activities.

#### **7.2.2 Landform and soils**

Prior to ground disturbance, the topsoil (nominally the top 10 cm of the soil profile) will be stripped and stockpiled away from the mining area to create a bund of no more than 2 m high to maintain biological integrity. Stockpiles will be located sufficiently distant from mining operations so that they will not be disturbed prior to being used in rehabilitation.

As the proposed activities will not disturb ground below the water table or any areas of high probability of ASS occurrence, it is unlikely that any ASS will be exposed or disturbed, therefore no further investigations into ASS are proposed to inform closure activities.

Following the completion of mining activities, topsoil and overburden will be utilised to backfill the mining pits to create a safe and stable soil profile to facilitate the final land-use of parks and recreation. Where mining of the remnant strip of vegetation on the western boundary of the site has been undertaken, overburden will be used to backfill this area to agreed final levels, prior to revegetation, consistent with the proposed target ecosystem.

### *Gaps and future data collection*

Urban Resources have undertaken preliminary investigations into the balance of material remaining following mine closure. The material balance will inform closure planning and assist in managing any soil and landform management requirements that may result from different soil and material types. Section 7.2.5 provides a summary of the material balance investigations proposed during the operational and closure planning phase of the Project.

The viability of the topsoil stockpiles will also be investigated to ensure that the topsoil to be used during rehabilitation will promote revegetation. If the topsoil is not viable, a process of remediation will be undertaken to add nutrients as required to the topsoil, and in extreme cases, replacement topsoil would be sourced from other sources, such as nurseries.

Geotechnical investigation will be undertaken to assess the stability of the areas being rehabilitated to ensure safe landforms will remain after closure.

### 7.2.3 Flora and vegetation

No threatened flora species pursuant to Schedule 1 of the WC Act or listed under the EPBC Act have been recorded within the Project area (Strategen 2015). *Dillwynia dillwynioides* and *Schoenus capillifolius* were recorded by Bennett (2006); however, these species were recorded in wetlands which will not be disturbed as part of the Project.

No TECs or PECs were identified as having the potential to occur within the Project area (Strategen 2015). No Declared Plant species pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) were recorded within the Project area.

The closure related issues in relation to flora and vegetation are re-establishing functioning fauna habitat for Black Cockatoos along the western boundary of the Project area<sup>1</sup>.

#### *Gaps and future data collection*

The major data gap in relation to flora and vegetation relates to the requirements for the potential rehabilitation along the western boundary to re-establish functioning vegetation types that will support foraging by Black Cockatoos. The final land use of this portion of the project area is currently unknown, further consultation and planning will be undertaken to confirm the final land use. To assist in developing an effective rehabilitation program for any areas that may be rehabilitated, Urban Resources will further investigate the vegetation type and composition proposed to be rehabilitated to inform the target ecosystem characteristics, including:

- species density
- percentage cover
- species diversity
- structure and function
- weed presence and density.

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 mid-storey levels. Rehabilitation efforts will focus on the VT 2 community to be re-established and an assessment on the methods for re-establishing this community will be undertaken. This assessment will allow the development of successful methods of rehabilitation and will form the foundation of a Rehabilitation Management Plan.

Rehabilitation requirements for the majority of the Project area, will involve soil profiling to a safe and stable landform, followed by respread of topsoil and seeding with pasture species prior to eventual use as parks and recreation.

### 7.2.4 Terrestrial fauna

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, and in the pine plantation which provides limited food resources for Carnaby's Black Cockatoo (CBC) only. Based on the results of the foraging assessment, the Project will result in the clearing of 6.54 ha of very good quality foraging habitat and 24.29 ha of low quality foraging habitat for CBC, Baudin's Black Cockatoo (BBC) and Forest Red-tailed Black Cockatoo (FRTBC). Signs of CBC foraging were observed in scattered occurrences within VT 2 (Strategen 2015).

<sup>1</sup> Revegetation of the western boundary of the Project area is to be confirmed following future discussion and agreement with LandCorp on final land use.

### *Gaps and future data collection*

The major data gap in relation to fauna relates to the requirements for the potential rehabilitation along the western boundary in regards to re-establishing functioning fauna habitat that will support foraging by Black Cockatoos. The closure planning process will develop appropriate measures to target terrestrial fauna habitat re-establishment in this area, using species identified in the target ecosystem and other black cockatoo foraging species.

#### **7.2.5 Materials balance and characterisation**

Urban Resources has undertaken a preliminary materials balance investigation, estimating the materials and final levels that will be left post-mining. Materials balance estimates undertaken to date have been demonstrated in the bulk earthworks natural surface design drawing provided in Figure 7-9. Materials anticipated to be used in rehabilitation include overburden and topsoil.

Urban Resources propose to undertake a more detailed assessment to identify materials available and required for use in rehabilitation of the site. The assessment will estimate the volume required for rehabilitation and closure, including the mulch/topsoil (or growth medium) required, taking into account the proposed land uses on-site; including the rehabilitated remnant vegetation and re-profile landform to enable parks and recreation land-use. Urban Resources will progressively undertake materials audits to confirm quantities available for rehabilitation and closure during the course of the Project, as part of progressive rehabilitation activities.

The mining process will involve clearing of vegetation, removal of topsoil and overburden material, followed by sand extraction. No waste products or problematic material, such as ASS will be disturbed as part of the operations. Urban Resources will continue to monitor any materials removed for sand mining that may be acid bearing. Outcomes of any ongoing monitoring and materials balance data will further guide post-closure management of the Project area.

### *Gaps and future data collection*

As no waste products or problematic materials, such as ASS, will be disturbed as part of the operations, no further investigations are proposed. However, Urban Resources will progressively undertake materials audits to confirm quantities available for rehabilitation and closure during the course of the Project as outlined above.

#### **7.2.6 Rehabilitation**

Urban Resources propose to develop agreed final landforms and post-mining land use(s) consistent with stakeholder expectations. The overall post-mining land use is expected to be Parks and Recreation consistent with the areas current zoning, to support the adjacent future residential development. The area will contain open parklands and recreation land use with a potential vegetated corridor along the western boundary of the Project area which will focus on providing food resources for Black Cockatoos.

The objective of rehabilitation is to re-establish the target ecosystem along the western boundary of the Project area and establish a land-formed soil profile able to support future Parks and Recreation land use. Rehabilitation efforts will focus on the VT 2 community where revegetation is proposed to reinstate Black Cockatoo foraging habitat. Completion criteria will be developed and refined, where applicable and appropriate, as more information comes available, through the life of the Project.

The following actions will be implemented as part of rehabilitation activities:

- stockpiling of cleared vegetation for use during rehabilitation
- stockpiling of topsoil in windrows to enable the soil profile to be reinstated during rehabilitation
- re-profiling of surfaces using site specific criteria developed from studies conducted to determine final design and levels in accordance with the Mine Plan
- mechanical treatment of compacted surfaces (ripping and scarifying)
- replacement of topsoil

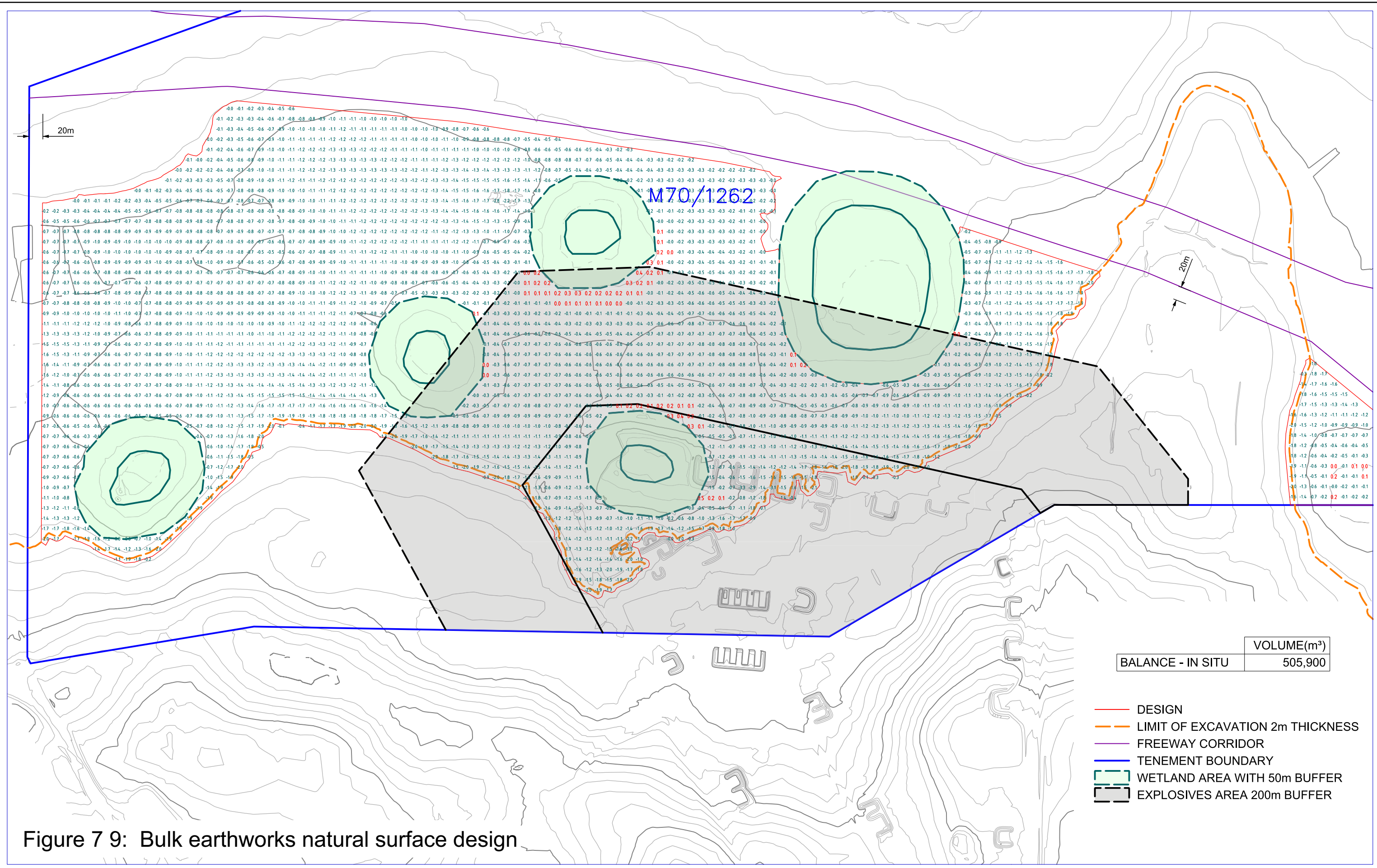


- spreading of stockpiled vegetation
- direct seeding of future development areas with pasture species
- potential revegetation of the vegetated corridor on the western boundary of the Project area via seeding with appropriate local species to be confirmed following further discussion and agreement with LandCorp
- monitoring to collect data on revegetation efforts and to demonstrate the ability of the area to support the post-mining land use
- development of contingency actions to address any deficiencies identified from the rehabilitation monitoring.

Following rehabilitation, sign off by landholders and other key stakeholders that rehabilitation is complete will be required.

***Gaps and future data collection***

A Rehabilitation Plan is to be produced that will include the above requirements and details soil handling, rehabilitation of the landscape, methodology for re-vegetation and the monitoring program to be implemented.



	VOLUME(m <sup>3</sup> )
BALANCE - IN SITU	505,900

- DESIGN
- LIMIT OF EXCAVATION 2m THICKNESS
- FREEWAY CORRIDOR
- TENEMENT BOUNDARY
- WETLAND AREA WITH 50m BUFFER
- EXPLOSIVES AREA 200m BUFFER

Figure 7 9: Bulk earthworks natural surface design

REV	DATE	AMENDMENT	SM	DRN	CKD
A	28/04/15	INITIAL ISSUE			
ORIG SIZE	ARCHIVE UR143_20-07-03A.dgn				
A1					

**NOTES**

1. THE VOLUMES ON THIS PLAN HAVE BEEN CALCULATED USING INFORMATION SUPPLIED BY THE CLIENT. THE ACCURACY OF THESE VOLUMES DEPENDS ON THE QUALITY OF THE DATA SUPPLIED.
2. THE VALUES ON THIS PLAN HAVE BEEN CALCULATED USING GRIDDED DATA INTERPOLATED FROM THE ORIGINAL SURVEYS
3. FILL VALUES SHOWN 3 IN METRES  
CUT VALUES SHOWN -3 IN METRES

**SCALE 1 : 2500**

DATUM  
VERTICAL A.H.D.  
HORIZONTAL PERTH COASTAL GRID 94, PCG94

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URBAN RESOURCES  
KARNUP TENEMENT M70/1262  
BULK EARTHWORKS  
NATURAL SURFACE TO DESIGN  
GRIDDED DIFFERENCES

DRAWING NUMBER **UR 143.20 - 07 - 03** REV **A**

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