



# **Holcim (Australia) Pty Ltd**

## Dunloe Sand Quarry Landscape Management Plan

April 2022

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# Table of contents

1.	Introduction.....	1
1.1	Aim.....	1
1.2	Objectives.....	1
1.3	Targets.....	1
1.4	Consultation.....	1
2.	Environmental requirements.....	5
2.1	Legislation.....	5
2.2	Conditions of approval.....	5
3.	Existing environment and impacts.....	9
3.1	Existing environment.....	9
3.2	Impacts.....	9
4.	Environmental control measures.....	14
5.	Monitoring and reporting.....	16
5.1	Environmental inspections.....	16
5.2	Monitoring.....	16
5.3	Contingency plan.....	18
5.4	Reporting.....	18
6.	Review and improvement.....	19

# Table index

Table 2-1	Consent conditions relevant to the LMP.....	5
Table 3-1	Threatened species.....	11
Table 4-1	Environmental controls and mitigation measures.....	14

# Figure index

Figure 3-1	Vegetation communities.....	10
Figure 3-2	Threatened flora locations.....	12
Figure 3-3	Threatened fauna recordings.....	13
Figure 3-3	Permanent photo points and monitoring locations.....	17

# Appendices

Appendix A – Rehabilitation and Revegetation Management Plan

Appendix B – Agency consultation

Appendix C – Long Term Management Strategy

Appendix E – Koala Management Plan

Appendix F – Monitoring forms



# 1. Introduction

This Landscape Management Plan (LMP) forms part of the Environmental Management Strategy (EMS) for Dunloe Sand Quarry. This LMP has been prepared to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06\_0030, the mitigation measures outlined in MOD2 (GHD 2017), the Environmental Impact Statement (EIS) (Planit 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation.

## 1.1 Aim

The aim of this LMP is to describe the rehabilitation and biodiversity management strategies, procedures, controls and monitoring programs to be implemented to prevent or minimise impacts and facilitate effective rehabilitation of Dunloe Sand Quarry during operational and post-operational phases.

## 1.2 Objectives

To achieve this aim, Holcim will:

- Rehabilitate areas identified in the Rehabilitation and Revegetation Management Plan (RRMP).
- Protect and manage land outside the approved disturbance areas.

## 1.3 Targets

The following targets have been established for the management of biodiversity and rehabilitation of Dunloe Sand Quarry:

- Screen the development from surrounding properties.
- Provide additional native habitat for flora and fauna through the creation of wildlife corridors.
- Protection and management of areas outside the disturbance areas.

Additional targets / completion criteria are included in the RRMP in Appendix A.

## 1.4 Consultation

Extensive consultation was undertaken with the local community during preparation of the EIS and MOD2. Any concerns identified by relevant stakeholders were addressed in the EIS and MOD2 mitigation measures which have been incorporated into this LMP.

As per CoA 27(a), Schedule 3, the Department of Industry (DoI), Office of Environment and Heritage (OEH) and Department of Primary Industries - Fisheries (DPI Fisheries) now all part of the Department of Planning, Industry and Environment (DPI&E) and Tweed Shire Council were consulted in relation to this LMP. The Community Consultative Committee (CCC) will be updated about the revised management plans at the next meeting.

A summary of the agencies' comments and the response is provided in Table 1-1 and evidence of the consultation is provided in Appendix B. DPI had no objection to the LMP and no response was received from DoI.

**Table 1-1 Response to agencies comments**

Agency comment	Response
Biodiversity and Conservation Division (previously OEH)	

Agency comment	Response
Revises the Landscape Management Plan to:	
Include the relevant qualifications and experience of the contributors to demonstrate compliance with Project Approval 27(a)	A letter dated 19/06/2009 from DPE approved the specialist who prepared the original Landscape Management Plan. As the current version is primarily a revision of the format, specialist input was not considered necessary.
Indicate in Table 2.1 that Project Approval Conditions 28 clauses (h) and (i) are addressed in Appendix C	The comment refers to the Koala Management Plan which is Appendix D. Conditions 28 clauses (h) and (i) in Table 2.1 updated to refer to Appendix D
Revises the Rehabilitation and Revegetation Management Plan to include Project Condition 28 in the list of conditions addressed	The Rehabilitation and Revegetation Management Plan has been updated (refer Appendix A).
Revises the Koala Management Plan to:	
Replace references to sections and tables of other management plans with the relevant content being referred to in order to minimise potential errors resulting from subsequent management plan revisions or amendments	References to relevant sections of other plans is considered appropriate because it avoids duplication and possible inconsistencies when one section is updated but not the other. Reference to Section 5.4.1 updated to Section 5.4 Form A in Appendix E includes koala observations, it is also included in the Environmental Inspection Checklist
Include mapping of koala habitat, koala records and potential koala movement corridors (i.e. habitat links) within and adjacent to the subject land and along the haul road between the quarry site and the Pottsville Road intersection	Table 3-1 and Figure 3-3 provide a description and map of koala sightings (noting the Flying Fox symbols in the north west of Figure 3-3 should be koalas)
Acknowledge the possibility of infrequent koala movement during hours of quarry operation	The Koala Management Plan has been updated to indicate the possibility of koala movements during quarry operations
Identify the most likely areas of interaction between koalas and quarry vehicles (e.g. koala habitat links)	Section 1.2.1 of the Koala Management Plan identifies the most likely areas of interaction – along the haul road adjacent to koala habitat
Include a proposed amendment to the quarry induction process to include an explanation of the legal consequences of unauthorised clearing of native vegetation on the quarry site	A dot point added to control B1 in Table 4-1 of the Landscape Management Plan
Include provision of compensatory koala food tree plantings as a contingency measure in the event of unauthorised clearing taking place	Compensatory koala food tree planting included in Table 1 of the Koala Management Plan
Ensure the proposed monitoring methodology focuses on identifying areas of koala activity susceptible to road strike rather than attempting to identify temporal changes in koala densities	Koala monitoring revised to focus on identifying areas of koala activity rather than temporal changes in koala densities
Reduce the proposed koala road-strike threshold for management action from three koalas for the year to any koala at any time	Updated
<b>Tweed Shire Council</b>	
General comment:	

Agency comment	Response
The bulk of the overall management plan comprises material from between 2006 and 2016 and it is difficult to interpret which previous study or work the published content refer to	Initial ecological investigations were undertaken and reported in the approved 2006 RRMP. This document was then updated in the 2016 RRMP, and attached to this LMP, to reflect the change to revegetation around the ponds. The RRMP is included to provide the historical context of the ecology and rehabilitation work undertaken for the site. Further amendments to the LMP are not considered necessary.
Hours of operation are proposed as the key threat mitigating factor in relation to koalas and vehicle strike. This does not satisfactorily account for winter, when the acknowledged high risk times of dawn and dusk occur during these hours of operation	Section 3.2.2 of the LMP and Section 1.2.1 of the Koala Management Plan have been updated.
The plan should note that koalas can be on the ground at any time of day or night	Section 1.2.1 of the Koala Management Plan has been updated.
The plan should also identify the times of the year when risk is higher due to seasonal movements of young males, presence of females with back young and the concurrence of haulage times with dawn and dusk during winter as per above	Section 1.2.1 of the Koala Management Plan has been updated.
All actions in relation to koala sightings and quarry related vehicle strike are assigned responsibility to the 'Planning and Environment Manager – NSW'. The document needs specify what organisation this relates to	Unless otherwise stated, roles / positions detailed throughout the EMS and sub-plans, including the LMP and Koala Management Plan, are internal Holcim roles.
No specific actions are proposed in response to quarry related vehicle koala strikes	<p>The LMP/ Koala Management Plan proposes an adaptive management approach to ensure any management measures implemented are targeted and will be effective in managing site-specific issues. There have been no records of koala vehicle strike during the site's operation. The adaptive management approach outlined in the LMP/Koala Management Plan will be informed by ongoing monitoring and reporting in relation to koala impacts.</p> <p>A new Section 1.6 has been included in the Koala Management Plan outlining potential management measures which could be implemented where vehicle strike impacts are experienced. Any measures to be implemented will be selected in response to the findings of the investigation into the incident (e.g. location, contributing factors such as non-compliance with site rules, etc.) and in consultation with local koala experts and Tweed Shire Council.</p>
There is no obligation or accountability for quarry staff to record koala sightings	This requirement is included in Section 1.3 of the Koala Management Plan. This has also been included in an update to Table 1 in Section 1.5 of the Koala Management Plan ensuring these requirements are included in the site's induction material.

Agency comment	Response
3 koala strikes per year is too many for the endangered population to sustain	<p>Table 1 in Section 1.5 of the Koala Management Plan has been updated to include:</p> <ul style="list-style-type: none"> <li>• Quarry-related vehicle koala strikes reach or exceed three for the year recorded for any two (2) years in a rolling five (5) year period.</li> </ul>
'Increased presence of koalas on haulage routes' is intimated as the likely cause for vehicle strikes. This is considered to be a premature and unfounded assumption	<p>The wording referred to in Table 1 in Section 1.5 of the Koala Management Plan has been amended to reiterate that adaptive management will be required in response to both:</p> <ul style="list-style-type: none"> <li>• Increased occurrence of koala sightings on or nearby haul routes; and</li> <li>• Increased incidence of koala vehicle strikes as a result of quarry operations.</li> </ul>

## 2. Environmental requirements

### 2.1 Legislation and guidelines

Legislation relevant to biodiversity and rehabilitation management includes:

- *Environmental Planning and Assessment Act 1979 (EP&A Act)*
- *National Parks and Wildlife Act 1974 (NPW Act)*
- *Biodiversity Conservation Act 2016 (BC Act)*
- *Fisheries Management Act 1994 (FM Act)*
- *Biosecurity Act 2015*
- *Pesticides Act 1999*
- *Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act)*

Further discussion of the above legislation is provided in the EMS, as well as the EIS and MOD2.

Guidelines referred to in the preparation of the LMP include:

- *The constructed Wetlands Manual, Volumes 1 and 2 (DLWC 1998)*
- *Policy and Guidelines: Aquatic Habitat Management (DPI 1999)*

### 2.2 Conditions of approval

The Development Consent conditions relevant to this LMP are listed in Table 2-1. A cross reference is also included to indicate where the condition is addressed in this LMP or other environmental management documents.

**Table 2-1 Consent conditions relevant to the LMP**

Condition No.	Requirement	Reference		
Schedule 3, Condition 1	Within 1 month of the date of approval of the Landscape Management Plan (see condition 27 below), the Proponent must:	Table 4-1		
	(a) Engage a registered surveyor to mark out the boundaries of the approved limits of extraction;			
	(b) Submit a survey plan of these boundaries to the Secretary; and			
	(c) ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.			
Schedule 3, Condition 25	The Proponent must rehabilitate the site to the satisfaction of the Secretary. This rehabilitation must be generally consistent with the proposed rehabilitation activities described in the documents listed in condition 2 of Schedule 2 and comply with the objectives in Table 5.	Appendix A		
	Table 5: Rehabilitation Objectives			
	<table border="1"> <thead> <tr> <th>Feature</th> <th>Objective</th> </tr> </thead> <tbody> <tr> <td>All areas of the site affected by the project</td> <td> <ul style="list-style-type: none"> <li>• Safe</li> <li>• Hydraulically and geotechnically stable</li> <li>• Non-polluting</li> <li>• Fit for the intended post-quarrying land use/s</li> <li>• Final landform integrated with</li> </ul> </td> </tr> </tbody> </table>		Feature	Objective
Feature	Objective			
All areas of the site affected by the project	<ul style="list-style-type: none"> <li>• Safe</li> <li>• Hydraulically and geotechnically stable</li> <li>• Non-polluting</li> <li>• Fit for the intended post-quarrying land use/s</li> <li>• Final landform integrated with</li> </ul>			

Condition No.	Requirement	Reference
	<p>surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land</p> <p>Surface infrastructure</p> <ul style="list-style-type: none"> <li>Decommissioned and removed, unless otherwise agreed by the Planning Secretary</li> </ul> <p>Void lake</p> <ul style="list-style-type: none"> <li>Water retained on the site maintains long-term water quality objectives fit for the intended post-mining purpose</li> <li>Water discharged from the site is suitable for receiving waters, aquatic ecology and riparian vegetation</li> </ul>	
Schedule 3, Condition 26	The Proponent must:	Appendix A
	(a) rehabilitate and revegetate the 15 ha hectares of land identified in the EA (see the revegetation plan in Appendix 2); and	
	(b) within 12 months of the commencement of quarrying operations, make suitable arrangements to provide appropriate long term security for the revegetation area to ensure it is managed for conservation purposes, to the satisfaction of the Secretary.	Table 4-1
Schedule 3, Condition 27	The Proponent must prepare a Landscape Management Plan for the project to the satisfaction of the Secretary. This plan must:	This plan was updated by Ben Luffman (B.App.Sc. Hons). Refer to Table 1-1 for details regarding specialists.
	(a) be prepared:	
	<ul style="list-style-type: none"> <li>by suitably qualified consultants, including a specialist hydrologist, coastal engineer, wetlands ecologist and landscape architect;</li> <li>in consultation with Council, DoI, OEH, DPI Fisheries and the CCC; and</li> <li>in accordance with extant guidelines including the DoI's Constructed Wetlands Manual, Volumes 1 and 2 and the DPI's Policy and Guidelines: Aquatic Habitat Management, 1999;</li> </ul>	
	(b) be submitted to the Secretary prior to starting quarrying operations on the site; and	Completed circa 2009
	(c) include a:	Appendix A
	<ul style="list-style-type: none"> <li>Rehabilitation and Revegetation Management Plan; and</li> <li>Long Term Management Strategy.</li> </ul> <p>The Proponent must implement the plan as approved by the Secretary.  <i>Note: The Department accepts that the initial Landscape Management Plan may not include the detailed Long Term Management Strategy. However, a conceptual strategy must be included in the initial plan, along with a timetable for augmentation of the strategy with each subsequent review of the plan.</i></p>	Appendix C
Schedule 3, Condition 28	The Rehabilitation and Revegetation Management Plan must include:	Appendix A and Appendix D
	(a) the rehabilitation objectives for the site and revegetation areas;	
	(b) a description of the short, medium, and long term measures that would be implemented to:	
	<ul style="list-style-type: none"> <li>rehabilitate and stabilise the site;</li> <li>implement the revegetation strategy; and</li> <li>manage the remnant vegetation and habitat on the site and in the revegetation areas;</li> </ul>	
	(c) detailed performance and completion criteria for the rehabilitation and stabilisation of the site and implementation of the revegetation strategy;	
	(d) a detailed description of how the performance of the rehabilitation of the quarry and the revegetation areas would be monitored over time to achieve the stated objectives;	
	(e) a detailed description of what measures would be implemented over	

Condition No.	Requirement	Reference
	<p>the next 5 years to rehabilitate and manage the landscape of the site and revegetation areas including the procedures to be implemented for:</p> <ul style="list-style-type: none"> <li>• progressively rehabilitating and stabilising areas disturbed by quarrying;</li> <li>• implementing revegetation and regeneration within the disturbance areas and revegetation areas;</li> <li>• protecting areas outside the disturbance areas, including SEPP 14 wetlands and SEPP 26 littoral rainforests;</li> <li>• vegetation clearing protocols;</li> <li>• managing impacts on fauna;</li> <li>• controlling terrestrial and aquatic weeds and pests;</li> <li>• controlling access;</li> <li>• bushfire management; and</li> <li>• reducing the visual impacts of the project;</li> </ul> <p>(f) a description of the potential risks to successful rehabilitation and/or revegetation, and a description of the contingency measures that would be implemented to mitigate these risks;</p> <p>(g) details of who is responsible for monitoring, reviewing, and implementing the plan; and</p> <p>(h) a monitoring and reporting program of the project's impacts on Koalas, including road strike, to the satisfaction of the Secretary; and</p> <p>(i) adaptive management options for managing impacts on Koalas, including specific impact triggers, developed in consultation with Council.</p>	Appendix D
Schedule 3, Condition 29	<p>The Long Term Management Strategy must:</p> <p>(a) define the objectives and criteria for quarry closure and post-extraction management;</p> <p>(b) investigate options for the future use of the site;</p> <p>(c) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and</p> <p>(d) describe how the performance of these measures would be monitored over time.</p>	Appendix C
Schedule 3, Condition 30	<p>Prior to starting quarrying operations on the site, the Proponent must lodge a rehabilitation bond for the project with the Secretary. The sum of the bond must be calculated at:</p> <p>(a) \$2.50/m<sup>2</sup> for the total area to be disturbed and/or revegetated in each 5 year review period (see condition 31 below); and</p> <p>(b) \$1.50/m<sup>2</sup> for the total area of land previously disturbed and/or rehabilitated by the project, to the satisfaction of the Secretary.</p> <p><i>Notes:</i></p> <p><i>If the rehabilitation and revegetation works are completed to the satisfaction of the Secretary, the Secretary will release the rehabilitation bond.</i></p> <p><i>If the rehabilitation and revegetation works are not completed to the satisfaction of the Secretary, the Secretary will call in all or part of the rehabilitation bond, and arrange for the satisfactory completion of the relevant works.</i></p>	Table 4-1
Schedule 3, Condition 31	<p>Within 6 months of each Independent Environmental Audit (see condition 6 of schedule 5) excluding the inaugural audit, unless the Secretary directs otherwise, the Proponent must review, and if necessary revise, the sum of the rehabilitation bond to the satisfaction of the Secretary. This review must consider:</p> <p>(c) the effects of inflation;</p> <p>(d) any changes to the total area of disturbance; and</p> <p>(e) the performance of the rehabilitation and revegetation to date.</p>	Table 4-1
Schedule 3, Condition 38	<p>The Proponent must establish and subsequently maintain the vegetated buffer around the extraction area within 12 months of the date of this approval.</p>	Appendix A



Condition No.	Requirement	Reference
	<i>Note: The vegetation buffer must be detailed in the Landscape Management Plan.</i>	
Schedule 5, Condition 1A	The Proponent must ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
	(a) a summary relevant background or baseline data;	Section 3
	(b) a description of: <ul style="list-style-type: none"> <li>the relevant statutory requirements (including any relevant approval, licence or lease conditions);</li> <li>any relevant limits or performance measures/criteria; and the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;</li> </ul>	Section 1.3 and Section 2.1
	(c) a description of the measures that to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 4
	(d) a program to monitor and report on the: <ul style="list-style-type: none"> <li>impacts and environmental performance of the project; and effectiveness of any management measures (see (c) above);</li> </ul>	Section 5.2
	(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 5.3
	(f) a program to investigate and implement ways to improve the environmental performance of the project over time	Section 6
	(g) a protocol for managing and reporting any: <ul style="list-style-type: none"> <li>incidents;</li> <li>complaints;</li> <li>non-compliances with statutory requirements; and exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul>	Refer to the EMS Incidents will be reported in accordance with conditions 3 and 4 of Schedule 5
	(h) a protocol for periodic review of the plan.	Section 6
Schedule 5, Condition 1B	<p>Within 3 months of the submission of:</p> <p>(a) an incident report under condition 4 below;</p> <p>(b) an Annual Review under condition 5 below;</p> <p>(c) an audit report under condition 6 below; and</p> <p>(d) any modifications to this approval,</p> <p>the Proponent must review the strategies, plans and programs required under this approval, to the satisfaction of the Secretary. The Proponent must notify the Department in writing of any such review being undertaken. Where this review leads to revisions in any such document, then within 6 weeks of the review the revised document must be submitted for the approval of the Secretary.</p> <p><i>Note: The purpose of this condition is to ensure that strategies, plans and programs are regularly updated to incorporate any measures recommended to improve environmental performance of the project.</i></p>	Refer to the EMS



## 3. Existing environment and impacts

### 3.1 Existing environment

A Flora and Fauna Assessment completed in 2006 identified, eleven (11) vegetation communities on the property, as listed below and shown on Figure 3-1:

- Community 1: Tall Closed Forest (Littoral Rainforest)
- Community 2: Very Tall Open Forest/Woodland (Blackbutt)
- Community 3: Tall/Very Tall Closed Forest (Brushbox)
- Community 4: Tall Closed Forest (Coastal Swamp Box with Littoral Rainforest understorey)
- Community 5: Mid-High Woodland (Banksia)
- Community 6: Tall/Very Tall Closed Forest (Paperbark)
- Community 7: Mid-high/Tall Closed/Open Forest (Paperbark/Swamp Oak)
- Community 8: Mid-high/Tall Closed/Open Forest (Swamp Oak)
- Community 9: Low/Tall Open Forest (Mangrove)]
- Community 10: Low/Mid-high Closed Grassland (Pasture)/Open Paddock with scattered trees
- Community 11: Very Tall Closed Grassland (Sugarcane)

The fauna survey of the site (and immediately adjacent areas) resulted in the recording of 71 species of bird, 8 reptiles, 7 amphibians and 17 mammals (or evidence of their presence).

### 3.2 Impacts

#### 3.2.1 Flora

The flora survey of the site identified 152 species on site. The development of the quarry will result in the removal of vegetation contained within Community 10 (Grassland/pasture with scattered trees) within the approved sand extraction areas. It is considered that the development of these areas will not have a significant environmental impact to these flora species.

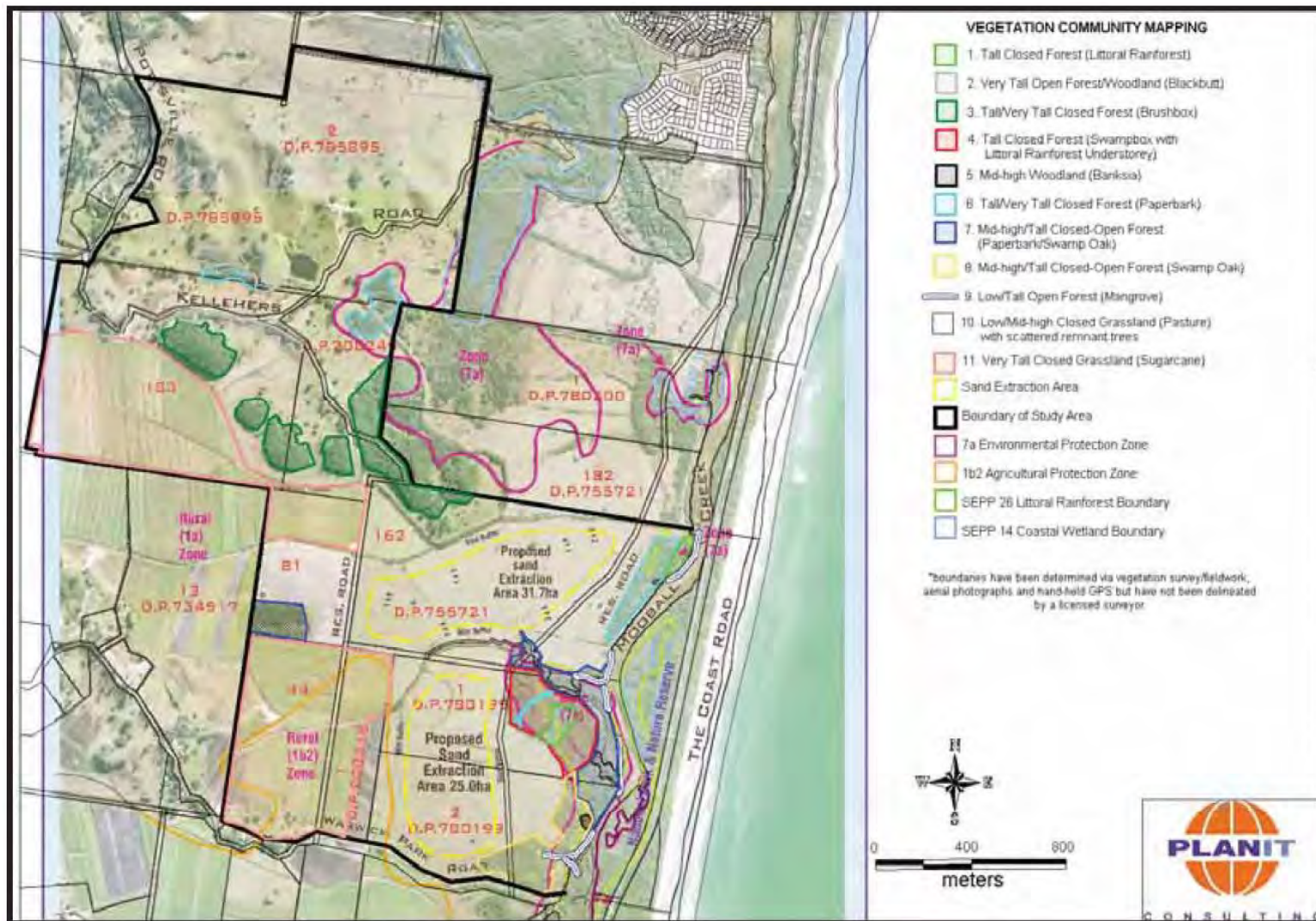
#### 3.2.2 Fauna

The proposed development will result in a very minor loss (isolated trees / shrubs within paddocks) of fauna habitat.

The proposed vegetation removal / modification works are not considered to significantly impact upon the endemic fauna assemblage of the site or local / sub-regional populations.

A relatively low diversity of fauna was recorded or predicted to occur within the areas to be disturbed.

The quarry access road runs parallel with the northern Brushbox Forest (Community 3), which provides koala habitat. Potential impacts to koalas include unauthorised clearing of koala habitat and vehicle strike as a result of trucks and light vehicles accessing the Quarry.



**Figure 3-1 Vegetation communities**

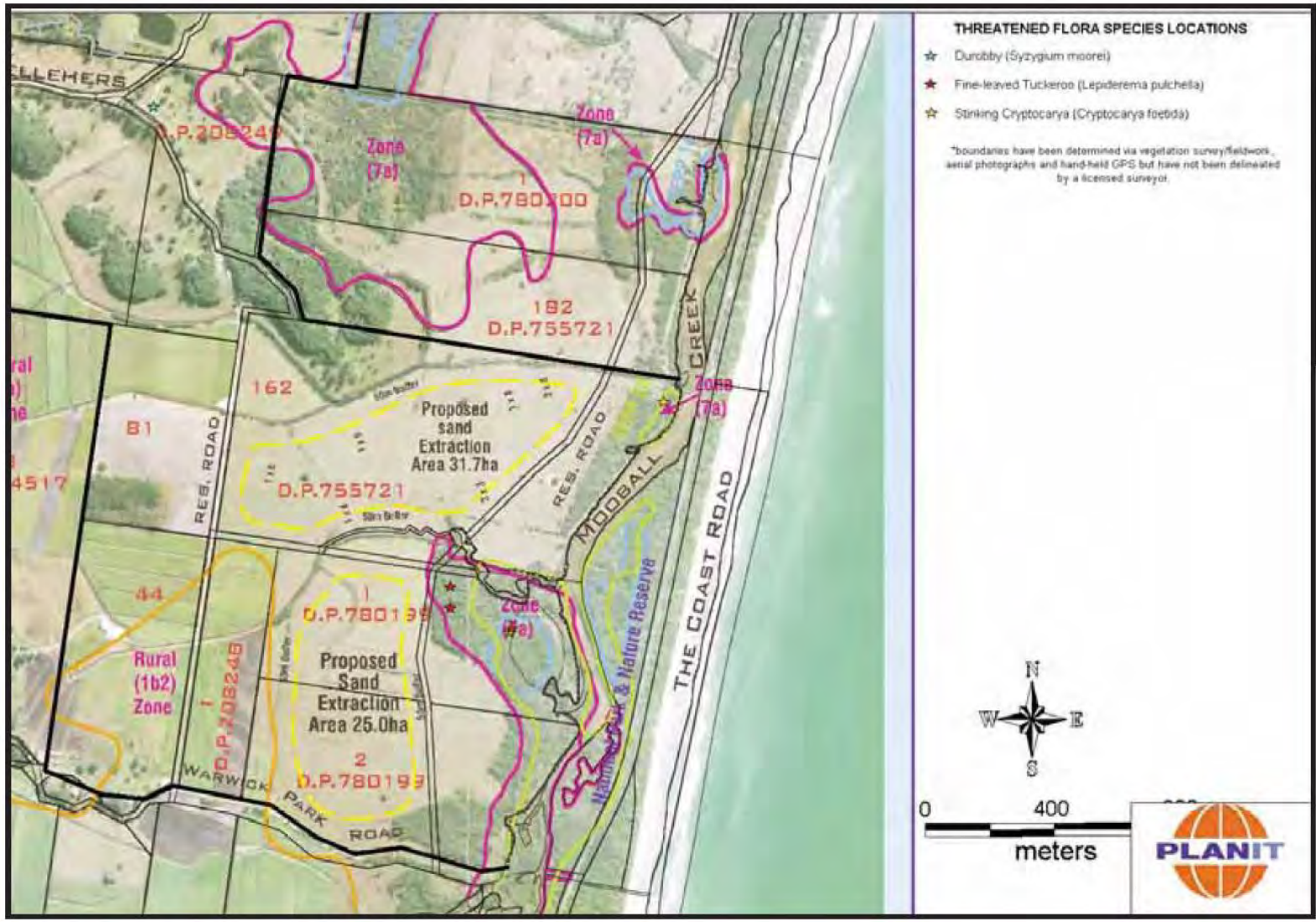
### 3.2.3 Threatened Species

Of the species identified on the property, six (6) species in total are identified as endangered under the *Threatened Species Conservation Act 1995*, as listed in Table 3-1 and shown on Figure 3-2 and Figure 3-3. It is considered that the proposal will not result in a significant adverse impact to these species.

**Table 3-1 Threatened species**

Species	Location	Status
<b>Fauna</b>		
Koala	NW corner of the site in association with Community 3 Brushbox Forest on Bedrock. Two individuals recorded via spotlighting.	Vulnerable
Grey Headed Flying-fox	All areas where melaleuca, Eucalypts and Banksias. Predominately eastern forests adjacent Mooball Creek.	Vulnerable
Little Bentwing Bat	Eastern forests on sand (predominately Littoral Rainforest, Swampbox Forest on sand, Paperbark Forest [Communities 1, 4, 6] and also NW Brushbox Forest on bedrock [Community 3]	Vulnerable
<b>Flora</b>		
<i>Cryptocarya foetida</i>	Littoral rainforest, usually on sandy soils, but mature trees are also known on basalt soils.	Vulnerable
<i>Syzygium moorei</i>	Two planted specimens (~3 m in height) recorded adjacent entry track to Lot 1 on DP208249. Both plants to be retained.	Vulnerable
<i>Lepiderema pulchella</i>	11-13 individuals (<3 m in height) and 2 mature flowering individuals (<10 m) recorded within Communities 1 and 4. As these communities will be retained and buffered in association with the development no impact is expected.	Vulnerable





**Figure 3-2 Threatened flora locations**

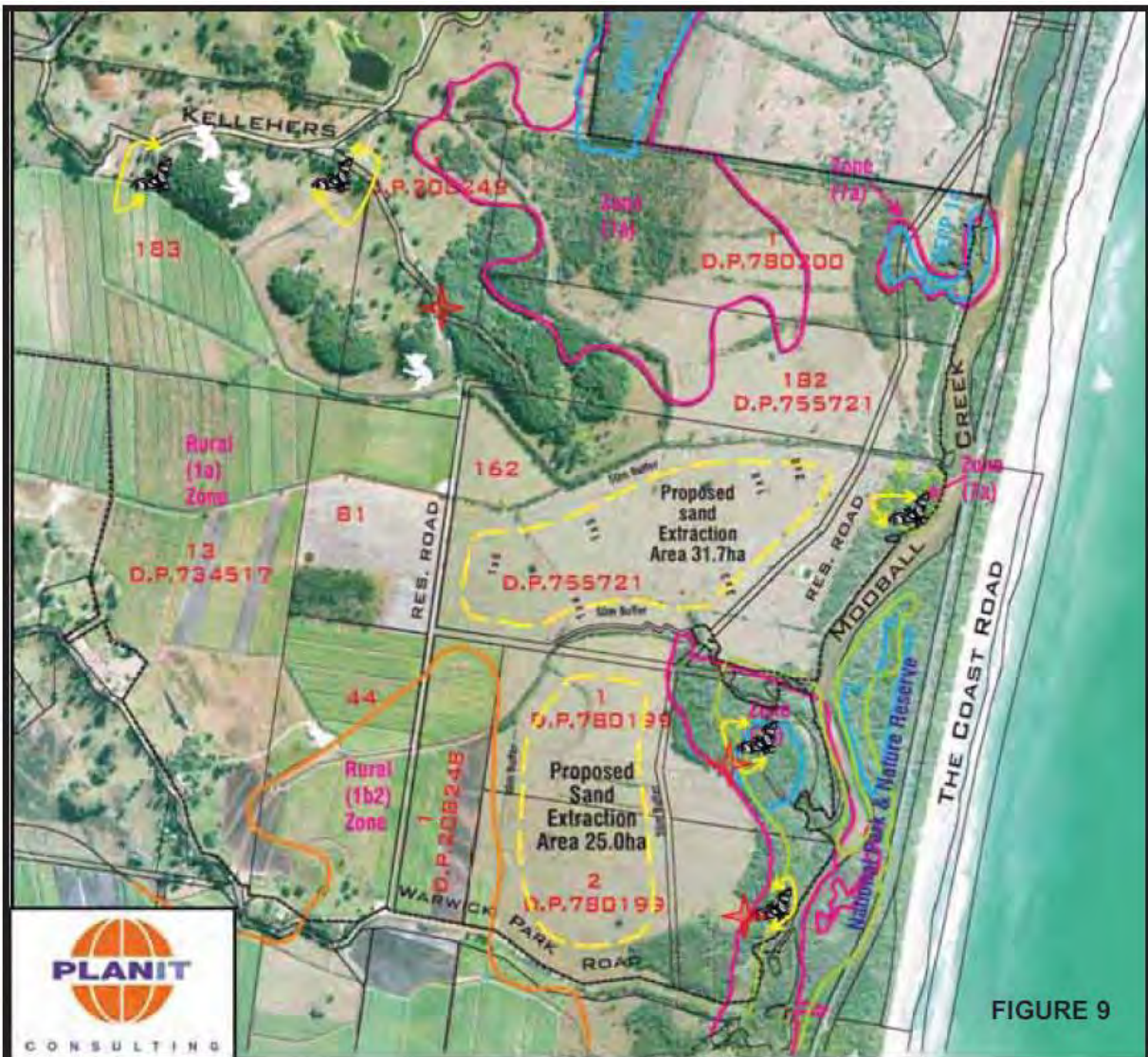


FIGURE 9

THREATENED FAUNA RECORDINGS



Koala sightings @ 552650, 6856670; 552720, 6856610; 553290, 6856060



Grey-headed Flying Fox sightings @ 552490, 6856650; 553060, 6856630; 554650, 6855670; 554170, 6855010; 554270, 6854570



Little Bentwing Bat Anabat Detections @ 553317, 6856232; 554202, 6855016; 554190, 6854517

\*boundaries have been determined via vegetation survey/fieldwork, aerial photographs and handheld GPS but have not been delineated by a licensed surveyor

Figure 3-3 Threatened fauna recordings



## 4. Environmental control measures

Environmental requirements and control measures are identified in the CoA and the EIS. Specific measures and requirements to address biodiversity and rehabilitation are outlined in Table 4-1.

**Table 4-1 Environmental controls and mitigation measures**

Ref.	Environmental Management Measure	Timing	Responsibility
B1	<p>All employees and subcontractors will undergo site induction training relating to flora and fauna management issues, including:</p> <ul style="list-style-type: none"> <li>• Pre-clearing requirements</li> <li>• Fauna rescue requirements</li> <li>• Weed control measures</li> <li>• No-go areas</li> <li>• Unexpected finds procedure</li> <li>• Legal consequences of unauthorised clearing</li> </ul>	Pre-operation and operation	Quarry Manager
B2	Engage a registered surveyor to mark out the boundaries of the approved limits of extraction and submit a copy of the survey plan to the Secretary. ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.	Pre-operation and operation	Quarry Manager
B3	<p>Prior to starting quarrying operations on the site, Holcim will lodge a rehabilitation bond for the project with the Secretary. The sum of the bond must be calculated at:</p> <p>(a) \$2.50/m<sup>2</sup> for the total area to be disturbed and/or revegetated in each 5 year review period; and</p> <p>(b) \$1.50/ m<sup>2</sup> for the total area of land previously disturbed and/or rehabilitated by the project, to the satisfaction of the Secretary.</p> <p>The rehabilitation bond is to be reviewed within 6 months of each Independent Environmental Audit, excluding the inaugural audit, to the satisfaction of the Secretary – refer to Schedule 3, Condition 31.</p>	Operation	Quarry Manager
B4	Implement the RRMP (Appendix A)	Pre-operation and operation	Quarry Manager
B5	Implement the Koala Management Plan (Appendix D)	Operation	Quarry Manager
B6	Within 12 months of the commencement of quarrying operations, the proponent will make suitable arrangements to provide appropriate long term security for the revegetation area to ensure it is managed for conservation purposes	Operation	Quarry Manager
B7	<p>Implement the Long-term Management Plan (Appendix C) so at the completion of extraction, the infrastructure is removed and the site is rehabilitated to the satisfaction of the Secretary to ensure it is:</p> <ul style="list-style-type: none"> <li>• Safe</li> <li>• Hydraulically and geotechnically stable</li> <li>• Non-polluting</li> <li>• Fit for the intended land use and integrated in to the surround landform</li> </ul>	Post operation	Quarry Manager

Ref.	Environmental Management Measure	Timing	Responsibility
B8	Install and monitor (refer Section 5) fauna boxes within the Rehabilitation Areas, including: <ul style="list-style-type: none"> <li>• 2 x sugar glider boxes</li> <li>• 2 x cockatoo boxes</li> <li>• 2 x possum boxes</li> <li>• 1 x rosella/orikeye box</li> <li>• 1 x microbat box</li> <li>• 1 x owl box</li> <li>• 1 x kingfisher box</li> </ul>	Operation	Quarry Manager

## 5. Monitoring and reporting

### 5.1 Environmental inspections

Routine weekly inspections by the Quarry Manager (or delegate) will occur throughout the operational lifetime of the quarry to identify any ad-hoc issues such as weeds and pest animals using the *Environmental Inspection Checklist* in the Environmental Monitoring and Management Plan.

### 5.2 Monitoring

In relation to the LMP, routine weekly monitoring will be recorded on the *Environmental Inspection Checklist* in the Environmental Monitoring and Management Plan.

Specific monitoring of Rehabilitation Areas will utilise systematic visual monitoring to determine the success of the measures implemented and establishment of the rehabilitation areas. This data will be used to provide comparisons between monitoring efforts.

Monitoring requirements are adapted from the RRMP (Appendix A) and detailed in Table 5-1. The plot based monitoring forms (i.e., Forms C and D, Appendix E) are to be undertaken at all 13 permanent monitoring locations, as shown on Figure 5-1. The plot-less monitoring forms (i.e., Forms A and B, Appendix E) are to be undertaken within the whole area of each of the three Rehabilitation Areas or the 13 permanent monitoring locations.

**Table 5-1 Rehabilitation area monitoring**

Monitoring Requirement	Frequency	Details
Routine Rehabilitation Monitoring	Quarterly	See Form A (Appendix E)
Site Condition	Six Monthly	See Form B (Appendix E)
Revegetation / Forest Structure	Annually (end-calendar-year)	See Form C (Appendix E)
Floristic Composition	Annually (end-calendar-year)	See Form D (Appendix E)
Photographs at established photo points	Quarterly	See Figure 5-1
Fauna Box Monitoring	Six Monthly	See Fauna Box Monitoring Form (Appendix E)
Koala monitoring	On going	See Section 1.3 Appendix D

Thirteen permanent photo points have been established (Figure 5-1) where photographs will be taken at regular intervals to provide a visual indication of plant growth (height and extent) and weed presence. Photographs shall be taken at the SW, SE, NW, NE corners of each monitoring site.





**Figure 5-1 Permanent photo points and monitoring locations**

### **5.3 Contingency plan**

Contingency plans are provided in the RRMP (Appendix A).

### **5.4 Reporting**

The general reporting requirements are described in the EMS.

Annual reports summarising the findings of monitoring detailed in Section 5.2 will be prepared in Quarter 1 each calendar year for the previous calendar year. This summary report will be presented in the Annual Report (refer to the EMS).

All records will be:

- Maintained in a legible form.
- Kept for at least 4 years.
- Produced to any authorised officer of the EPA upon request.

## 6. Review and improvement

Continuous improvement of this LMP will be achieved in accordance with the EMS, through the ongoing evaluation of environmental management performance against environmental policies, objectives and targets.

The continuous improvement process is designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement; and make comparisons with objectives and targets.

# Appendices

# **Appendix A** – Rehabilitation and Revegetation Management Plan

**Dunloe Sand Quarry**  
Rehabilitation and Revegetation Management  
Plan

# Document Control

## Current Revision

Revision	Date issued	Reviewed by	Approved by	Date approved	Rev Type
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<b>Document Title</b>	Rehabilitation and Revegetation Management Plan
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# Contents

1.0	INTRODUCTION.....	1
2.0	SITE DESCRIPTION.....	3
2.1	LOCATION AND CURRENT USE.....	3
2.2	APPROVED PROJECT DESCRIPTION.....	6
2.3	EXISTING VEGETATION COMMUNITIES .....	8
2.4	THREATENED FLORA SPECIES.....	8
2.5	EXISTING FAUNA .....	9
2.6	HABITATS AND COMMUNITIES OF SIGNIFICANCE .....	9
3.0	SITE REHABILITATION.....	22
4.0	REHABILITATION STRATEGY.....	27
4.1	WEED MANAGEMENT STRATEGY .....	32
4.2	REVEGETATION STRATEGY .....	39
4.3	REVEGETATION TYPES.....	40
4.3.1	ASSISTED NATURAL REGENERATION (WITH SUPPLEMENTARY PLANTINGS)	40
4.3.2	RECONSTRUCTION/BUFFER PLANTING.....	66
4.3.3	REVEGETATION TECHNIQUES.....	69
4.4	MAINTENANCE, MONITORING AND REPORTING.....	70
4.5	BUSHFIRE RISK ASSESSEMENT .....	79
4.6	ENVIRONMENTAL PROTECTION ZONE PERFORMANCE CRITERIA	80
4.7	CORRECTIVE ACTIONS.....	83
4.8	VISUAL AMENITY SCREENING.....	84
4.9	COMPLETION CRITERIA .....	84
5.0	FAUNA HABITAT ENHANCEMENT.....	86
5.1	FAUNA MANAGEMENT DURING VEGETATION CLEARING.....	95
5.1.1	GENERAL FAUNA MANAGEMENT.....	96
5.1.2	SUCCESSIONAL CLEARING PROTOCOL .....	97
5.1.3	ONGOING FAUNA MANAGEMENT DURING QUARRY OPERATIONS	99
5.2	FAUNA NESTBOXES .....	100
6.0	REFERENCES.....	102
7.0	ATTACHMENTS .....	102
	ATTACHMENT 1 – LANDSCAPING PLANS .....	103
	ATTACHMENT 2 – VEGETATION MANAGEMENT PLAN.....	104



## FIGURES

Figure 1: Aerial Photograph .....	5
Figure 2: Previously Approved Development Concept (Total Rehabilitation Area 15 ha, exact location and extent determined in OPW Rehabilitation Plans) .....	7
Figure 3: Vegetation Community Map (Source: Planit Consulting, 2006) .....	17
Figure 4: Vegetation Community Map, Northern Portions (Source: Planit Consulting, 2006) .....	18
Figure 5: Vegetation Community Map, Southern Portions (Source: Planit Consulting, 2006) .....	20
Figure 6: Threatened Flora Records (Source: Planit Consulting, 2006) .....	21
Figure 7: Threatened Fauna Records .....	21
Figure 8: Approved Revegetation Concept Plan (Total Rehabilitation Area 15 ha, exact location and extent determined in OPW Rehabilitation Plans) .....	25
Figure 9: Detailed Revegetation/Rehabilitation Plan (also refer Attachment 1) .....	26
Figure 10: Example of Natural Regeneration During Trials in 2008 .....	29
Figure 11: Source - Ku-ring-gai Parks Dept. NSW, cited in Buchanan (1989) Comparison of labour hours using traditional weeding and natural regeneration methods. ....	32
Figure 12: Rehabilitation Area / Zone 1 .....	43
Figure 13: Before and After Rehabilitation Images of Rehabilitation Area / Zone 1 .....	43
Figure 14: Staging of Zone 1A (also refer Attachment 1) .....	44
Figure 15: Staging of Zone 1B (also refer Attachment 1) .....	45
Figure 16: Staging of Zone 1C (also refer Attachment 1) .....	45
Figure 17: Freshwater Wetland Module Pioneer Planting .....	48
Figure 18: Freshwater Wetland Module Diversity Planting .....	48
Figure 19: Planting Module 1 .....	50
Figure 20: Planting Module 2 .....	51
Figure 21: Planting Module 3 .....	52
Figure 22: Rehabilitation Area / Zone 2 .....	53
Figure 23: Before and After Images of Rehabilitation Area / Zone 2 .....	50
Figure 24: Staging of Zone 2A .....	51
Figure 25: Staging of Zone 2B .....	52
Figure 26: Staging of Zone 2C .....	53
Figure 27: Wetland Community Module .....	54
Figure 28: Freshwater Wetland Module Pioneer Planting .....	55
Figure 29: Rehabilitation 2A Species List .....	56
Figure 30: Planting Module 1 .....	57
Figure 31: Planting Module 2 .....	57
Figure 33: Rehabilitation Area / Zone 3 .....	58
Figure 35: Staging of Zone 3 .....	59
Figure 36: Swamp Sclerophyll / Swamp Oak Community Module .....	60
Figure 37: Planting Module 1 .....	61
Figure 38: Planting Module 2 .....	62
Figure 39: Planting Module 3 .....	62
Figure 40: Staging of Zone / Area 4 .....	64
Figure 41: Rehabilitation Area 4 (Wet Sclerophyll Forest) Module .....	65
Figure 42: Area 4 Planting Modules .....	66
Figure 43: 10m Western Visual Buffer Location .....	66
Figure 44: Extraction Lake Buffer Zone Location .....	67

Figure 45: Buffer Zone Planting List .....	66
Figure 46: Buffer Zone Planting Module .....	67
Figure 47: Buffer Zone Planting Profile.....	67
Figure 48: Areas Proposed for Future Agricultural Use .....	68
Figure 49: Clearing Zones.....	96

**TABLES**

Table 1: Management Techniques .....	28
Table 2: Rehabilitation Schedule.....	31
Table 3: Weed Presence Observations .....	33
Table 4: Recommended Weed Treatments.....	35
Table 5: Monitoring Triggers .....	71
Table 6: Growth Rate Targets (Height).....	80
Table 7: Plant Stock Conditions Guide .....	80
Table 8: Community Diversity Guide .....	82
Table 9: Coastal Community Diversity Guide .....	82
Table 10: Completion Criteria (1B, 1C, 2C, 2A and 3 EPZ) .....	84
Table 11: Suitable Habitat Requirements .....	86

## 1.0 INTRODUCTION

This Rehabilitation and Revegetation Management Plan for the Dunloe Sand Quarry has been prepared to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06\_0030, the mitigation measures outlined in MOD2 (GHD 2017), the Environmental Impact Statement (EIS) (Planit 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation. Specifically, this report addresses the requirements of Conditions 26, 27a, 28 and 29 of the Section 75J approval issued for the quarry. Condition 25 of Schedule 3 of the approval also provides details on the rehabilitation object:

*The Proponent must rehabilitate the site to the satisfaction of the Secretary. This rehabilitation must be generally consistent with the proposed rehabilitation activities described in the documents listed in condition 2 of Schedule 2 and comply with the objectives in Table 5.*

Also relevant to the preparation of the report are the previous findings and commitments of the previously prepared and submitted Flora and Fauna Assessment (Planit Consulting, 2006) and Rehabilitation Concept Plan (Planit Consulting, 2007) and the previously approved revisions of the Rehabilitation & Revegetation Management Plan (Planit Consulting, 2009 and 2016).

The progressive rehabilitation of the wider site throughout the lifespan of the sand quarry operations is a commitment of the Dunloe Sand operation with the aim of providing for a well-established and long term environmentally sound landscape at the completion of operational works of the quarry, and visual buffering to adjoining properties throughout the lifespan of the project. Condition 28 of the approval requires detail of rehabilitation objectives, criteria/performance and monitoring. This rehabilitation plan provides those objectives such as floristic diversity, long term stability and integrity. Further, the long-term objectives post operations are considered such as agriculture. This report provides greater detail within relevant sections with timelines represented where necessary.

This Rehabilitation and Revegetation Management Plan outlines a program of staged rehabilitation of various areas of the site. These areas to be rehabilitated were previously approved within the Development Consent 06\_0030. This plan shows a detailed commitment to revegetating previously disturbed areas to create and enhance wildlife corridors, protect riparian areas and ensure the stability of ground and surface water quality within the catchment of Mooball Creek. It is envisaged that the revegetation of the site can, where possible, through future evolving legislation, be implemented within the scope of a carbon offset program. It is noted that revegetation has already commenced in numerous zones in accordance with the previously approved Rehabilitation & Revegetation Plan (Planit Consulting, 2009). The subsequent approved revision of the Rehabilitation & Revegetation Plan (Planit Consulting, 2016) incorporated minor changes regarding areas proposed to be rehabilitated and monitoring procedures, as well as future uses of the site after the project has ceased operation.

This document outlines the procedures for management and monitoring to achieve the rehabilitation objectives beyond the lifespan of the quarry operations.

Rehabilitation objectives of this Plan are:

- To ensure that rehabilitation works undertaken during the lifespan of the quarry continue to thrive following the completion of operational works of the quarry.
- To implement rehabilitation management and monitoring procedures throughout the completion of quarry operations to provide for a permanent, healthy, local ecosystem that successfully functions within the natural parameters of the existing, localised, vegetative communities.
- Upon closure of the quarry operations the rehabilitated and revegetated areas are considered well established and capable of thriving without the need for continuing works and management.

Potential future uses of the site following a lengthy lifespan, such as this project, are difficult to accurately predict. Many variables could occur that may dictate end uses such as State, Regional and Local Government, strategies, policies and legislation changes and directions over time. The certainty is that the mitigation and remedial measures implemented during the operations and at the cessation of operations, as presented throughout the Environmental Management Plan (EMP) and this Rehabilitation and Revegetation Management Plan, will ensure that the site will be remediated to the satisfaction of the company, the relevant Government agencies and the community, ensuring environmental quality in the locality.

Much of the existing areas of the site that are presently under environmental protection through zoning within the Tweed Shire Council Local Environmental Plan (LEP) may remain under various legislated forms of environmental protection. Those areas of rehabilitated land (particularly those linking and expanding wildlife corridors) not within these protected zones may overtime be included.

Similarly, agriculturally zoned lands within the site that will not be impacted by the sand quarry operations may remain under such zonings into the future.

The proposed use for the land surrounding the lakes is for agricultural purposes, in particularly the plantation of fruiting trees (i.e. avocado trees). More details regarding the proposed agricultural use of these areas are provided later on in this report.

## 2.0 SITE DESCRIPTION

### 2.1 LOCATION AND CURRENT USE

The Dunloe Sand Quarry (the site) is located at Pottsville Road, approximately three (3) kilometres (km) south of Pottsville. The site comprises the following land parcels:

- Lot 1 DP208249
- Lot 182 DP755721
- Lot 183 DP755721
- Lot 44 DP755721
- Lot 81 DP755721
- Lot 162 DP755721
- Lot 2 DP 780199
- Lot 1 DP780199
- Lot 1 DP780200
- Lot 2 DP785895

The property is informally known and referred to as 'Dunloe Park'.

The site is currently used for agricultural purposes (grazing of livestock) and the Sand Quarry. All existing site improvements are associated with these agricultural uses, with the exception of existing dwelling houses as depicted in **Figure 1** and facilities/infrastructure associated with the sand quarry.

In addition, the site currently contains the following:

- Maintained and intact boundary and paddock fencing
- Agricultural drainage lines running predominantly east west
- Small livestock water dams
- Internal access tracks for farm machinery movement.

Large agricultural sheds are also present which are utilised for the purpose of storage and ancillary maintenance of machinery and plant equipment associated with both the agricultural activities and quarry.

Access to the quarry is provided from Pottsville Road. Various unconstructed road reserves and dirt/gravel tracks provide access within the property. A dedicated ingress and egress facility occurs on Pottsville Mooball Road through to the quarry site via the haul road.

The site is large in extent (~630 ha) and exhibits evidence of having been previously cleared in association with the historical farming uses (i.e. even aged/height canopies of existing vegetation communities). Evidence of logging on the upper slopes and ridges is also apparent with cut-stumps recorded and existing trees with bifurcated trunks regrown from older, larger stumps also noted. It is considered likely that a previous selective logging cycle removing Blackbutt, Mahogany, Tallowwood and Turpentine has occurred with Brushbox left as a result of its lower timber production value.

The majority of the site is utilised for agricultural purposes (with the exception of the sand quarry). This historical and ongoing use has resulted in the construction of numerous paddocks (partitioned by barbed wire fencing, cattle gates, constructed drains etc) and rotational agriculture plots which are dominated by pasture grasses and associated herbaceous weed species (i.e. Fireweed, Blue Billygoat, Blady Grass etc). Remnant trees do occur within the paddock zones (Figs, Eucalypts) with regrowth Casuarina also common adjacent the constructed channels which drain the grazing/agriculture areas. One large dam is also present proximate to the farmhouse on the northern Lot 2 with several small dams other dams scattered throughout the property.

Whilst the rural uses dominate the site, native vegetation communities occur in the form of regrowth Wet Sclerophyll Forest on the western upper slopes and a combination of Swamp Sclerophyll (Melaleuca, Casuarina) and Coastal Forests on sand (Swampbox, Littoral Rainforest, Banksia Forest) in the eastern areas adjacent Mooball Creek. An examination of the structural diversity of the lower strata of the recorded forests and review of the grazing use indicates that cattle have been largely excluded from the eastern coastal forests for the duration of their growth. The western sclerophyll forest patches, however, exhibit impacts of ongoing cattle grazing within the lower strata which have reduced typical structural and floristic diversity.

Portions of the eastern areas are nominated as being contained within the SEPP 26 (Littoral Rainforest) and SEPP 14 (Coastal Wetlands) designations. Such areas reflect the mosaics of Swampbox//Littoral Rainforest communities on sand and Melaleuca/Casuarina Forests/Swamps respectively.





Figure 1: Aerial Photograph

## 2.2 APPROVED PROJECT DESCRIPTION

A section 75J approval was issued under the *Environmental Planning and Assessment Act 1979* to allow the sand quarry development. The development involves the staged extraction of sand from two proposed pond areas comprising at total of 56.7 hectares. The northern extraction pond (31.7 ha) will form Stage 1 of the proposal; and Stage 2 will involve the extraction of sand from the southern pond (25 ha) (refer **Figure 2**). It is noted that Stage 1 works have commenced operations.

Mineral Resources within the two approved extraction pits total 6.88 Mm<sup>3</sup>, including approximately 0.22 Mm<sup>3</sup> of overburden. Computer modelling of a proposed pit design indicated that up to 6 Mm<sup>3</sup> of sand products could be extracted from the proposed pits; processing of the sand would result in <100 000 m<sup>3</sup> of fines requiring re-internment in the pits.

The approved development will ultimately yield approximately 230,000 cubic metres or 300,000 tonnes of sand per annum, with an anticipated lifespan of 26 years.

A relatively small works area has been established adjacent to the south-western corner of extraction pond stage one (1), which contains the work plant and machinery, stockpiled material and a small building housing workers amenities and an administration area.

Results of soil testing have indicated that the sand resource is of a quality that is in line with Australian Standard 2758.1-1998 (Aggregates and Rock for Engineering Purposes) and is suitable for use in the manufacture of concrete. Calculations indicate that the *in situ* sand resource volume present within the proposed extraction areas, assuming 35% batters is approximately 6,000,000m<sup>3</sup>. The volume of overburden has been calculated at approximately 220,000m<sup>3</sup>. Of the estimated 6,000,000m<sup>3</sup> of extractable material, 90,000 tonnes has been identified as being suitable for brickies loam. However, the latter was estimated from an area of only 4ha subject to investigations in this regard.

The approved development layout and extraction ponds are confined to areas containing mainly pastoral grasses, thereby avoiding disturbance to surrounding areas of wetlands and littoral rainforest. Approximately 17 hectares of the site will undergo revegetation to increase the flora and fauna links between the existing areas of vegetation on and adjacent to the site.

The approved development will see unwanted material and potential acid sulfate soils strategically re-deposited within the extraction ponds to limit chances for oxidation (below the water table).





Figure 2: Previously Approved Development Concept (Total Rehabilitation Area 15 ha, exact location and extent determined in OPW Rehabilitation Plans)

## 2.3 EXISTING VEGETATION COMMUNITIES

A detailed Flora and Fauna Assessment was undertaken over the Dunloe Park lands by Planit Consulting in 2006. This assessment described and mapped (refer **Figures 3-5**) eleven Vegetation Communities:

Community 1:	Tall Closed Forest (Littoral Rainforest) [T7D]
Community 2:	Very Tall Open Forest/Woodland (Blackbutt) [T8M/S]
Community 3:	Tall/Very Tall Closed Forest (Brushbox) [T7D]
Community 4:	Tall Closed Forest (Coastal Swamp Box with Littoral Rainforest understorey) [T7D]
Community 5:	Mid-High Woodland (Banksia) [T6S]
Community 6:	Tall/Very Tall Closed Forest (Paperbark) [T8D]
Community 7:	Mid-high/Tall Closed/Open Forest (Paperbark/Swamp Oak) [T6D]
Community 8:	Mid-high/Tall Closed/Open Forest (Swamp Oak) [T6D]
Community 9:	Low/Tall Open Forest (Mangrove) [T5M]
Community 10:	Low/Mid-high Closed Grassland (Pasture)/Open Paddock with scattered trees [G2D]
Community 11:	Very Tall Closed Grassland (Sugarcane) [G4D]

Of these communities, numbers 1, 6, 7, 8 and 9 are reflective of Endangered Ecological Communities all of which will be retained in association with the approved quarry development.

## 2.4 THREATENED FLORA SPECIES

Three threatened flora species were recorded onsite during the previous survey works (refer **Figure 6**):

### *Stinking Cryptocarya*

8-10 individuals (<5m in height) were recorded within Communities 1 and 6. As these communities will be retained and buffered in association with the development no impact is expected.

### *Durrobbby*

Two planted specimens (~3m in height) were recorded adjacent entry track to Lot 1 on DP208249. Both plants to be retained in association with the sand quarry.

### *Fine-leaved Tuckeroo*

11-13 individuals (<3m in height) and 2 mature flowering individuals (<10m) were recorded within Communities 1 and 4. As these communities will be retained and buffered in association with the development no impact is expected.

## 2.5 EXISTING FAUNA

The fauna survey of the site (and immediately adjacent areas) resulted in the recording of 71 species of bird, 8 reptiles, 7 amphibians and 17 mammals (or evidence of their presence).

Of these species, three (Koala, Grey Headed Flying-fox, Little Bentwing Bat) are listed as vulnerable within the *Threatened Species Conservation Act 1995*.

A Section 5A of the *Environmental Planning and Assessment Act 1979* (the '7-Part Test of Significance') was conducted for the three recorded species plus an additional three species which are considered possible occurrences on site and may have the potential to be impacted as a result of the proposal. Section 5A was also conducted for the recorded Endangered Ecological Communities. The assessment concluded that the impacts of the development are unlikely to threaten the viability of any local populations of the nominated species/communities. A species impact assessment was therefore not required and the development was subsequently approved subject to conditions.

## 2.6 HABITATS AND COMMUNITIES OF SIGNIFICANCE

The areas of the site to be protected from development impacts contain several vegetation communities/ecosystems of significance which mostly occur in the eastern portions of the site adjacent Mooball Creek and the Wooyung Nature Reserve. These communities (interconnected eastern Communities 1 & 4-9) are considered to be of ecological significance as a result of one or more of the following:

- Being a wetland environment (freshwater or marine)
- Representing riparian communities fringing Mooball Creek
- Being representative of a rare, vulnerable or endangered forest ecosystem (Upper Northeast Bioregion) or being a regionally significant vegetation community (Tweed Shire)
- Being representative of an Endangered Ecological Community
- Containing vulnerable or endangered plant species

As such, the development does not encroach into these areas nominated as being significant which are largely contained within the existing 7a zone and/or SEPP14/26 designations. Recommendations for management of weeds and revegetation to promote the continued viability of these ecosystems are incorporated within this report.



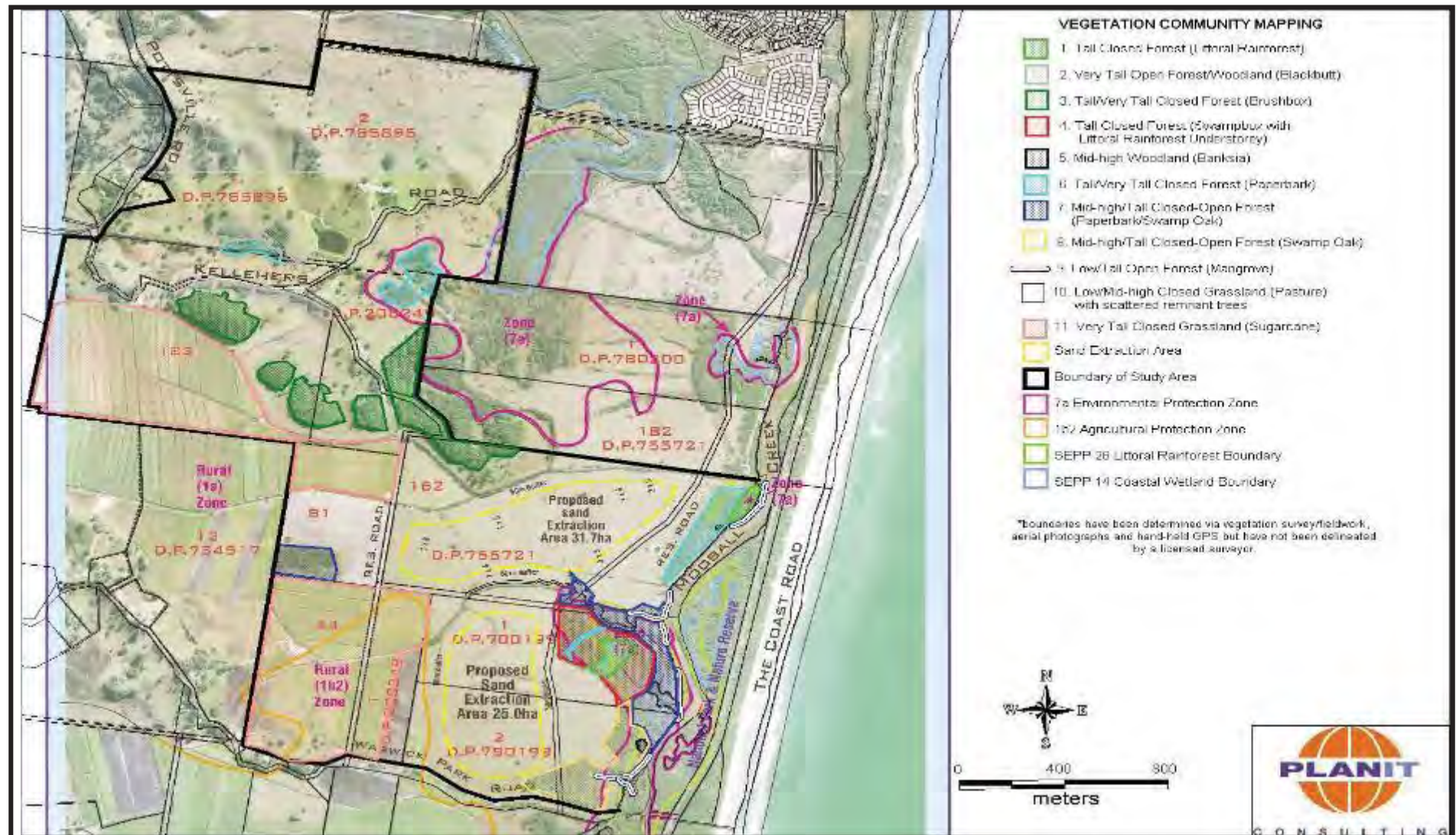


Figure 3: Vegetation Community Map (Source: Planit Consulting, 2006)



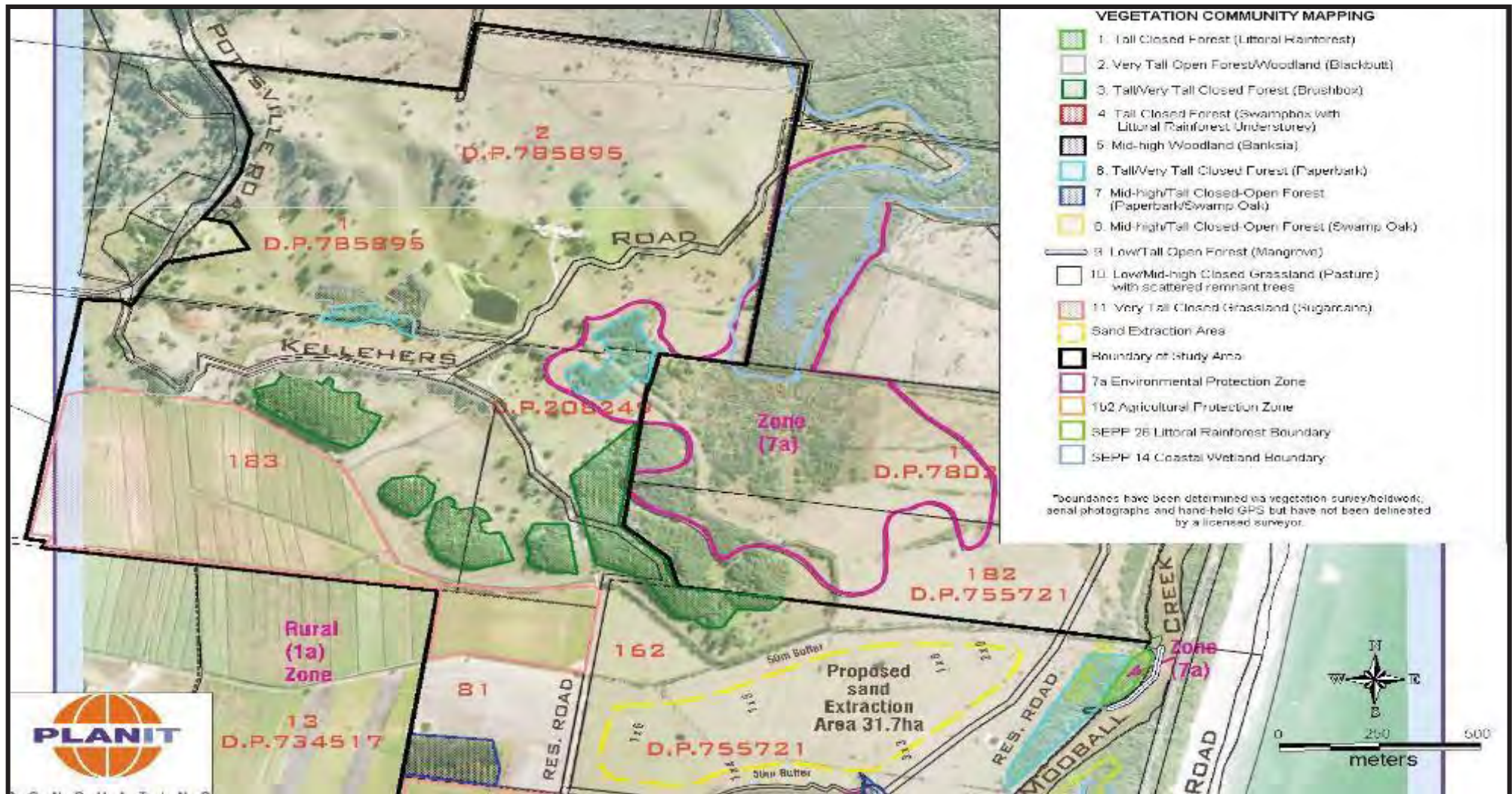


Figure 4: Vegetation Community Map, Northern Portions (Source: Planit Consulting, 2006)



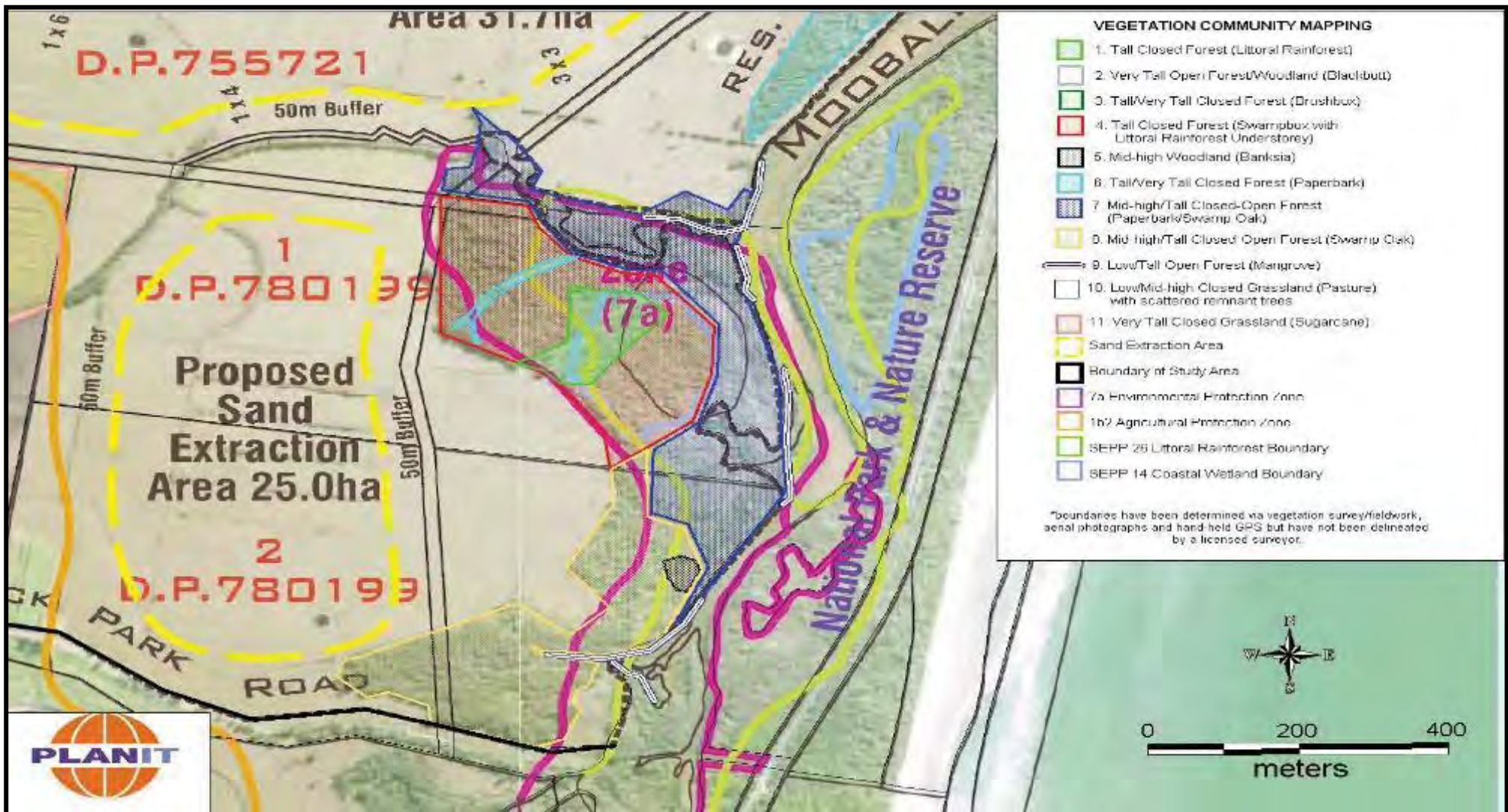


Figure 5: Vegetation Community Map, Southern Portions (Source: Planit Consulting, 2006)



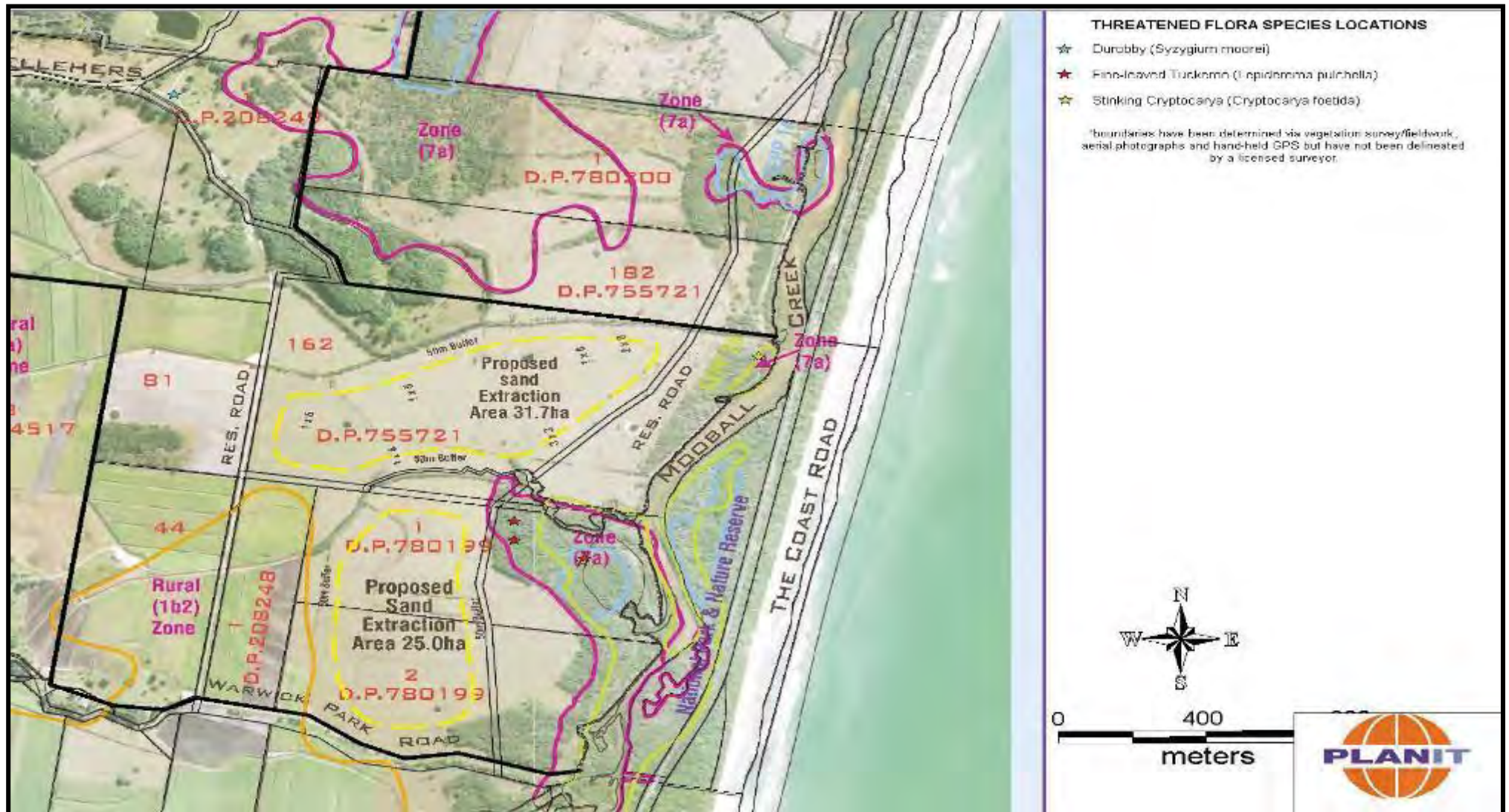


Figure 6: Threatened Flora Records (Source: Planit Consulting, 2006)





THREATENED FAUNA RECORDINGS



Koala sightings @ 552650, 6856670; 552720, 6856610; 553290, 6856060



Grey-headed Flying Fox sightings @ 552490, 6856650; 553060, 6856630; 554650, 6855670; 554170, 6855010; 554270, 6854570



Little Bentwing Bat Anabat Detections @ 553317, 6856232; 554202, 6855016; 554190, 6854517

\*boundaries have been determined via vegetation survey/fieldwork, aerial photographs and handheld GPS but have not been delineated by a licensed surveyor

Figure 7: Threatened Fauna Records



### 3.0 SITE REHABILITATION

Rehabilitation has been conditioned as part of the development consent. The planting of fruit trees or other agricultural crops and pastures is to occur around the two extraction ponds, while rehabilitation will take place in other areas of the site, including buffer areas.

This landscaping has been carried out for the following reasons:

- To provide an effective, aesthetically appealing and practical vegetation buffer to the perimeter of the development;
- To rehabilitate selected areas within the overall Dunloe Park Land holding to consolidate and enhance the existing flora and fauna corridors to the north and east of the extraction areas;
- To maintain the agricultural nature and viability of the property.

A conceptual Revegetation/Rehabilitation Plan has been prepared by Planit Consulting which was approved as part of the Sand Quarry approval (refer **Figure 8**) and refined and implemented within the approved Rehabilitation & Revegetation Management Plan (Planit Consulting, 2009) which identified 15 hectares of land to be rehabilitated in accordance with Condition 26 of the Consent issued. In addition, a further 2 ha will be provided along watercourses and a road within the site to provide wildlife linkage corridors between habitats of the site and locality.

#### *REHABILITATION PROCESS*

A long-term staged rehabilitation/revegetation process has also been derived and implemented for the 15 ha required by the Development Consent (additional 2 ha now provided) and associated approved concept plans. This strategy has chronologically focused upon assisting natural regeneration, plantings of pioneer species (to establish cover and suppress pasture weeds) and increasing floristic diversity. Additional actions to exclude cattle and increase foraging potential for threatened fauna have also been performed.

Planting initially begun on the western side of the development site and concentrated around the stockpiling locations and haulage routes and has now included Rehabilitation Zones 1-3 (as described within this report). Planting surrounding the extraction areas (proposed for agricultural use) will take place once extraction has ceased. This is due to the continuous need for accessibility (i.e. removing the dredge from the lake for servicing) which would be difficult with vegetated buffers surrounding the extraction lake during operation.

For the purposes of this document, the rehabilitation process can be defined in the following terms –

- Short Term Rehabilitation Processes refer to all actions to be conducted in the first four years of the commencement of rehabilitation/revegetation of a zone (e.g. Zone 1B). This may include but not be limited to, removal of cattle, initial monitoring (in the case of assisted natural regeneration) to determine the required density of supplementary plantings (if required), the installation of native species to the required densities, monitoring and weed control works for reconstruction/buffer planting and monitoring and replacement planting to achieve required densities.
- Medium Term Rehabilitation Processes refer to all actions to be conducted years 5 – 9 of commencement of the rehabilitation/revegetation processes. This can include, but not be limited to, monitoring, weed control, maintenance of exclusion fencing and fire trails and any replacement planting that may required to continue to meet required densities.
- Long Term Rehabilitation Processes refer to all actions to be conducted from 10 years of the commencement of rehabilitation/revegetation to surrender of the lease. This may include but not be restricted to monitoring, weed control works and maintenance of stock exclusion fences and fire trails.

*REHABILITATION SPECIES*

A wide range of native species endemic to the area has been selected for the rehabilitation and buffer areas. In this regard Rehabilitation Zone No.1 has been revegetated (combination of ‘assisted natural regeneration’ and revegetation/landscaping) with endangered ecological community (EEC) Swamp Sclerophyll plus Eucalypt Open Forest species and EEC Coastal Wetland within the localised soaks.



Rehabilitation Zone No. 2 has been revegetated with a combination of EEC Swamp Sclerophyll, EEC Swamp Oak and Banksia open forest species with EEC Saltmarsh within a minor tidal extension zone of the existing paddock.



Rehabilitation Zone No. 3 has been revegetated with a combination of EEC Swamp Sclerophyll and EEC Swamp Oak open forest.

Rehabilitation Zone No.4 is proposed to be revegetated reflective of a Wet Sclerophyll Forest.

The shrub and small tree layer of all rehabilitated forest communities has also incorporated (via regeneration or revegetation) a reasonable diversity of EEC Littoral Rainforest species reflective of existing remnant communities and to expand foraging habitat for threatened flying foxes and rainforest pigeons.

The rehabilitation program over the ~17 hectares will be staged over a 10 - 15-year timeframe (commenced ~ 6 years ago for Zones 1-3, i.e. 2013 see **Table 2**) and will ensure that regular monitoring and maintenance will continue for the life of the extraction project.

An amended Rehabilitation and Revegetation Management Plan has been prepared within this document which expands upon the previously approved conceptual plans / Rehabilitation & Revegetation Management Plan and satisfies the relevant conditions of the approval issued relating to site rehabilitation. The main purpose of the amended Rehabilitation and Revegetation Management Plan is to incorporate additional revegetation areas proposed (Zone No. 4) and the proposed future agricultural use surrounding the two lakes (i.e. avocado tree plantations).





Figure 8: Approved Revegetation Concept Plan (Total Rehabilitation Area 15 ha, exact location and extent determined in OPW Rehabilitation Plans)

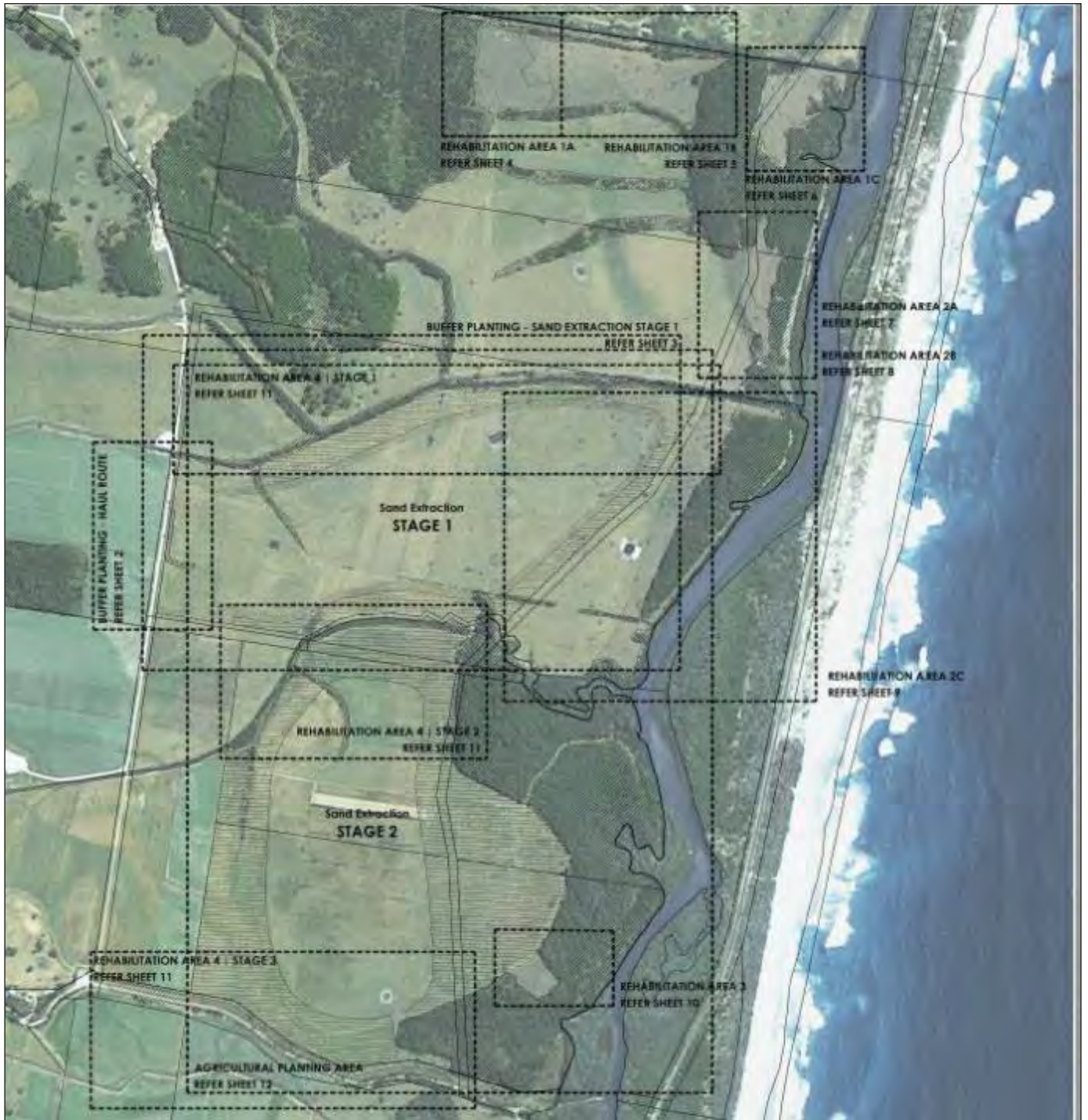


Figure 9: Detailed Revegetation/Rehabilitation Plan (also refer Attachment 1)



## 4.0 REHABILITATION STRATEGY

This Section outlines the Rehabilitation/Revegetation Strategy for the Environmental Protection Zones (EPZ) which has/will incorporate the following:

- **EXISTING VEGETATION COMMUNITIES:** Existing vegetation communities located external to the works area (refer **Figure 3**). The predominate management strategy for these zones will be the continued exclusion of cattle, monitoring and control of environmental weed infestations (to promote ongoing natural regeneration) and maintenance of existing fire trails
- **REHABILITATION ZONES:** The ~17 ha rehabilitation zone (Zones 1-4, refer **Figure 9**). A detailed staged rehabilitation/revegetation strategy for these zones is contained within the following sections of this report and focuses upon removing threatening impacts (i.e. grazing and weed invasion), managing natural regeneration and revegetation works to deliver the proposed vegetation communities. Targeted fauna habitat enhancement works have also been incorporated.

In accordance with best management practice, restoration and rehabilitation works sought to stabilize and reverse the negative effects of habitat fragmentation. Priority has been given to works which protect and expand larger remnants so that they are reintegrated into larger revegetated areas. This is based on the following ecological observations:

- Habitat fragmentation generally reduces the viability of both faunal and floral populations by restricting ranges of fauna below minimum levels and by preventing the natural exchange of genetic material which may ensure genetic vigour.
- Reconnecting fragmented landscapes into larger, (and, where appropriate, more consolidated) units by filling in gaps can increase habitat area and may improve linkages for passage of species. (The configuration of those linkages, however, will determine whether edge/area ratios reduce or increase.)
- Narrow corridor links may themselves be subject to feral predation, disease and species imbalances, therefore, the width of a corridor should exceed the extent of edge effects.
- Biological potential for diverse natural regeneration and expansion frequently exists in and adjacent to remnants. Investments which harness this potential usually provide higher ecological returns than reconstruction elsewhere (Greening Australia, 1999).

As such, the ~17 ha of site rehabilitation/restoration have been sited to close remnant canopy caps, re-connect existing fragmented remnants, increase the area:edge ratio of endangered ecological community remnants and provide/increase fauna habitat corridor widths.

- **BUFFER ZONES:** Visual buffer and extraction lake revegetation works (refer **Figure 9**). The strategy for these areas is the retention of the adjacent Casuarinas buffers and landscaping of the visual buffer to the machinery compound areas. Such revegetation was established within 12 months in accordance with Condition 39 of the consent. Ongoing weed management and monitoring are routinely performed to ensure the long-term viability of the buffers. Agricultural plantings to the edge of the lakes would not commence until the cessation of extraction activities cease at both ponds. This is necessary as ground anchors for the dredge are required to be set at the edge of the pond during extraction activities and moved around the pond perimeter from time to time as the dredging process dictates.

The below rehabilitation strategy has been prepared, implemented, and aimed to protect and enhance habitats retained within the EPZ.

It often takes a period of several years before the achievement of such aims are realised and as such it is of paramount importance that an appropriate strategy is derived and implemented in the initial phases of rehabilitation.

The primary objectives for the EPZ are quite simple and include:

- Retain significant existing communities (refer **Figure 3**)
- Retain and enhance existing fauna habitat
- Remove and manage processes potentially threatening the viability of existing remnants (refer **Figure 3**)
- Increase the extent of vegetation communities and potential fauna habitat over time (refer **Figure 9**).

Three management techniques will be implemented for the EPZs as identified in **Table 1**.

*Table 1: Management Techniques*

EPZ	OVER-RIDING TECHNIQUE
Existing vegetation communities	Weed removal and ongoing monitoring only (no revegetation)
Rehabilitation Zones	Assisted Natural Regeneration
Buffers	Reconstruction

Weed removal and management is discussed within **Section 4.1** below and will be undertaken where necessary within the existing vegetation communities in association with routine management.

The 17 ha rehabilitation zone has been managed via Assisted Natural Regeneration (GCCC (2007)/Greening Australia (1999)) due to its location within a fragmented landscape and proximity to established native vegetation communities. Greening Australia (1999) notes that ‘in or immediately adjacent to remnants, priority is given to facilitation of natural regeneration. In these locations, planting or direct seeding is only carried out where pre-existing species are incapable of colonization – and after a “rest” period sufficient to test natural regeneration. This is based on the following ecological and field observations.

- Natural regeneration potential can be surprisingly persistent in and adjacent to fragmented remnants. Natural regeneration maintains natural selection processes, can provide a wider range of site adapted species and genetic stock, demonstrates any capacity for future regeneration, and informs us about a site’s regeneration dynamics and any pre- existing species requiring reintroduction.
- Planting can be more expensive, interfere with regeneration and compromise the genetic integrity and scientific value of a site. Planted stock may not regenerate if the species selection or genetic stock is inappropriate to the site.

- The mechanisms of recovery of individual species after natural disturbances (particularly whether they form persistent soil seed banks or not) can provide insight into the restoration approach needed. This determination can be improved by conducting preliminary trials to trigger germination from soil seed banks (e.g. using fire, smoke, tillage or irrigation as appropriate) - Such trials can also help to determine pre-existing plant associations more precisely.'

Cattle were excluded from portions of the 15 ha rehabilitation zone (zones 1-3) in late 2008 to allow test trials of natural regeneration to be monitored with germination of pioneer canopy trees (*Melaleuca*, *Callistemon*, *Casuarina*, *Lophostemon*, *Banksias* etc.) noted (**Figure 10**).



Figure 10: Example of Natural Regeneration During Trials in 2008

A staged strategy (refer **Section 4.0/4.2**) which involves a combination of monitoring (and cattle exclusion and weed management) natural regeneration for a minimum period of 12 months, planting pioneer species (if needed) and supplementary planting (groundcovers and diversity plantings-if needed) has therefore been established (and implemented). This approach will ensure that establishment of endemic genetic flora is maximized over the life of the rehabilitation project.



In accordance with GCCC (2007) Assisted Natural Regeneration applies:

- To natural areas where the native plant community is largely healthy and functioning.
- When native plant seed is still stored in the soil or will be able to reach the site from nearby natural areas, by birds or other animals, wind or water.
- Where the natural regeneration processes (seedling germination, rootsuckering, *etc.*) are being inhibited by external factors, such as weed invasion, soil compaction, cattle grazing, mechanical slashing, *etc.*
- When limited human intervention, such as weed removal, minor amelioration of soil conditions, erection of fencing, cessation of slashing, *etc.* will be enough to trigger the recovery processes through natural regeneration.
- When the major component is weed control.

As discussed above assisted natural regeneration will apply to the ~17 ha regeneration/restoration zones.

However, the buffer areas associated with the extraction lake and machinery/compound areas (refer **Figure 9**) are disjunct from native vegetation communities and are located in historical areas of intensive grazing and agriculture. Natural regeneration potential from these areas is considered minimal with growth of pasture species prevalent. As such, Reconstruction/landscaping were required in these areas. Such intensive planting of native species was also considered necessary to comply with Condition 39 of the consent which required the buffer areas to be established within 12 months. In accordance with GCCC (2007) Reconstruction applies:

- Where the site is highly degraded or altered
- When the degree of disturbance has been so great and long-standing that the pre-existing native plant community cannot recover by natural means.
- To sites such as areas of fill, sites affected by stormwater flow, and areas that have been drastically cleared, either mechanically or by stock even though there may be a few remaining native trees or shrubs.
- When a greater degree of human intervention is required, such as weed removal, cessation of grazing and/or slashing, amelioration of soil conditions such as importation of soils, drainage works or reshaping of the landscape.
- When a major component is the importation of native species through planting.

The proposed schedule of rehabilitation is outlined in **Table 2**. It shows that the majority of the supplemental planting will occur with the first four years of rehabilitation (Short-term rehabilitation processes) in the case of the Sclerophyll Woodland and Forest Vegetation communities (1B, 1C, 2A, 2C and 3) and within the first 2 years of the wetland rehabilitation zones (1A and 2B). Buffer Zones (Buffer Zone 1) and Rehab Area 4 (Buffer Zone and Corridor) have shorter active planting/reconstruction planting schedules of 1 year only.

The specifics of each Planting Module are detailed in **Sections 4.3.1** and **4.3.2**.

Table 2: Rehabilitation Schedule

Rehab Zone	Stage	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
Buffer Zone 1	1	PM 1	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
		PM 2														
1A	1	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	2	NR&M	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	3	NR&M	NR&M	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
1B	1	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	2	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	3	NR&M	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	4	NR&M	NR&M	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	5	NR&M	NR&M	NR&M	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
1C	1	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	2	NR&M	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	3	NR&M	NR&M	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
2A	1	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	2	NR&M	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	3	NR&M	NR&M	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
2B	1	PM 1	PM 2	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M		
2C	1	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	2	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	3	NR&M	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
	4	NR&M	NR&M	NR&M	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
3	1	PM 1	PM 2	PM 2	PM 3	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M		
4 (Corridor and Buffer Zone)	1	PM 1	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	
		PM 2														
	2	PM 1	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M
		PM 2														
	3	PM 1	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M	NR&M
		PM 2														

PM 1 = Planting Module 1. PM 2 = Planting Module 2. PM 3 = Planting Module 3. NR & M = Natural Regeneration & Weed Management

## 4.1 WEED MANAGEMENT STRATEGY

The following weed management strategy has been prepared for the EPZ. The intent of the strategy is to progressively remove weed species from these areas. Substantial research regarding weed management activities within areas of native bushland has been undertaken in this regard. The strategy presented has been adapted from the following relevant sources as detailed in **Section 6**.

1. Target areas of least disturbance and weed invasion and work towards the more weed infested areas.

Under these circumstances the indigenous species have the upper hand because their seed or spores are already in the ground and the natural environment favours the plants that have evolved in it (Bradley, 1988). This method represents a significant reduction in follow-up time and related costs because the regeneration is more likely to comprise a higher proportion of native species. It is noted that this method is the EPA's preferred method of weed control (DEH, 1999).

2. Minimising the amount of soil disturbance will reduce the potential for a fresh weed invasion.

Weeding will cause some disturbance to the existing soil structure and layers depending on weed methods utilised (i.e. mechanical removal, hand removal). Disturbed soil should therefore always be returned as close as possible to its original layer and firmed down. This includes the mulch which is the first line of defence against a fresh invasion (Bradley, 1988).

3. Let native plant regeneration dictate the rate of weed removal

The regeneration of native species is inversely proportional to increasing weed growth. Therefore, weeding should not automatically move into more degraded areas when less infested areas have been initially weeded. It is often better to simply wait for the less infested areas to regenerate before proceeding slowly into the worse areas. Clearing all infested areas at once causes extensive, additional follow up weeding works (refer **Figure 11** below).

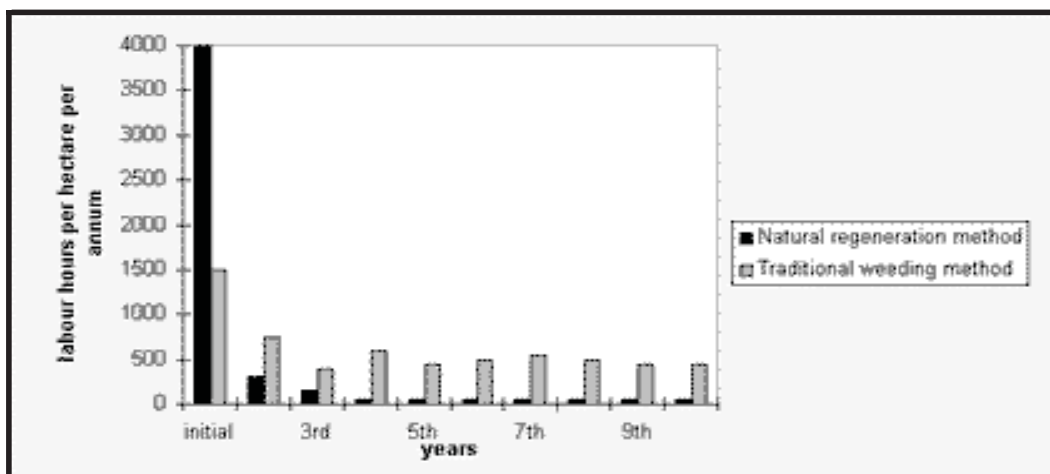


Figure 11: Source - Ku-ring-gai Parks Dept. NSW, cited in Buchanan (1989) Comparison of labour hours using traditional weeding and natural regeneration methods.

Implementing these principles into a weed management strategy begun by determining priority species and areas for management. Details with regard to weed presence from numerous inspections of the EPZs are detailed in **Table 3**. The recommended weed treatments are listed in **Table 4**.

Table 3: Weed Presence Observations

EPZ	OBSERVED WEED PRESENCE
Existing Vegetation Communities	<p>The existing native vegetation communities (refer <b>Figure 3</b>) contain minor elements of weed invasion, mostly on the perimeters or edges. Those recorded are described below:</p> <p><u>Community 3: Tall-Very Tall Closed Forest (Brushbox) on Bedrock</u>: The highly fragmented nature of this community, ongoing grazing and proximity to pasture areas resulted in the recording of numerous weed species on the remnant fringe. Such species included pasture/exotic grasses (Couch, Kikuyu, Guinea Grass, Pigeon Grass, Paspalum), Fireweed, Mistweed, Billygoat Weed, Balloon Cotton, Mile-a- Minute, Camphor Laurel, Bitou Bush, Flatweed, Cobblers Pegs, Thistle, Sirato, Inkweed, Wild Tobacco and White Passionflower.</p> <p><u>Community 4: Tall Closed Forest (Coastal Swamp Box with Littoral Rainforest understorey)</u>: Weed species were common in the western areas of the association adjacent to the open paddock/grassland grazing areas and included Lantana, Mile-a- minute, Groundsel and pasture grasses (Whisky Grass, Paspalum, Rhodes Grass etc).</p> <p><u>Community 5: Mid-high Woodland (Banksia)</u>: Weed species within this small forest patch included Lantana and pasture grasses (Whisky Grass, Paspalum, Rhodes Grass etc).</p>
EPZ	OBSERVED WEED PRESENCE
Existing Vegetation Communities	<p><u>Community 6: Tall/Very Tall Closed Forest (Paperbark)</u>: The most common weed species noted were Camphor Laurel which was a quite common re-growth species within the sub-canopy layer and Bitou Bush and Mickey Mouse Plant in the shrub layer.</p> <p><u>Community 7: Mid-high / Tall Closed-Open Forest (Paperbark / Swamp Oak)</u>: Weeds were present mostly within more recently disturbed areas adjacent to Mooball Creek or on remnant fringes and included Lantana, Groundsel, Camphor Laurel, pasture grasses, Umbrella Tree and Bitou Bush. The small western remnant also included common weeds in the ground-layer (pasture grasses [Couch, Kikuyu, Pigeon Grass, Guinea Grass] Fireweed, Crofton Weed, Mistweed, Billygoat Weed, Balloon Cotton, Mile-a-Minute, Camphor Laurel, Bitou Bush)</p> <p><u>Community 8: Mid-high/Tall Closed-Open Forest (Swamp Oak)</u>: Weeds occupied a number of small patches within this community and mostly included Lantana, Groundsel, Bitou Bush and pasture grasses.</p>
Rehabilitation Zones	<p>All Rehabilitation Zones (with the exception of Zone 4) have been excluded of cattle for a number of years and regeneration is currently in progress. Prior to rehabilitation works, pasture grasses and herbaceous pasture weeds (i.e. siratro, cuphea, fireweed, purple top, bitou bush, flatweed) were observed.</p>

Buffers	These areas contain pasture grasses and occasional herbaceous pasture weeds (i.e. siratro, cuphea, fireweed, purple top, bitou bush, flatweed). These areas have been 'reconstructed' concurrent with adjacent extraction works with continuous weed control occurring
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Table 4: Recommended Weed Treatments

Scientific Name*	Common Name	Recommended Treatment
<i>Panicum maximum</i> <i>Paspalum dilatatum</i> <i>P. conjugatum</i> <i>Setaria sphacelata</i> <i>Andropogon virginicus</i> <i>Chloris gayana</i> <i>Cynodon dactylon</i> <i>Pennisetum clandestinum</i>	Exotic/ pasture grasses	Spot spraying of clumps and hand removal of scattered individuals within rehabilitation zones. Routine spot spraying is to ensure that all foliage is wetted with Roundup Biactive [at a ratio of 1:100 [1 part glyphosate to 100 parts water]].
<i>Lantana camara</i>	Lantana	Spot spraying of Lantana with Roundup Biactive [at a ratio of 1:100] is recommended. Following treatment, Lantana is to be removed via hand and stored until complete browning out occurs. Note that removed biomass must be stored/hung off the ground to prevent re-shooting. Spot spraying is to ensure all foliage is wetted.  Addition of surfactant PULSE (200 mL/100 L) to Roundup is recommended to improve Lantana control.
<i>Ageratum houstonianum</i>	Blue Billygoat Weed	Spot spraying with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.
<i>Bidens pilosa</i>	Cobblers Pegs	Spot spraying with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.
<i>Phytolacca octandra</i>	Inkweed	Spot spraying with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.  Following herbicide treatment, any individuals regenerating from taproots are to be removed by hand. Care to be taken to avoid skin contact with sap.

Scientific Name*	Common Name	Recommended Treatment
<i>Baccharis halimifolia</i>	Groundsel	Spot spraying with Roundup Biactive [at a ratio of 1:100] or hand removal is recommended. Spot spraying is to ensure all foliage is wetted.  NOTE: If groundsel is seeding at any time, individual plants are to be removed via hand and bagged to prevent seed spread via wind.
<i>Cinnamomum camphora</i>	Camphor Laurel	Saplings of camphor laurel are to be treated via stem injection. 2mL of roundup bioactive is to be injected per cut. Juveniles sprayed with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Ageratina riparia</i>	Mistweed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Ageratina adenophora</i>	Crofton Weed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Conyza spp.</i>	Fleabane	Spot spraying Roundup Biactive [at a ratio of 1:100] (or hand removal for minor infestations). Spot spraying is to ensure all foliage is wetted.
<i>Chrysanthemoides monilifera</i>	Bitou bush	Mature stems to be treated via Cut-stump method. This will involve cutting the trunk at ground level and immediately swabbing the stump surface with Roundup Biactive. Juveniles sprayed with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Hypochaeris radicata</i>	Flatweed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Senecio madagascariensis</i>	Fireweed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Passiflora subpeltata</i>	Passion flower	Hand removal of juvenile stems is recommended with cut-stump for larger specimens.  Cut stump treatment will involve cutting the stem at ground level and immediately swabbing the stump surface with Roundup Biactive (1 part roundup: 2 parts water).
<i>Solanum mauritianum</i>	Wild Tobacco	Cut-stump treatment is to occur for mature stems. This will involve cutting the trunk at ground level and immediately swabbing the stump surface with Roundup Biactive.

Scientific Name*	Common Name	Recommended Treatment
		Spot spraying of juveniles with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.
<i>Verbena bonariensis</i>	Purple Top	Given low leaf surface area of this species, if isolated plants occur (i.e. small numbers, not within an area dominated by other weeds) they are to be removed via hand.
<i>Gomphocarpus physocarpus</i>	Cotton Bush	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.

\* where herbicide treatment is required the use of Roundup Biactive has been predominately recommended. The active ingredient of this herbicide is Glyphosate isopropylamine which has been found to be non-toxic to frog tadpoles and generally does not require the use of additional surfactants. The use of surfactant is only recommended for *Lantana camara*.



### RECOMMENDED APPLICATION TECHNIQUE FOR SPRAYING (Knapsack/Handgun Equipment)

The dilution rate is given as a ration (i.e. 1: 100 is 1 part Roundup Biactive: 100 parts water). Adjust equipment to achieve an even spray pattern. Apply to ensure complete and uniform wetting of all foliage. For handgun equipment, a D6 spray tip (Spraying Systems Australia P/L) or equivalent, and an operating pressure of 400-700 kPa is recommended.

### Additional Recommendations: Surfactant

#### GENERAL GUIDELINES

Do not vary from the 200ml of Pulse per 100L of spray solution because as has been shown, this is the optimum rate for Pulse. Do not reduce the rates of Roundup as all trial work has shown that the recommended label rates of Roundup are needed to achieve control. **AVOID EXCESSIVE AGITATION BOTH WHEN MIXING AND WHEN SPRAYING, AS FOAMING CAN OCCUR IF SOLUTION IS OVER AGITATED.** Wear gloves and a face shield or goggles when handling Pulse undiluted as it is severely irritating to the eyes.

#### Mixing:

1. Half fill tank with water.
2. Add the correct amount of Roundup and mix.
3. Fill tank until almost full.
4. Add Pulse at the rate of 200ml per 100L of spray solution and mix.
5. Complete filling tank.
6. Mix.

#### RESTRAINTS ON USE

Pulse should not be added to Roundup as a general-purpose surfactant as some antagonism can occur between Roundup and Pulse on typically easy-to-kill grasses such as wild oats and Brome grass. Currently there are no other herbicides recommended for use with Pulse on the Pulse label. Users should check with the manufacturer before using any particular herbicide or other pesticide with Pulse. Pulse is not a general-purpose surfactant but rather a specific spray additive for Roundup herbicide for the improved control of brush and woody weeds.

### RECOMMENDED APPLICATION TECHNIQUE FOR CUT-STUMP TREATMENT

Cut stump treatment will involve cutting the stem of the plant at ground level and immediately swabbing the stump surface with Roundup Bioactive (1 part roundup: 2 parts water).

## RECOMMENDED APPLICATION TECHNIQUE FOR STEM INJECTION

This shall involve use of an applicator calibrated to deliver 1 or 2 mL of Roundup Biactive (or other non-specific herbicides that are equivalent) per cut. 5cm cuts at 10-15cm centres around the tree's circumference are to be made at an oblique angle to ensure penetration of the sapwood beneath the outer bark.

In association with the progressive removal of the nominated weed species from these areas, a revegetation/regeneration strategy should be selected to ensure that the newly weeded areas become established with native species. The regeneration strategies utilised on site are discussed below.

### **4.2 REVEGETATION STRATEGY**

Revegetation for the purpose of rehabilitation of disturbed areas have been (or proposed to be) undertaken on site for the following reasons:

- To maintain the existing level of integrity of vegetation communities contained within the EPZ
- To maintain and potentially increase the floristic diversity currently exhibited within the EPZ through rehabilitation practices
- To ensure that degraded and managed areas regenerate and are revegetated with native endemic flora species
- To stabilize areas subjected to weed management and cessation of grazing pursuits
- To restore cover, habitat diversity and dispersal options for the faunal assemblage
- To increase crown cover in open areas such that with the ongoing regrowth succession of the site there is potential for the existing communities to reach remnant status in the future
- To reduce the visual impacts of the extraction areas via the use of planted buffers (rehabilitation).

In addition to the above rehabilitation intent, revegetation of the ~17 hectares of cleared/pasture areas is necessary for long-term protection of the retained vegetation communities (including riparian and endangered ecological communities) from existing edge effects and ongoing fragmentation including:

- Abiotic effects: those changes in light, temperature, humidity and wind that occur when a remnant edge is formed by the creation of new surrounding land uses, such as clearing land for grazing, agriculture or urban development.
- Direct biological effects: include changes in the number and abundance of species brought about by changed environmental conditions (e.g. the spread of species that adapt well to the altered climatic conditions, and the reduction in recruitment of species that do not prosper).
- Indirect biological effects: changes in the way species interact, particularly modified patterns of competition, pollination, and the dispersal of seeds (Greening Australia, 2000).

### 4.3 REVEGETATION TYPES

As suggested for the ~17 ha Rehabilitation Zone and the extraction Buffer Zones, the strategy of Assisted Natural Regeneration (with supplementary plantings where necessary) and Reconstruction (large-scale planting/revegetation) are the methods that would prove the most feasible and effective. These types of strategies are outlined below in addition to the discussions previously offered in **Section 4.0** above.

#### 4.3.1 ASSISTED NATURAL REGENERATION (WITH SUPPLEMENTARY PLANTINGS)

Assisted Natural Regeneration (with supplementary plantings where necessary) has been implemented for the Zones 1-3 (and to be implemented within Zone 4). The entire 15 ha was subdivided into three smaller zones based upon location (refer **Figure 9**). These three smaller zones were subdivided further based upon existing levels of natural regeneration (following the initial trials) and adjacent community types and have commenced regeneration procedures. Due to the large area of rehabilitation, each zone has also been broken into manageable units of 0.5-1 hectare. Similar approach is now proposed for Zone 4 which has been divided in three stages. These stages will provide linkages between existing habitats within and immediately external to the site, as well as providing a visual buffer.

Attachment 1 details the staged nature of the rehabilitation for the rehabilitation zones and shows that rehabilitation will not be started or completed at the one date for each of the zones. For instance, Zone 1B is subdivided into five stages (as stated above) and from the commencement of rehabilitation for Stage 1 to the completion of the Short-Term Rehabilitation Processes outlined below for Stage 5, a total of eight years has passed. Thus, the chronology of the below section refers to the commencement of rehabilitation.

The staging process shall/has occurred as follows and has been selected to maximize potential for natural regeneration of endemic flora:

#### Short Term Rehabilitation Processes (Years 1 - 4)

This management stage involved the following:

- Ensuring cattle are removed from the relevant rehabilitation zones/stages. Fencing shall only be necessary in the instance that cattle are grazing adjacent paddocks. If the adjacent paddocks are fallow, then separate fencing is unnecessary.
- Assessing the success of the preceding/existing natural regeneration to establish cover across the rehabilitation zone/stage.
- Where gaps in native cover occur, planting of pioneer trees and shrubs will be necessary in accordance with selected modules (refer **Section 4.3.1.1**). Pioneer species have been selected upon evaluation of previous regeneration trials, adjacent communities intended to be replicated and ability for pioneer species to establish quickly and shade-out weed species. Establishment of quick growing species will bring forward flowering and attraction of fauna to the rehabilitation zone. Birds and bats are likely to then deposit flora seeds from surrounding areas.
- Assess the diversity of the flora assemblage to ensure a healthy mix of native

species typical to the community being replicated is present (i.e. the community is not mono-specific except in intended areas).

- Where diversity is low, undertake diversity plantings from selected modules (refer **Section 4.3.1.1**). These species selected are based upon the existing adjacent vegetation communities, endemic littoral rainforest species and species suitable for threatened fauna foraging (in accordance with approved concept plans).
- Assessing the success of the preceding natural regeneration, pioneer plantings and diversity plantings to establish cover and floristic diversity across the rehabilitation zone/stage.
- Assess the occurrence of native ground covers within the across the rehabilitation zone/stage. In some instances, native groundcovers may be suppressed in association with early regrowth communities. If ground covers are not sufficiently established, then groundcover planting from selected modules shall be performed.
- Cattle, weed and fire trail monitoring and maintenance will be ongoing.

### **Medium Term Rehabilitation Processes (Years 5 - 9)**

This management stage involved the following:

- Where monitoring identifies shortfalls in diversity, cover and/or numbers as per **Section 4.4**, replacement or in-fill plantings will be undertaken as per the planting schedules outlined in **Figure 19**, **Figure 20** and **Figure 21** below.
- Cattle, weed and fire trail monitoring and maintenance will be ongoing.

### **Long Term Rehabilitation Processes (Years 10 +)**

This management stage involved the following:

- Assisted regeneration monitoring and maintenance will be ongoing.
- Cattle, weed and fire trail monitoring and maintenance will be ongoing.

This process shall occur for the balance of the project time-frame. Routine monitoring and maintenance (refer **Section 4.4**) shall be undertaken with corrective actions (refer **Section 4.7**) performed in incidences of non-compliance with set rehabilitation performance criteria (refer **Section 4.6**).

#### **4.3.1.1 DESCRIPTION OF ASSISTED REGENERATION ZONES**

As discussed, Zones 1-3 (initial 15ha rehabilitated) was subdivided into three smaller zones based upon site location. An additional area (Zone 4) is now proposed to enhance linkages between existing habitats within, and immediately adjacent to the site. Each of these zones is described separately below with discussions provided regarding existing levels of natural regeneration (following trials), intended vegetation communities to be established and planting modules for supplementary planting (only required if regeneration is unsuccessful and to increase floristic diversity). It is noted that rehabilitation has commenced within zones 1-3 (mixture of both supplementary planting and natural regeneration) with additional revegetation areas now proposed for Zone 4 (refer **Figure 14**). Furthermore, areas surrounding the two extraction lakes are proposed for future agricultural use (i.e. plantation of fruiting trees).



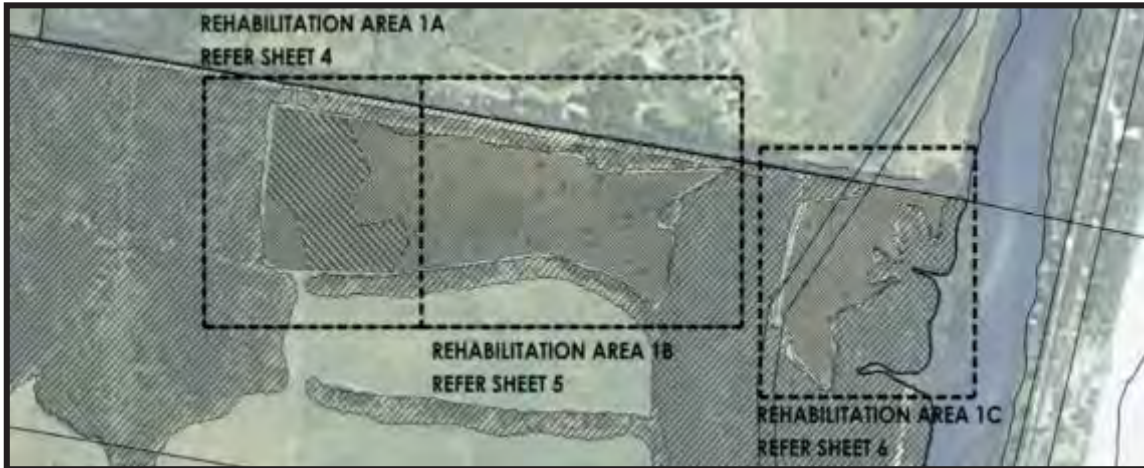


Figure 12: Rehabilitation Area / Zone 1

**REHABILITATION ZONE/AREA 1:**

This rehabilitation zone covers 8.9 ha and consolidates a fragmented corridor of Swamp Sclerophyll EECs and wetlands located in the northern areas of the site. Cattle have been excluded from this zone to allow rehabilitation. Species noted include Paperbark, Swamp Oak, Swamp Mahogany, Corkwood, Swampbox, *Banksia*, *Hovea*, Hatpins, Pennywort, Blady Grass, Bunchy Sedge and Sundew. Wetland plants are also common with a low-lying soak in the west of the zone managed for Freshwater Wetland EEC regeneration.



Figure 13: Before and After Rehabilitation Images of Rehabilitation Area / Zone 1



Each zone/area (1A-1C) has been broken down into management stages of approximately 0.5 ha to allow staged management as described in **Section 4.3.1** above. Zone 1A has been managed to establish a Freshwater Wetland EEC and zones 1B & 1C managed to establish Swamp Sclerophyll EECs. Littoral Rainforest EEC species are utilised in the sub-canopy and shrub layers.

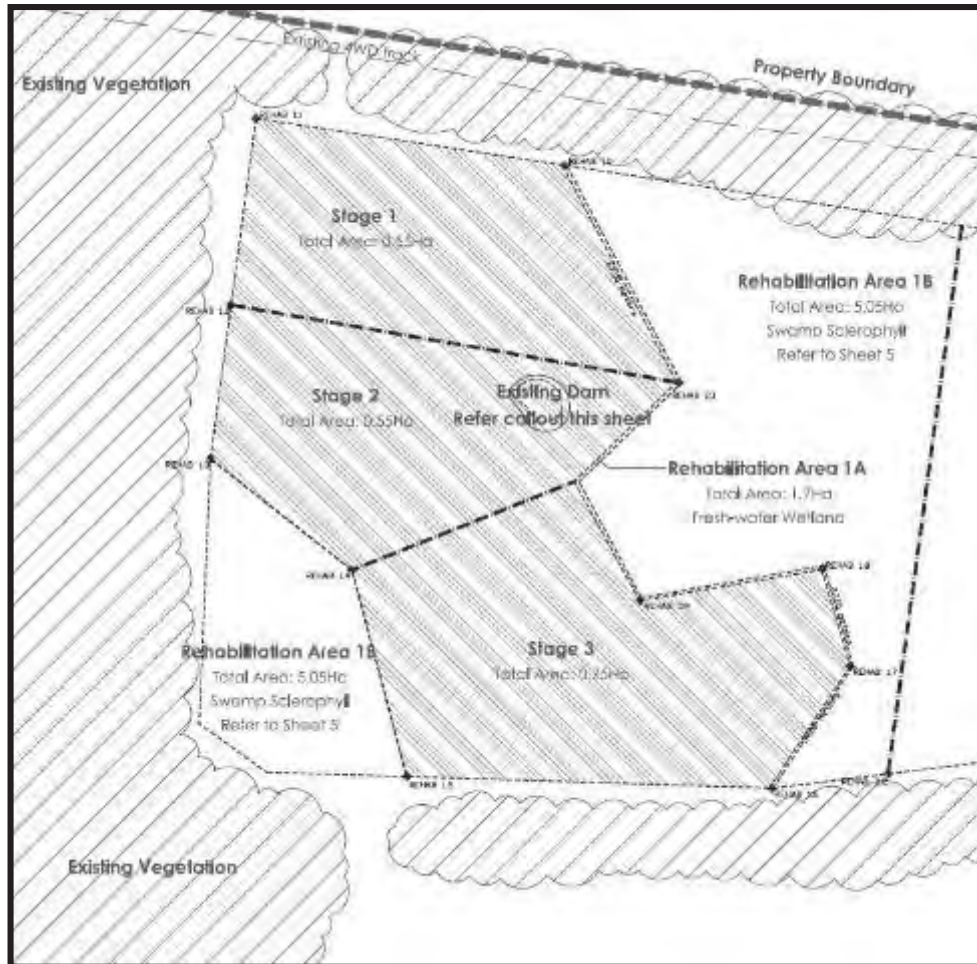


Figure 14: Staging of Zone 1A (also refer Attachment 1)

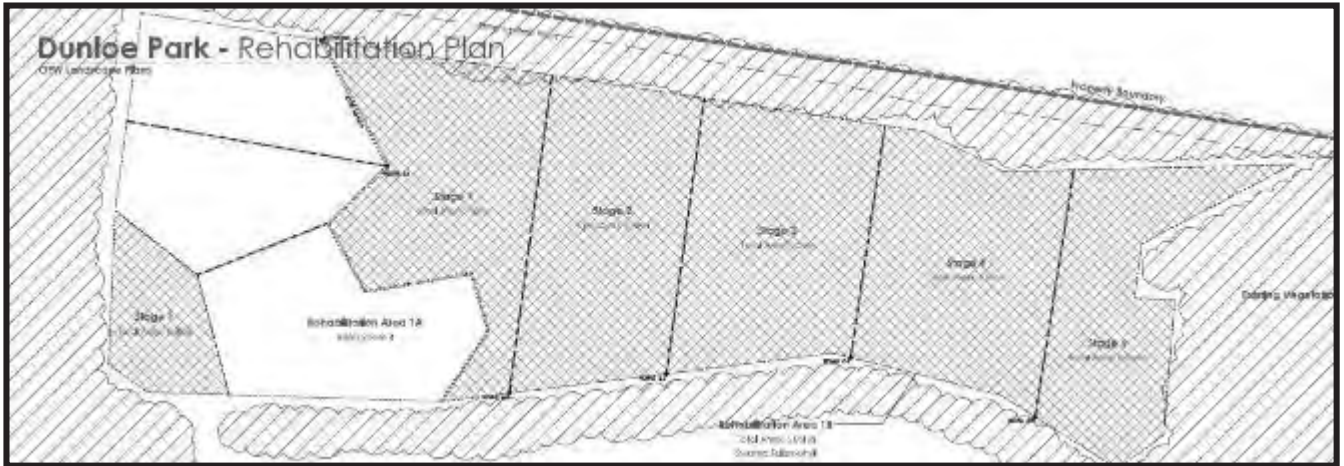


Figure 15: Staging of Zone 1B (also refer Attachment 1)

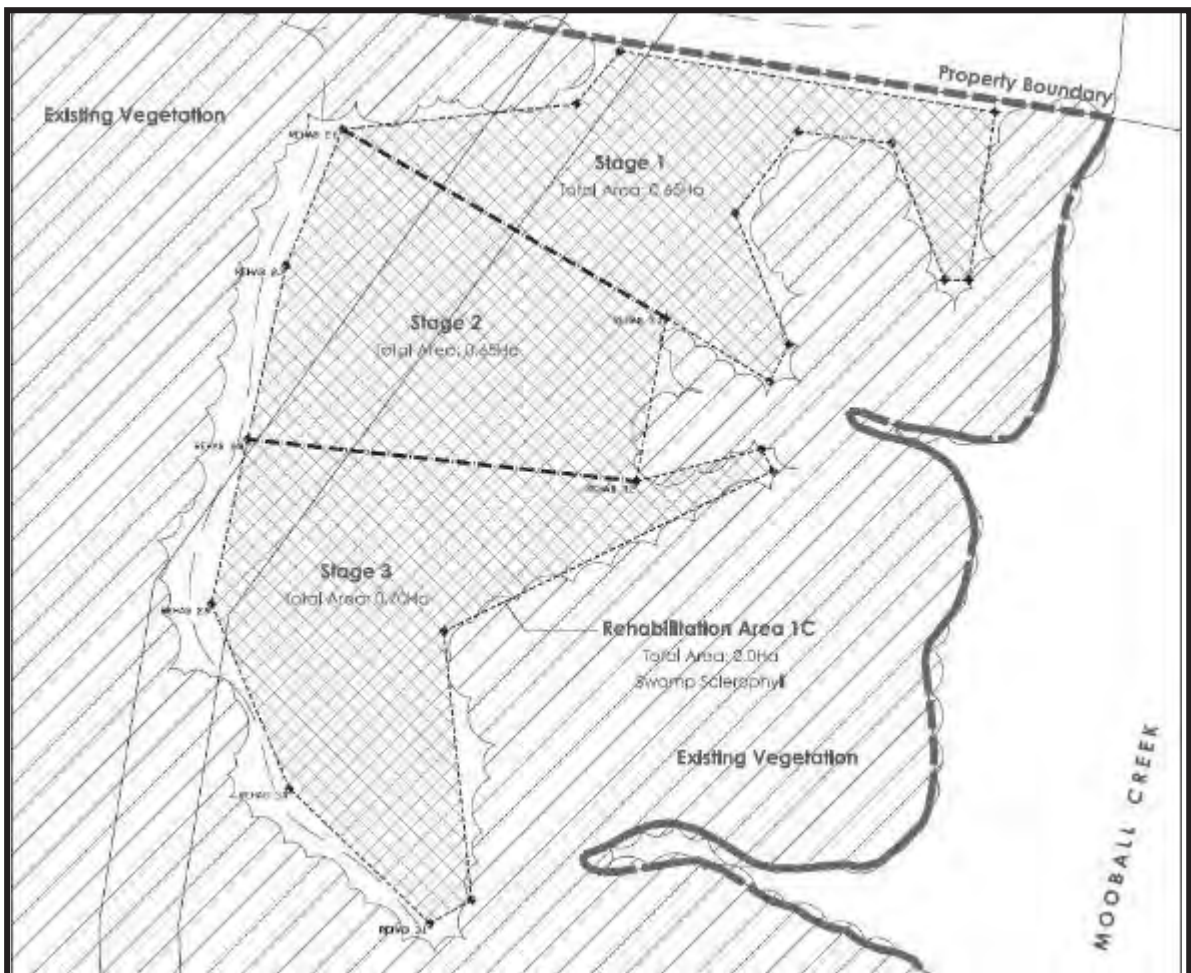


Figure 16: Staging of Zone 1C (also refer Attachment 1)

Revegetation modules for each of the community types have been provided for use in association with 'pioneer', 'diversity' and 'groundcover' supplementary plantings if required (as described in **Section 4.3.1** above). A full module and quantities (refer below and Attachment 1) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful (currently not the case).

However, the modules shall be utilised to select species and densities from to perform 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved or fail (refer **Section 4.6**).

I.E. Natural regeneration canopy coverage will not be considered achieved for any one area if it does not contain a canopy or small tree typical to the community (refer **Section 4.3.1** modules) within an area equal to or greater than 4 m<sup>2</sup> (i.e. if an area 2m x 2m does not contain any juveniles of required canopy tree/small tree than natural regeneration canopy cover is considered to be unsuccessful at that particular location).

In the event that such a location is deemed to occur then supplementary (pioneer species) planting shall be undertaken within the patch in accordance with **Section 4.3.1**.

For example, a patch of 10 m<sup>2</sup> within Rehabilitation Zone 1B is noted to be regenerated with native ground covers and/or shrubs but no tree species typical to the listed 'Swamp Sclerophyll' community occur. In this instance 5 x trees/small trees from the Rehabilitation Zone 1B are to be pocket planted at 75 mm pot sizes within the patch.

Further discussions regarding performance requirements and triggers for canopy 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings are provided in **Section 4.6**.

## Rehabilitation Area 1A

Total Area: 1.85Ha

Vegetation Type: Fresh-water Wetland

### TREES - TO DAM

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	Casuarina glauca	Swamp Oak	9	140MM	21
col sal	Callistemon salignus	Willow Bottlebrush			
lop sav	Lophosilemon suaveolens	Swampbox			
mel qui	Melaleuca quinquenervia	Paperbark			

### REHABILITATION AREA 1A (185 MODULES)

#### SEDGES, RUSHES + FERNS

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
bau jun	Baumea juncea	Bare Twigrush	100 (min 6 species) per mod	75MM TUBE	Stage 1 1500
bau ter	Baumea teretifolia	Twigrush			
ble ind	Blechnum indicum	Bungwa Fern			
cen asi	Centella asiatica	Pennywort			
cyp pol	Cyperus polystachyos	Bunchy Sedge			
flm ter	Flimbristylis ferruginea	Rusty Fringed-edge			
flm pol	Flimbristylis polytrichoides	Fuzzy Rush			
gah asp	Gahnia aspera	Saw Sedge			
jun kro	Juncus kraussii	Searush			
jun uni	Juncus uniolatus	Common Rush			
phl lan	Philydrum lanuginosum	Frogmoult			
phr aus	Phragmites australis	Common Reed			
sch val	Schoenoplectus valdus	Clubrush			
sch lit	Schoenoplectus littoralis	Clubrush			
spo vit	Sporobolus virginicus	Salt Couch			
tri str	Triplachne striatum	Sheared Arrow Grass			
xyr com	Xyris complanata	Hatpins			



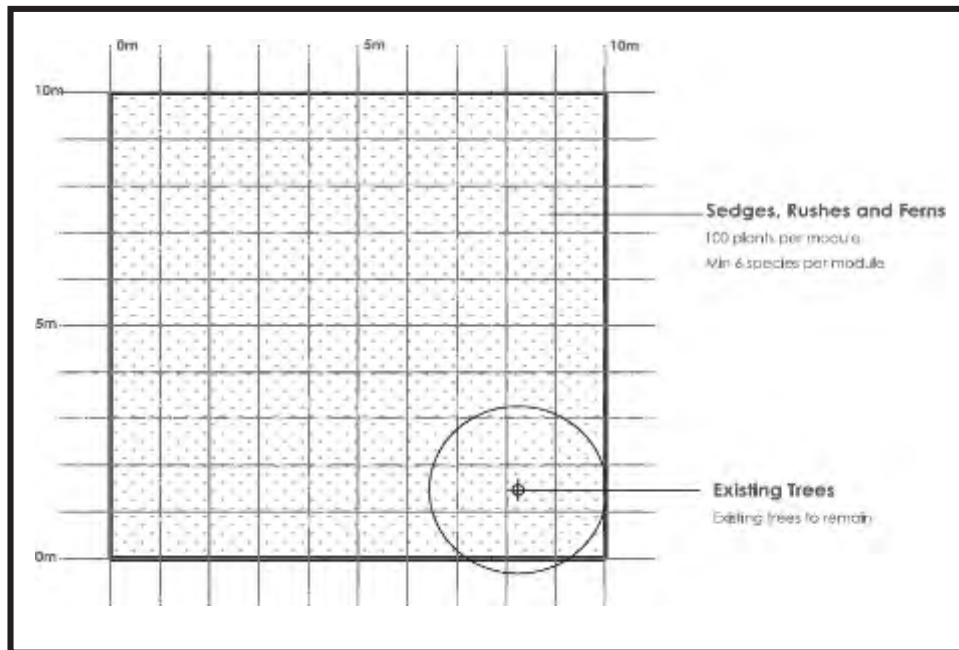


Figure 17: Freshwater Wetland Module Pioneer Planting

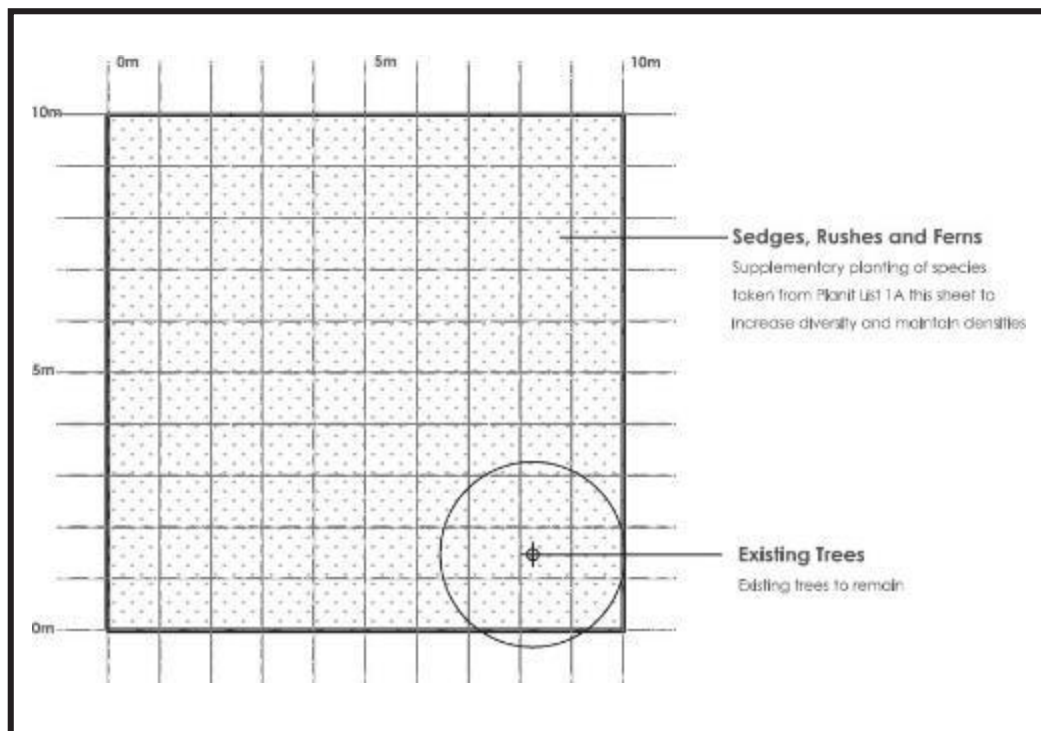


Figure 18: Freshwater Wetland Module Diversity Planting

**REHABILITATION AREAS 1B & 1C TOTAL AREA: 4.2HA  
VEGETATION TYPE: SWAMP SCLEROPHYLL**

TREES - module 1, 2 and 3				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
cal sal	<i>Callistemon salignus</i>	White Bottlebrush	30 Minimum 2 species selected per module	75MM TUBE
car int	<i>Corymbia intermedia</i>	Pink Bloodwood		
euc ter	<i>Eucalyptus tereticornis</i>	Blue Gum		
euc rob	<i>Eucalyptus robusta</i>	Swamp Mahogany		
mel qui	<i>Melaleuca quinquenervia</i>	Paperbark		
lop sau	<i>Lophoslemon suaveolens</i>	Swamp Box		
SMALL TREES / SHRUBS - module 1, 2 and 3				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
all for	<i>Allocasuarina torulosa</i>	Forest Oak	30 Minimum 2 species selected per module	75MM TUBE
acr imp	<i>Acronychia imperforata</i>	Beach Acronychia		
ban int	<i>Banksia integrifolia</i>	Coastal Banksia		
cup ana	<i>Cupanopsis anacardioides</i>	Tuckeroo		
dub myo	<i>Dubautia myoporoides</i>	Corkwood		
hove acu	<i>Hovea acutifolia</i>	Hovea		
not lan	<i>Notolaea longifolia</i>	Long-leaved Mock-bilve		
pit rev	<i>Pittosporum revolutum</i>	Forest Pittosporum		
syz ole	<i>Syzygium oleosum</i>	Blue Lillypill		
tro lau	<i>Trochocarpa laurina</i>	Tree Heath		

GROUNDCOVERS - module 3 only					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
aus dul	<i>Austramyrtus dulcis</i>	Midyim	50 Minimum 2 species selected per module	75MM TUBE	To be determined based on bush regeneration expert
ble ind	<i>Blechnum indicum</i>	Bungwall Fern			
cen asi	<i>Cenifella asiatica</i>	Pennywort			
cyp pol	<i>Cyperus polystachyos</i>	Flat Sedge			
dia cae	<i>Dianella caerulea</i>	Blue Flag Lilly			
gan asp	<i>Gahnia aspera</i>	Saw Sedge			
hib sca	<i>Hibbertia scandens</i>	Snake Vine			
har vio	<i>Hardenbergia violacea</i>	Native sarsaparilla			
lom lan	<i>Lomandra longifolia</i>	Marrush			
pit-etc	<i>Pteridium esculentum</i>	Braken Fern			
sch val	<i>Schoenoplectus vallidus</i>	Clubrush			
xyl com	<i>Xyris complanata</i>	Yelloweyed Grass			

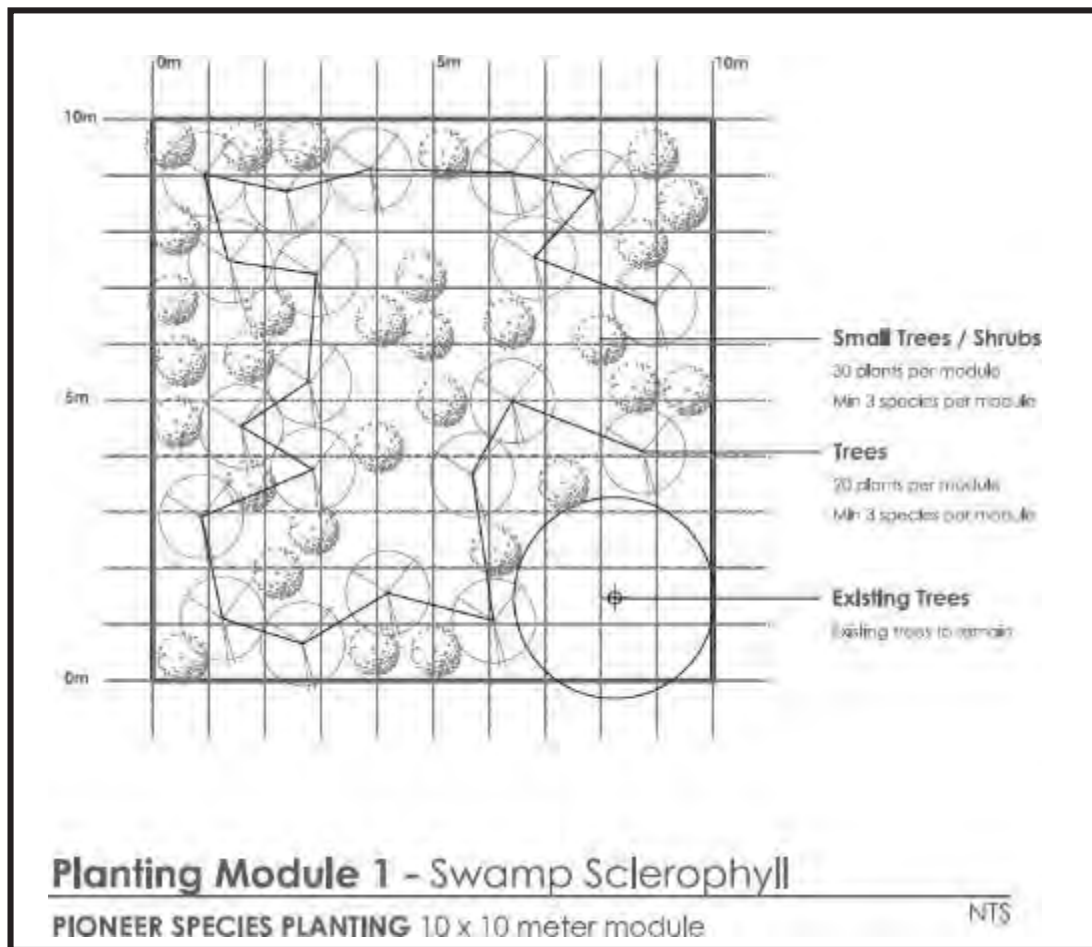


Figure 19: Planting Module 1



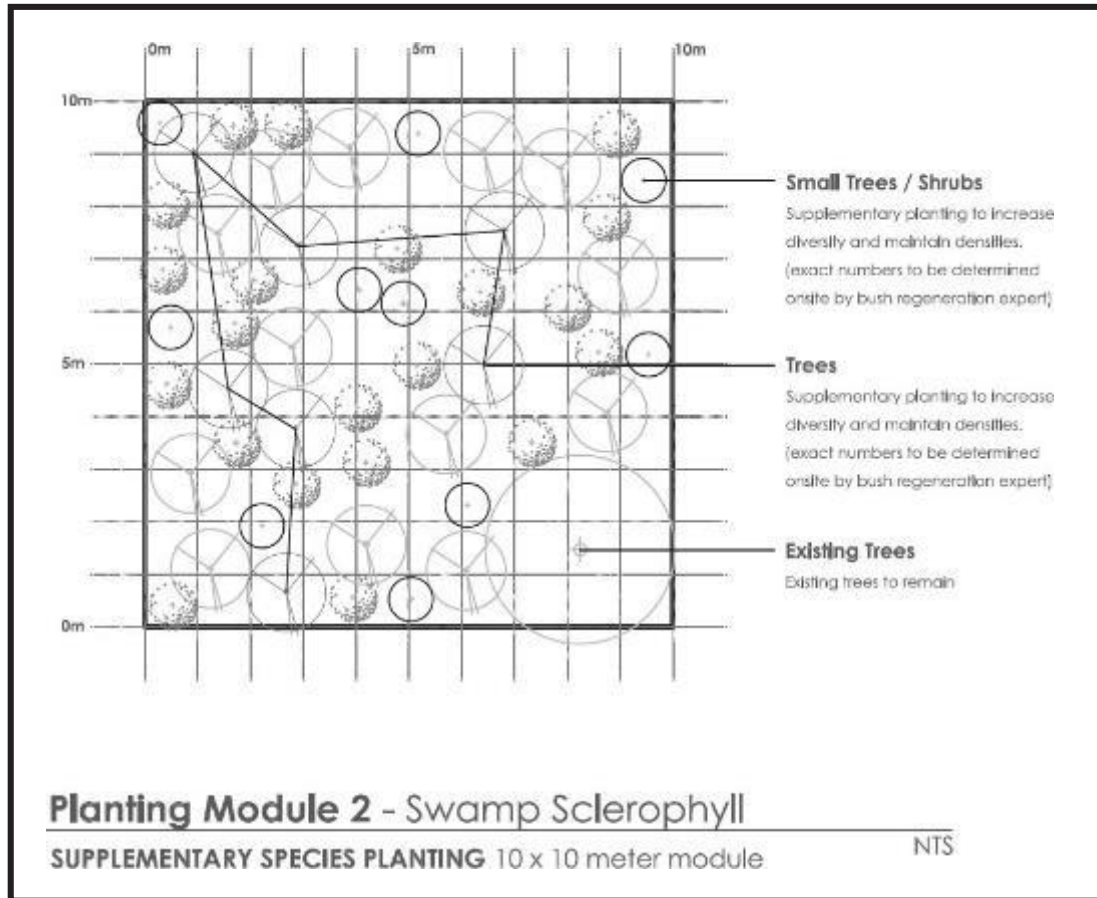


Figure 20: Planting Module 2

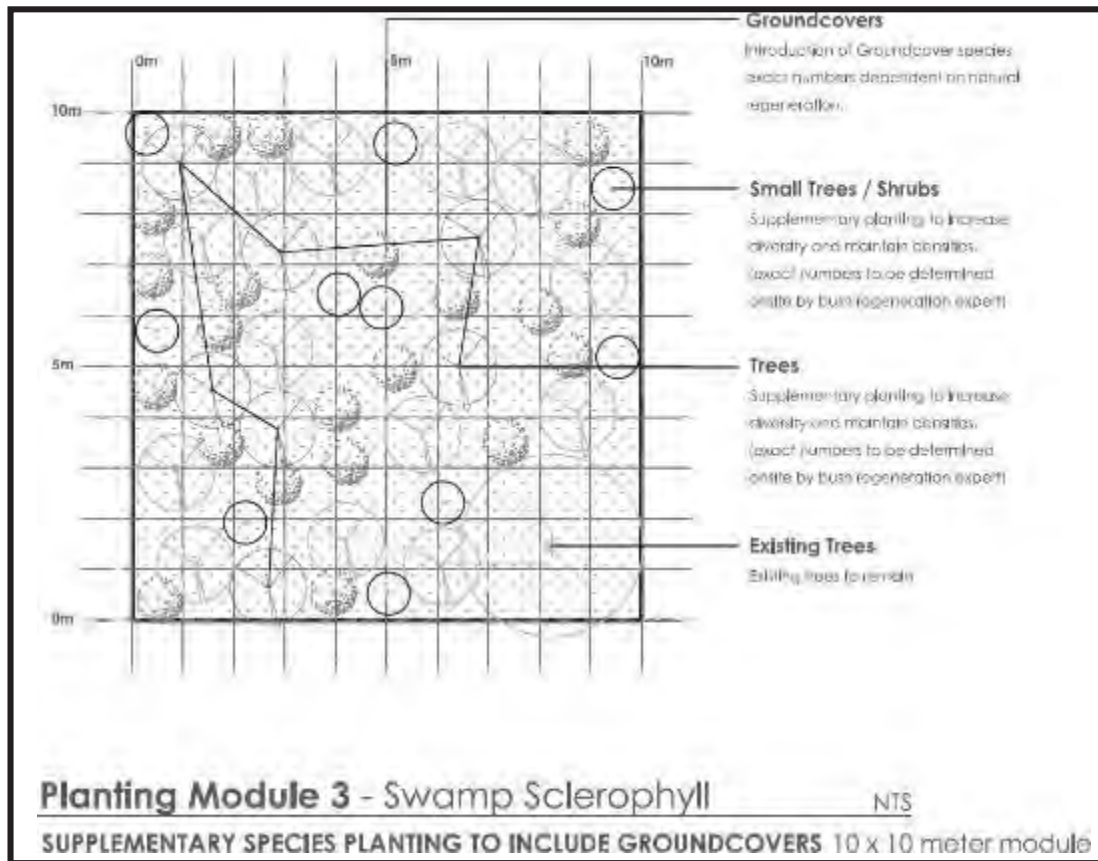


Figure 21: Planting Module 3

REHABILITATION ZONE/AREA 2:

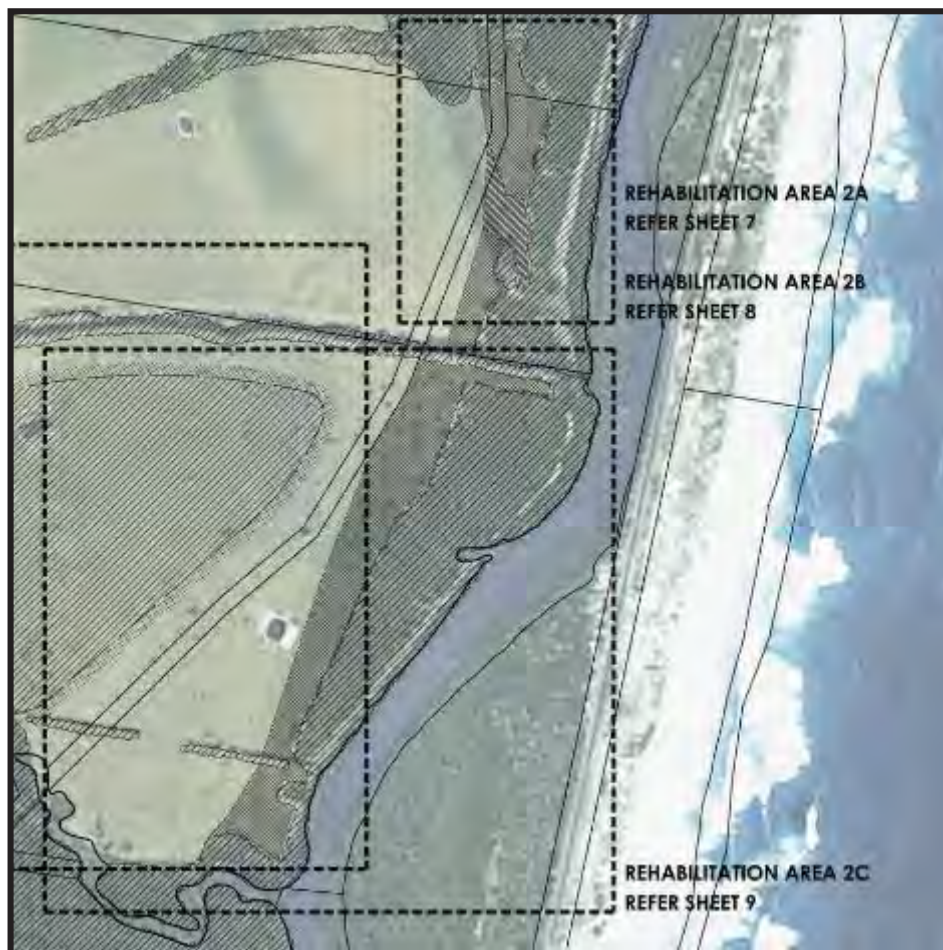


Figure 22: Rehabilitation Area / Zone 2

This rehabilitation zone covers 5.08 ha and consolidates a fragmented corridor of Swamp Sclerophyll EECs and wetlands located adjacent to Mooball Creek. Cattle have been excluded from this zone to allow rehabilitation. Species noted prior to regeneration procedures include Banksia, Swamp Oak, Paperbark, Willow Bottlebrush, Corkwood, Swampbox, Geebung, Bracken, Midyim, Blady Grass, Bunchy Sedge and Tuckeroo. Wetland plants are also common with a low-lying soak in the northeast of the zone managed for a combination Freshwater Wetland and Saltmarsh EEC regeneration.





Figure 23: Before and After Images of Rehabilitation Area / Zone 2

Each zone/area (2A-2C) has been broken down into management stages of approximately 0.5-1ha to allow staged management as described in **Section 4.3.1** above. Zone 2B is managed to establish a Freshwater Wetland EEC and zones 2A & 2C is managed to establish a combination of Swamp Sclerophyll/Swamp Oak EECs and Banksia Forest. Littoral Rainforest EEC species is utilised in the sub-canopy and shrub layers.

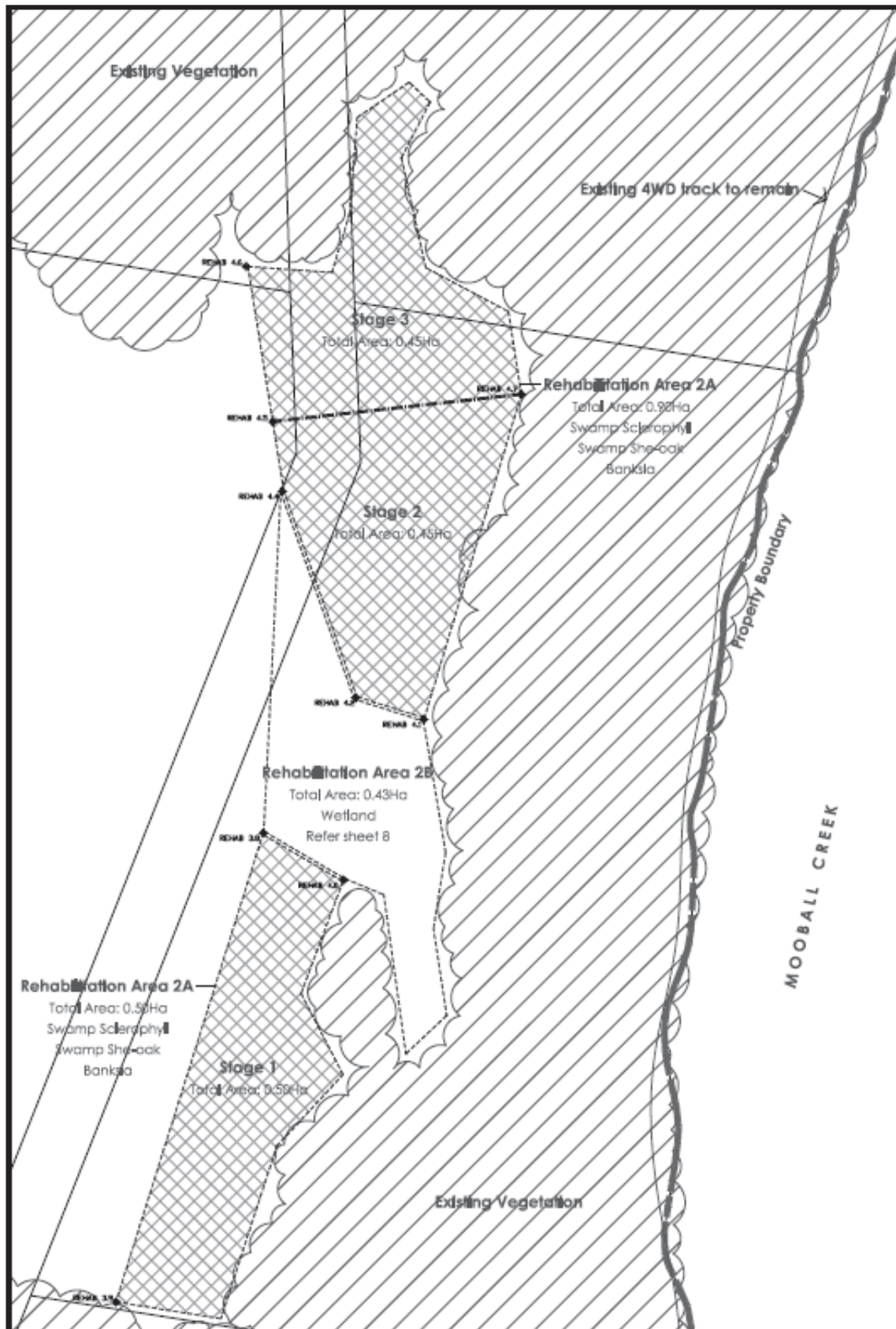


Figure 24: Staging of Zone 2A



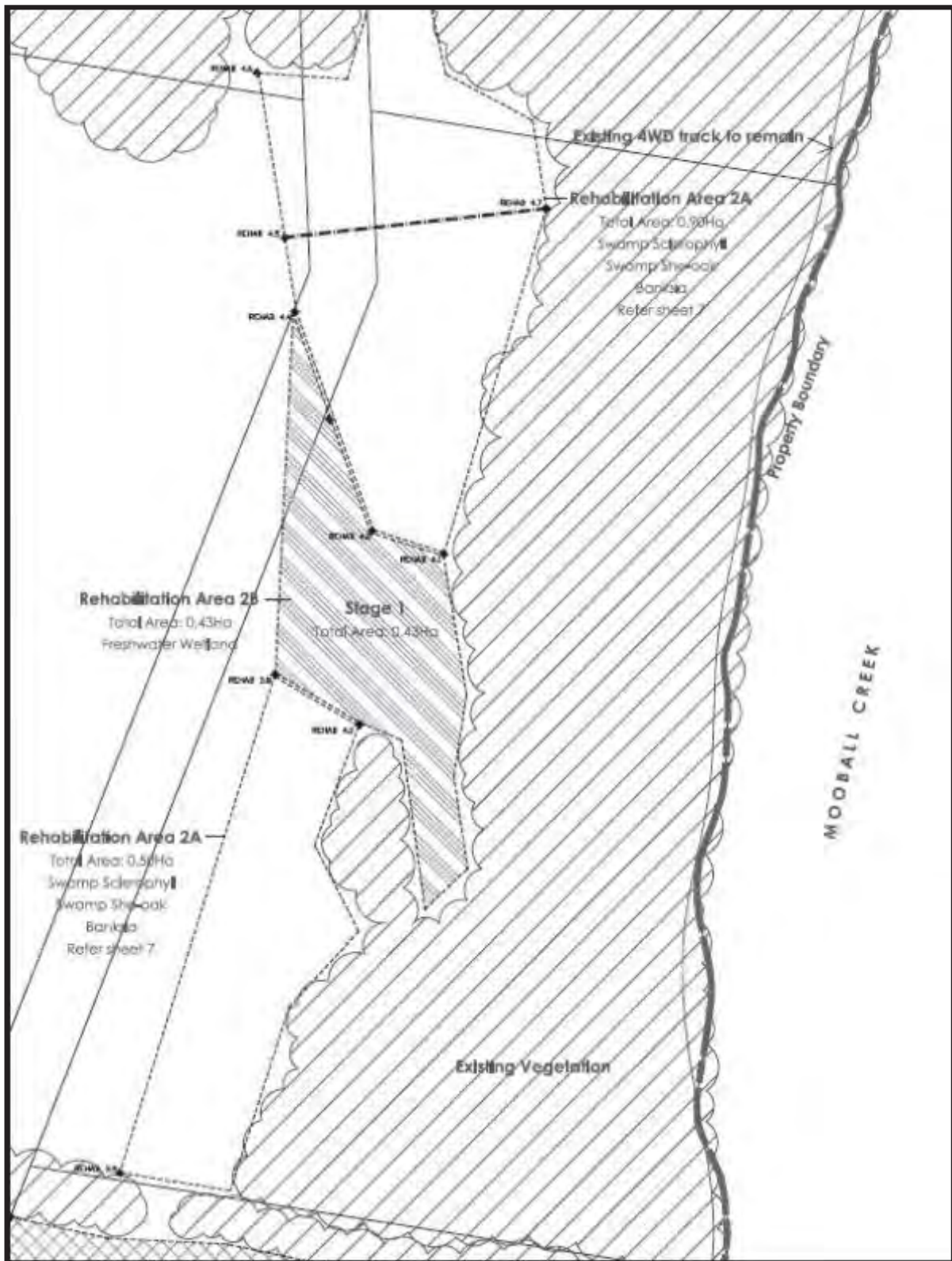


Figure 25: Staging of Zone 2B

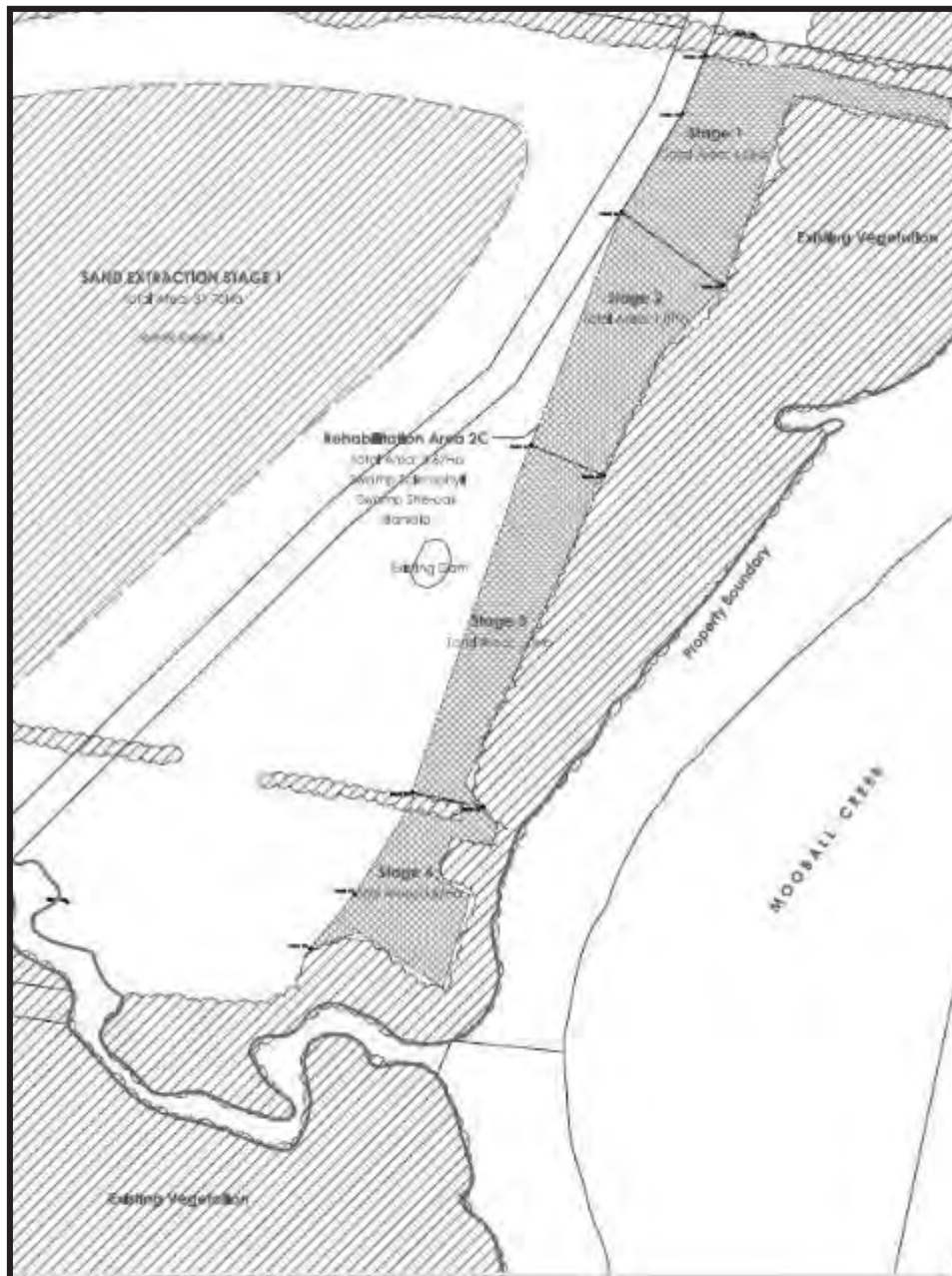


Figure 26: Staging of Zone 2C

Revegetation modules for each of the community types have been provided for use in association with ‘pioneer’, ‘diversity’ and ‘groundcover’ supplementary plantings if required (as described in **Section 4.3.1** above). A full module and quantities (refer below and **Attachment 1**) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful (currently not the case).

However, the modules shall be utilised to select species and densities from to perform ‘pioneer’, ‘diversity’ and/or ‘groundcover’ supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved (refer **Section 4.6**).

Rehabilitation Area 2B - species list				
REHABILITATION AREA 2B				
TOTAL AREA:0.43Ha (43 MODULES)				
SEDGES, RUSHES + FERNS				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
baa jun	<i>Baumea juncea</i>	Sare Twigrush	100	75MM TUBE
baa ter	<i>Baumea teretica</i>	Twigrush		
ble ind	<i>Blechnum indicum</i>	Bungwall Fern		
cea asi	<i>Cerata asiatica</i>	Pennywort		
cyp pol	<i>Cyperus polystachyos</i>	Sunchy Sedge		
fim fer	<i>Fimbristylis ferruginea</i>	Rusty Fringesedge		
fim pol	<i>Fimbristylis polytrichoides</i>	Fuzzy Rush		
gab asi	<i>Gahnia aspera</i>	Saw Sedge		
jun tra	<i>Juncus trausneri</i>	Searush		
jun val	<i>Juncus vernalis</i>	Common Rush		
phj lan	<i>Philydrium lanuginosum</i>	Frogmoss		
phr aus	<i>Phragmites australis</i>	Common Reed		
sch val	<i>Schaenoplectus vernalis</i>	Clubrush		
sch ill	<i>Schaenoplectus illinoensis</i>	Clubrush		
spo vir	<i>Sporobolus virginicus</i>	Salt Couch		
trg str	<i>Triglochin striatum</i>	Steakd Arrow Grass		
xyr com	<i>Xyris complanata</i>	Hatpin		

Figure 27: Wetland Community Module

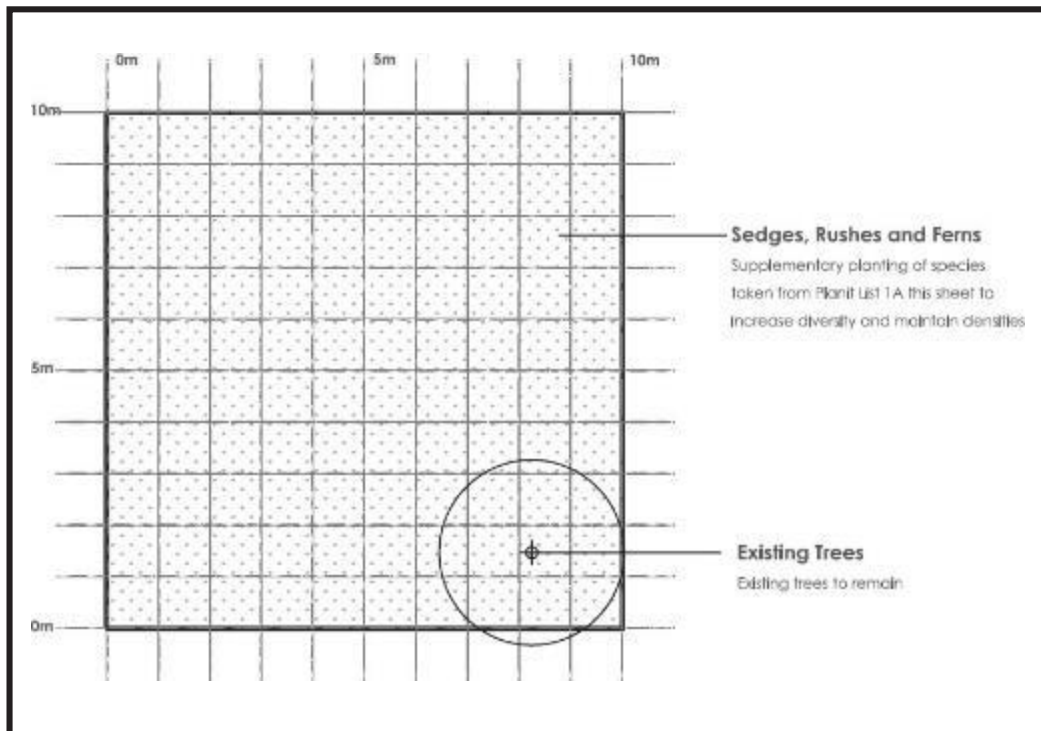


Figure 28: Freshwater Wetland Module Pioneer Planting



**REHABILITATION AREAS 2A & 2C TOTAL AREA: 7.1HA  
VEGETATION TYPE: SWAMP SCLEROPHYLL/SWAMP OAK & BANKSIA**

<b>Rehabilitation Area 2A - species list</b>				
<b>REHABILITATION AREA 2A</b>				
<b>TOTAL AREA:1.40ha (140 MODULES)</b>				
<b>TREES - module 1, 2 and 3</b>				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
ban int	<i>Banksia integrifolia</i>	Coastal Banksia	20 Minimum 3 species selected per module	75MM TUBE
cal sal	<i>Callistemon salignus</i>	White Bottlebrush		
lap sau	<i>Lophostemon suaveolens</i>	Swamp Hair		
mel qui	<i>Melaleuca quinquenervia</i>	Paperbark		
<b>SMALL TREES / SHRUBS - module 1, 2 and 3</b>				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
acm hem	<i>Acmena hemilampra</i>	Broad-leaved Lillypill	30 Minimum 2 species selected per module	75MM TUBE
aca sop	<i>Acacia sophorae</i>	Coast Wattle		
ale cor	<i>Alectryon corkaceus</i>	Beach Alectryon		
can bar	<i>Commersonia bartramia</i>	Brown Kumajong		
cup ana	<i>Cupaniopsis anacardioides</i>	Tuckeroo		
dub mya	<i>Dubalia myoporoides</i>	Corkwood		
ela ret	<i>Elaeocarpus reticulatus</i>	Blueberry Ash		
exo lat	<i>Exocarpos latifolius</i>	Broad-leaved Cherry		
per str	<i>Persoonia stradbrenkensis</i>	Coast Geebung		
<b>GROUNDCOVERS - module 3 only</b>				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
adi his	<i>Adiantum hispidulum</i>	Rough Maidenhair	50 Minimum 5 species selected per module	75MM TUBE
aus dul	<i>Austromyrtus dulcis</i>	Midyim		
ble car	<i>Blechnum cartilagineum</i>	Gristle Fern		
ble ind	<i>Blechnum indicum</i>	Bungwall Fern		
cit pen	<i>Citrum pendunculatum</i>	Swamp Lilly		
gah asp	<i>Gahnia aspera</i>	Saw Sedge		
lam lon	<i>Lomandra longifolia</i>	Matrush		

Figure 29: Rehabilitation 2A Species List



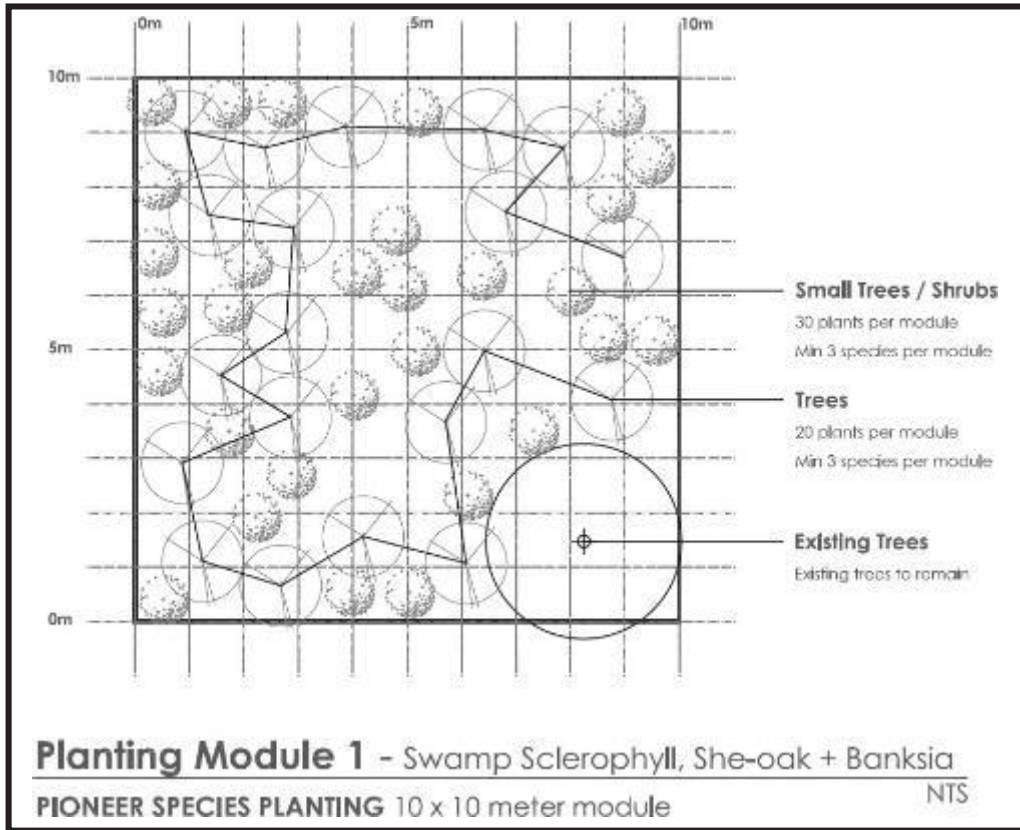


Figure 30: Planting Module 1

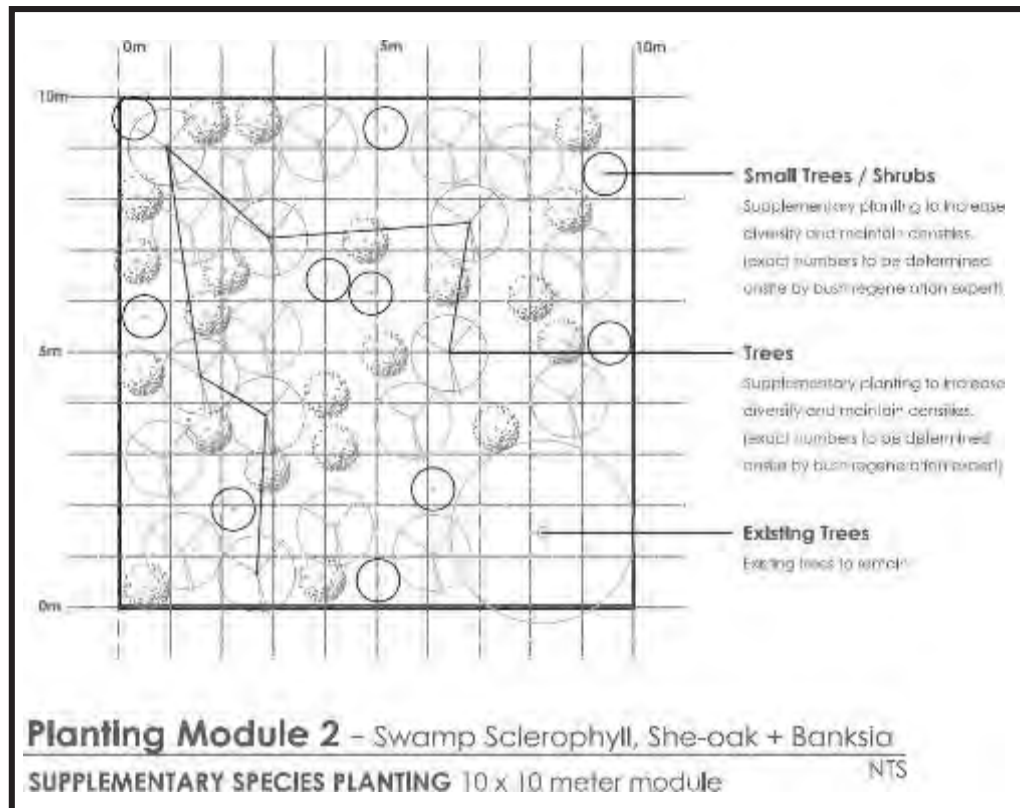


Figure 31: Planting Module 2

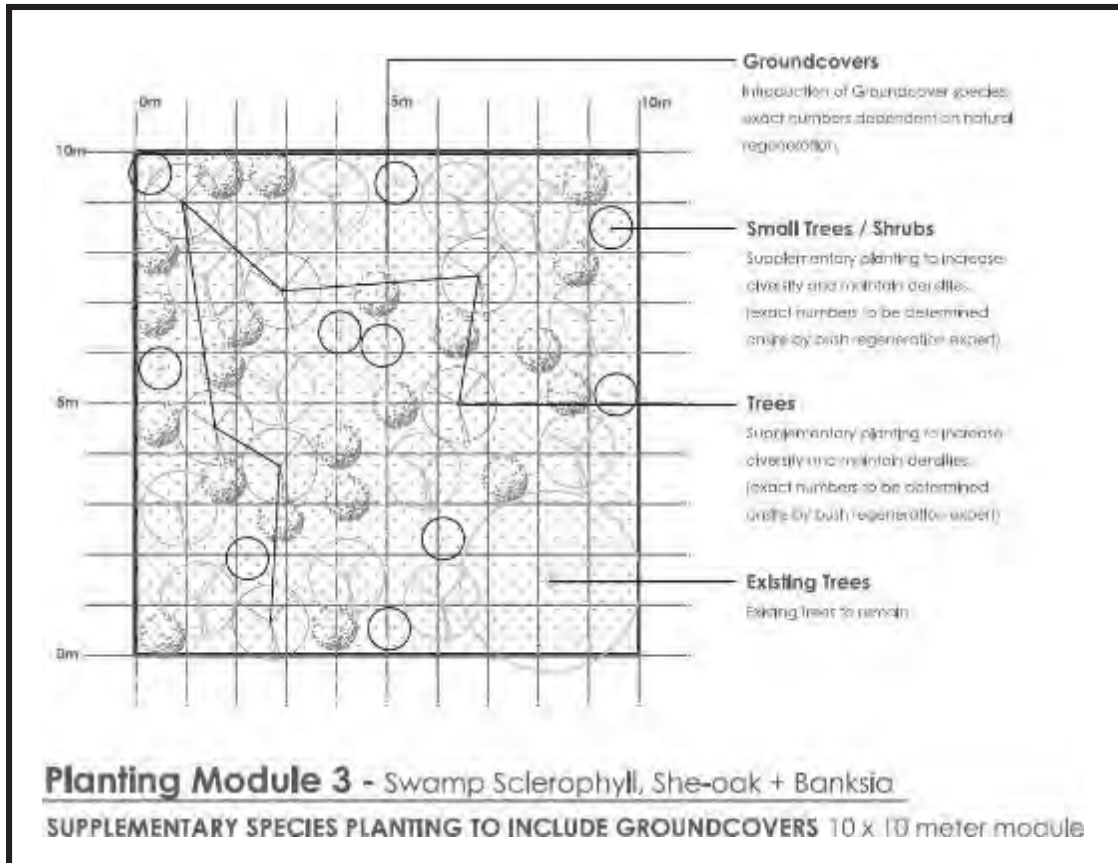


Figure 32: Planting Module 3

*REHABILITATION ZONE/AREA 3:*

Figure 33: Rehabilitation Area / Zone 3

The Rehabilitation Area 3 shown on **Figure 33** is a 0.6 ha area within the broader Rehabilitation Zone 3 (covering a total 1.2 ha). Vegetation enhancement occurs across the whole of Rehabilitation Zone 3, however the subsection of Rehabilitation Area 3 as shown on **Figure 33** has been identified as an area which would benefit from further assistance to support the connectivity of the landscape. Additional planting within Rehabilitation Area 3 (**Figure 33**) will consolidate a fragmented corridor of Swamp Sclerophyll, Swamp She-oak and Swamp box/Littoral Rainforest EECs located adjacent to Mooball Creek. Cattle have been excluded from this zone to allow rehabilitation. Species noted include Banksia, Swamp Oak, Paperbark, Bracken and Blady Grass. Whisky grass is also common.



Figure 34: Images of Rehabilitation Area / Zone 3 - 2009

The rehabilitation area (within Zone 3) occurs in one management stage of 0.6ha (**Figure 35**). The zone is managed to establish a combination of Swamp Sclerophyll and Swamp Oak EECs. Littoral Rainforest EEC species is utilised in the sub-canopy and shrub layers.

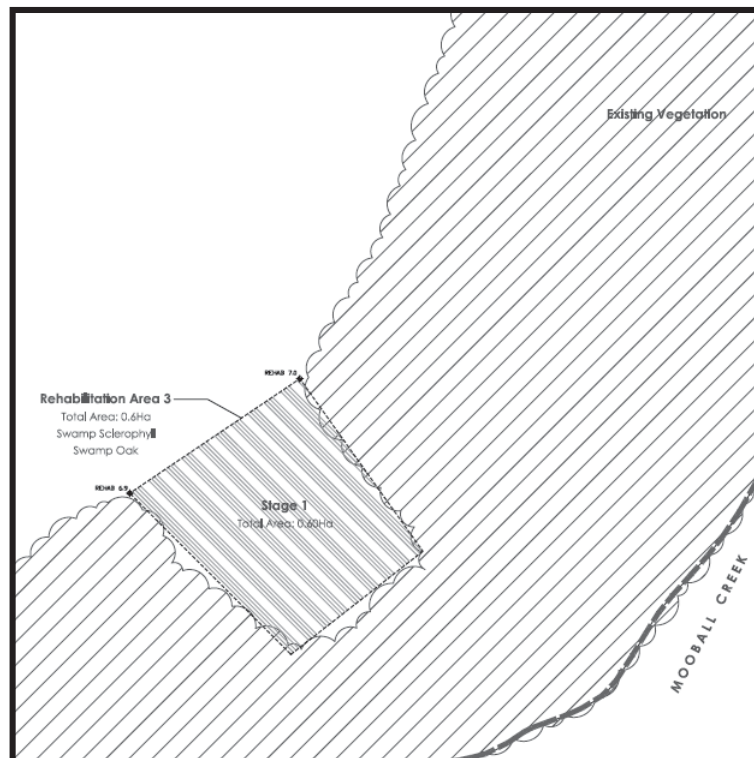


Figure 35: Staging of Zone 3

A revegetation module for this community type has been provided for use in association with 'pioneer', 'diversity' and 'groundcover' supplementary plantings if required (as described in **Section 4.3.1** above). A full module and quantities (refer below and **Attachment 1**) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful (currently not the case).



However, the modules shall be utilised to select species and densities from to perform 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved (refer Section 4.6).

Rehabilitation Area 3 - species list					
<b>REHABILITATION AREA 3</b>					
<b>TOTAL AREA:1.20ha (120 MODULES)</b>					
<b>TREES - module 1, 2 and 3</b>					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	<i>Casuarina glauca</i>	Swamp Oak	20	75MM TUBE	Stage 1 1000
cal sal	<i>Callistemon salignus</i>	White Bottlebrush	Maximum 5 species selected per module		Stage 2 1000
lop sau	<i>Lophostemon suaveolens</i>	Swamp Box			
mel qui	<i>Malaleuca quinquenervia</i>	Paperbark			
<b>SMALL TREES / SHRUBS - module 1, 2 and 3</b>					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	
acr imp	<i>Acronychia imperatoria</i>	Beach Acronychia	30	75MM TUBE	Minimum 3 species selected per module
all lit	<i>Allcasuarina littoralis</i>	Black She-oak			
ban int	<i>Banksia integrifolia</i>	Coast Banksia			
com bar	<i>Commersonia bartramia</i>	Brown Kumajong			
dub myo	<i>Duboisia myoporoidea</i>	Corkwood			
gau sem	<i>Gouia semiglauc</i>	Wild Quince			
mbi pyr	<i>Mitchochocarpus pyriformis</i>	Yellow Pearfruit			
per str	<i>Persoonia stradbrenensis</i>	Coast Geebung			
plf gla	<i>Plidosigma glabrum</i>	Plum Myrtle			
pol ele	<i>Polyscias elegans</i>	Celerywood			
<b>GROUNDCOVERS - module 3 only</b>					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	
adi his	<i>Adiantum hispidulum</i>	Rough Maidenhair	50	75MM TUBE	Minimum 2 species selected per module
aus dul	<i>Austromyrtus dulcis</i>	Midyim			
ble ind	<i>Blechnum indicum</i>	Bungwall Fern			
chr apl	<i>Chrysocephalum apiculatum</i>	Yellow Butters			
cri pen	<i>Crinum pendunculatum</i>	Swamp Lilly			
gah asp	<i>Gahnia aspera</i>	Saw Sedge			
gao rot	<i>Goodenia rotundifolia</i>	Star Goodenia			
lom lon	<i>Lomandra longifolia</i>	Mahush			

Figure 36: Swamp Schlerophyll / Swamp Oak Community Module



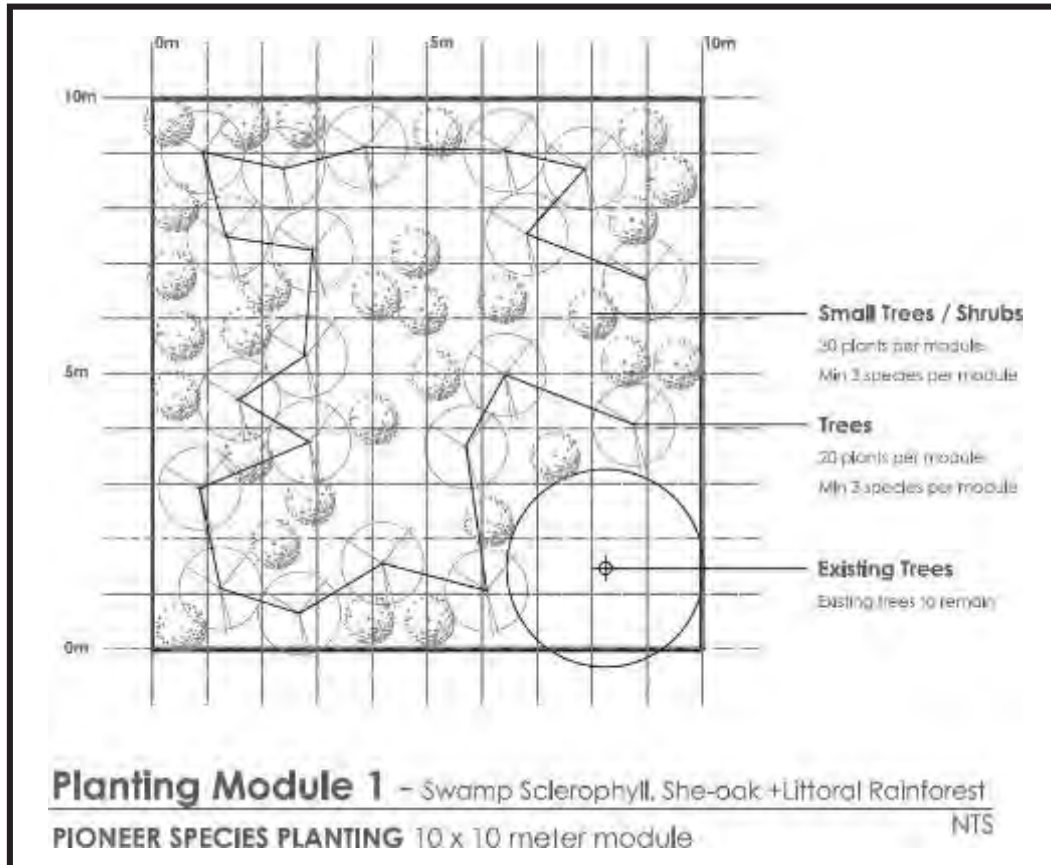


Figure 37: Planting Module 1

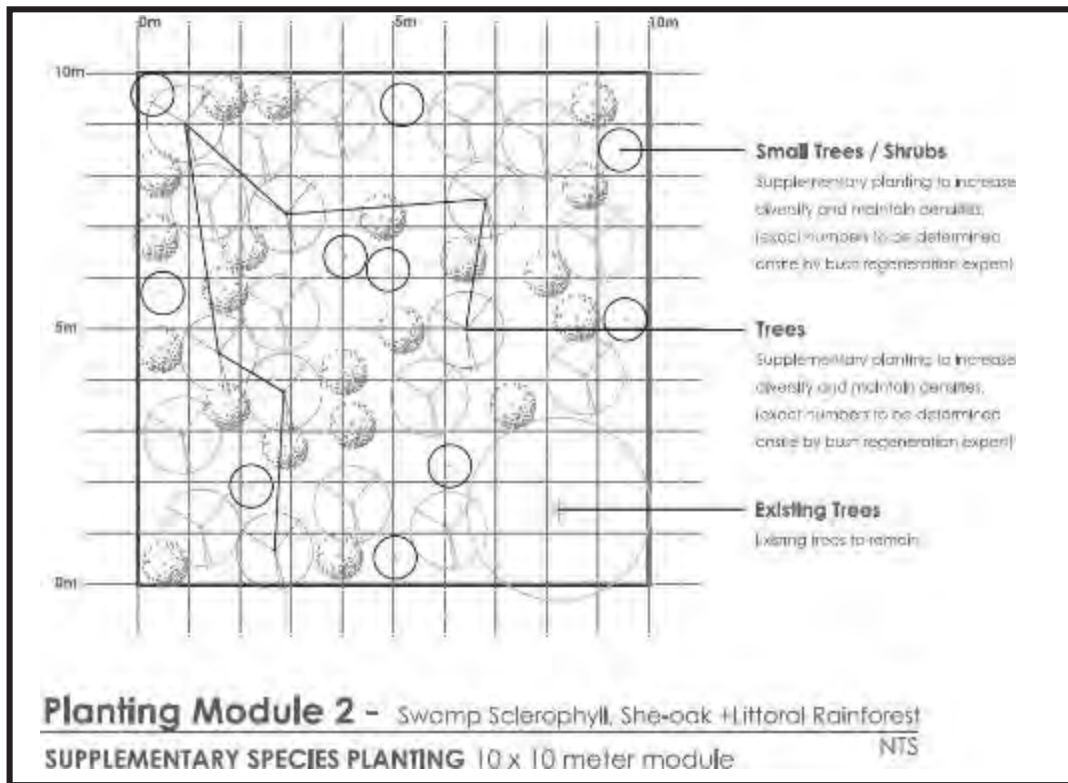


Figure 38: Planting Module 2

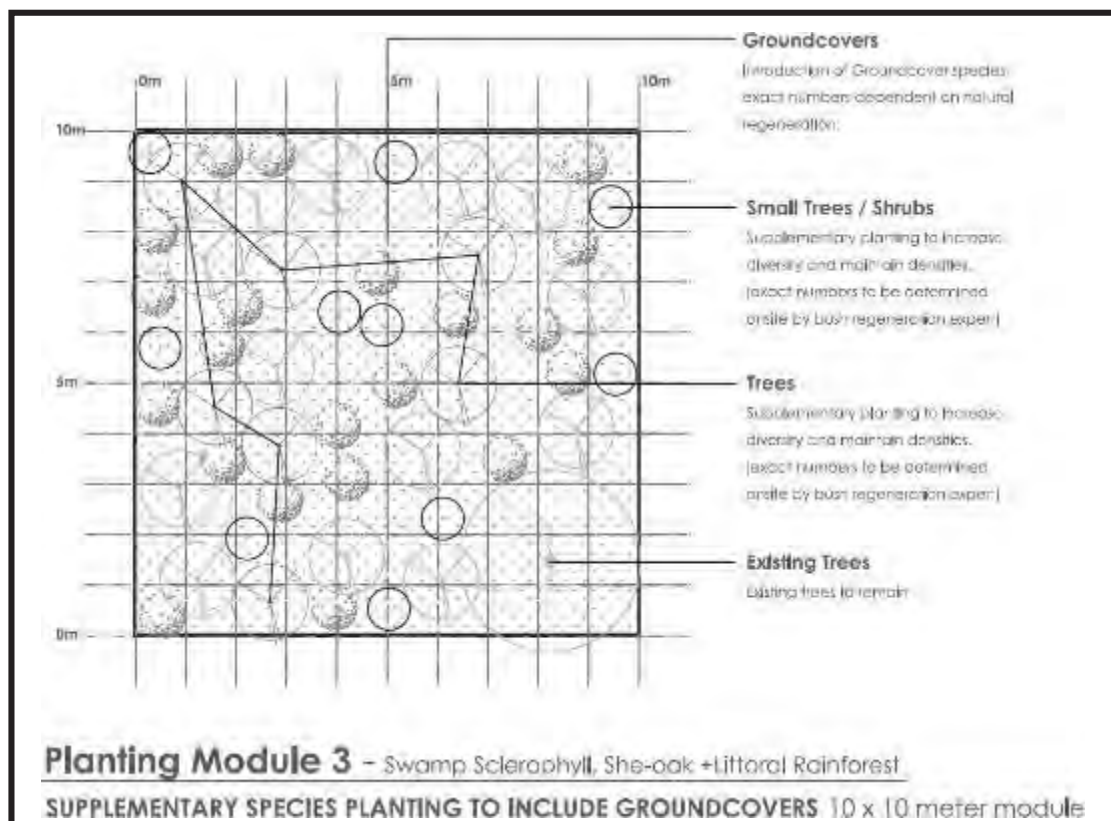


Figure 39: Planting Module 3



REHABILITATION ZONE/AREA 4:

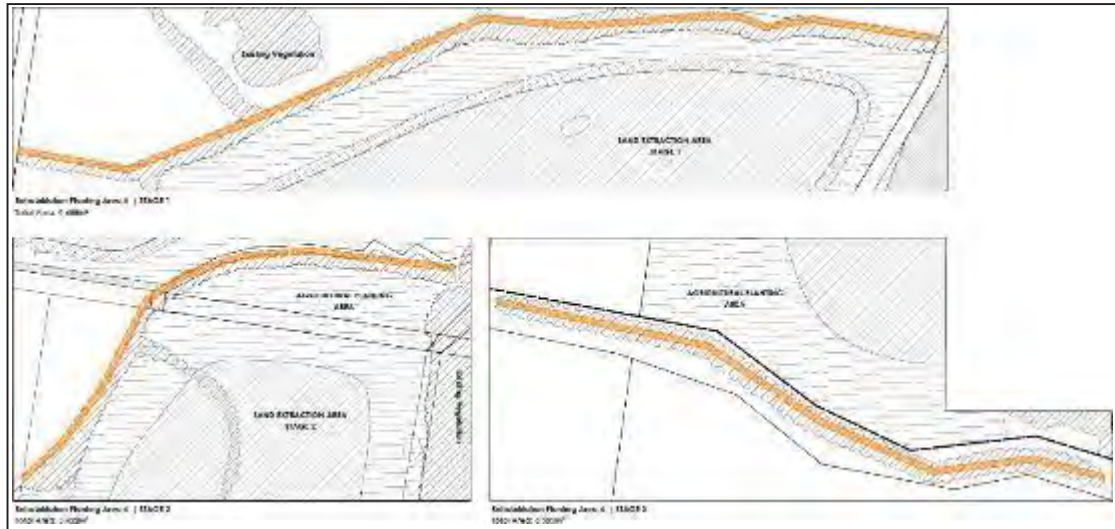


Figure 40: Staging of Zone / Area 4

This rehabilitation zone covers ~2.1 ha hectares and is proposed to provide a wildlife corridor (linkage) between existing habitats within and external to the site and a visual buffer between the Sand Quarry and external properties. The 8 m wide vegetated corridors are proposed along the northern sides of Sheens Creek, Warwick Park Rd and the unnamed watercourse between Stage 1 and Stage 2 (refer to **Figure 41**).

Species noted include Paperbark, Swamp Oak, Swampbox, Banksia, Pennywort, Blady Grass, Bunchy Sedge and Sundew.

Each zone/area (4A-4C) has been broken down into management stages of approximately 0.5-1 ha to allow staged management as described in **Section 4.3.1** above. These zones will be managed to establish a Wet Sclerophyll Forest which will act as a wildlife corridor between habitats within and adjacent the site.



REHABILITATION AREA 4 - STAGE 1 Total Area: 9,688M <sup>2</sup> (9.7 MODULES) CANOPY TREES					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	970
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcarys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophoslemon suaveolens	Swampbox			
lop con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			
REHABILITATION AREA 4 - STAGE 2 Total Area: 5,432M <sup>2</sup> (5.5 MODULES) CANOPY TREES					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	550
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcarys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophoslemon suaveolens	Swampbox			
lop con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			
REHABILITATION AREA 4 - STAGE 3 Total Area: 6,584M <sup>2</sup> (6.6 MODULES) CANOPY TREES					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	660
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gums			
euc mic	Eucalyptus microcarys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophoslemon suaveolens	Swampbox			
lop con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

Figure 41: Rehabilitation Area 4 (Wet Sclerophyll Forest) Module

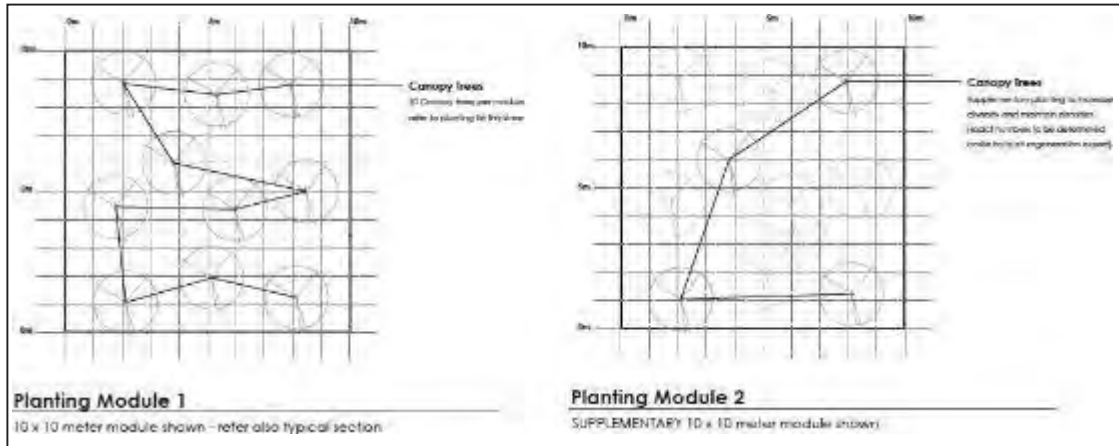


Figure 42: Area 4 Planting Modules

### 4.3.2 RECONSTRUCTION/BUFFER PLANTING

This type of revegetation has occurred within the western visual buffer to the haul route, processing area, site office and wash plant. In accordance with Condition 39 of the Development Consent these buffer areas were established within 12 months. Following planting of the buffers (with endemic native species) the areas are monitored and maintained as per the Rehabilitation Zones and in accordance with **Section 4.4** below.

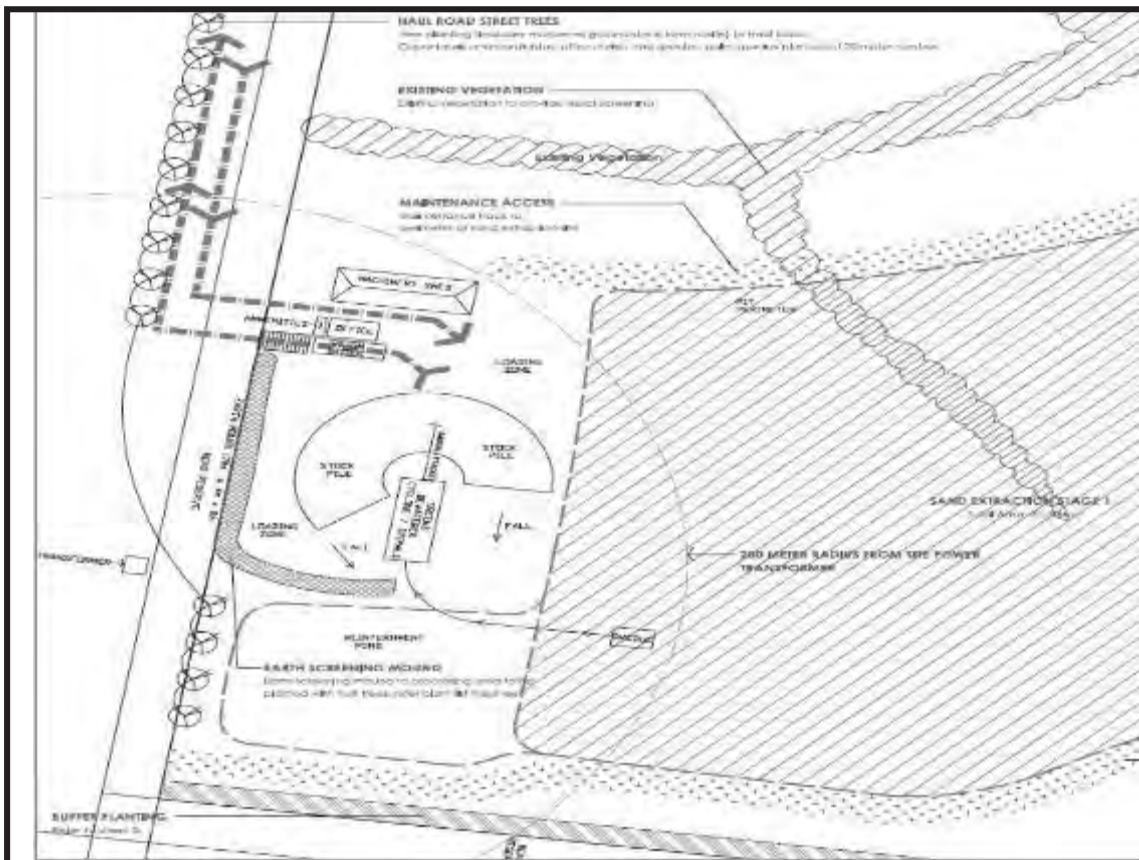


Figure 43: 10m Western Visual Buffer Location



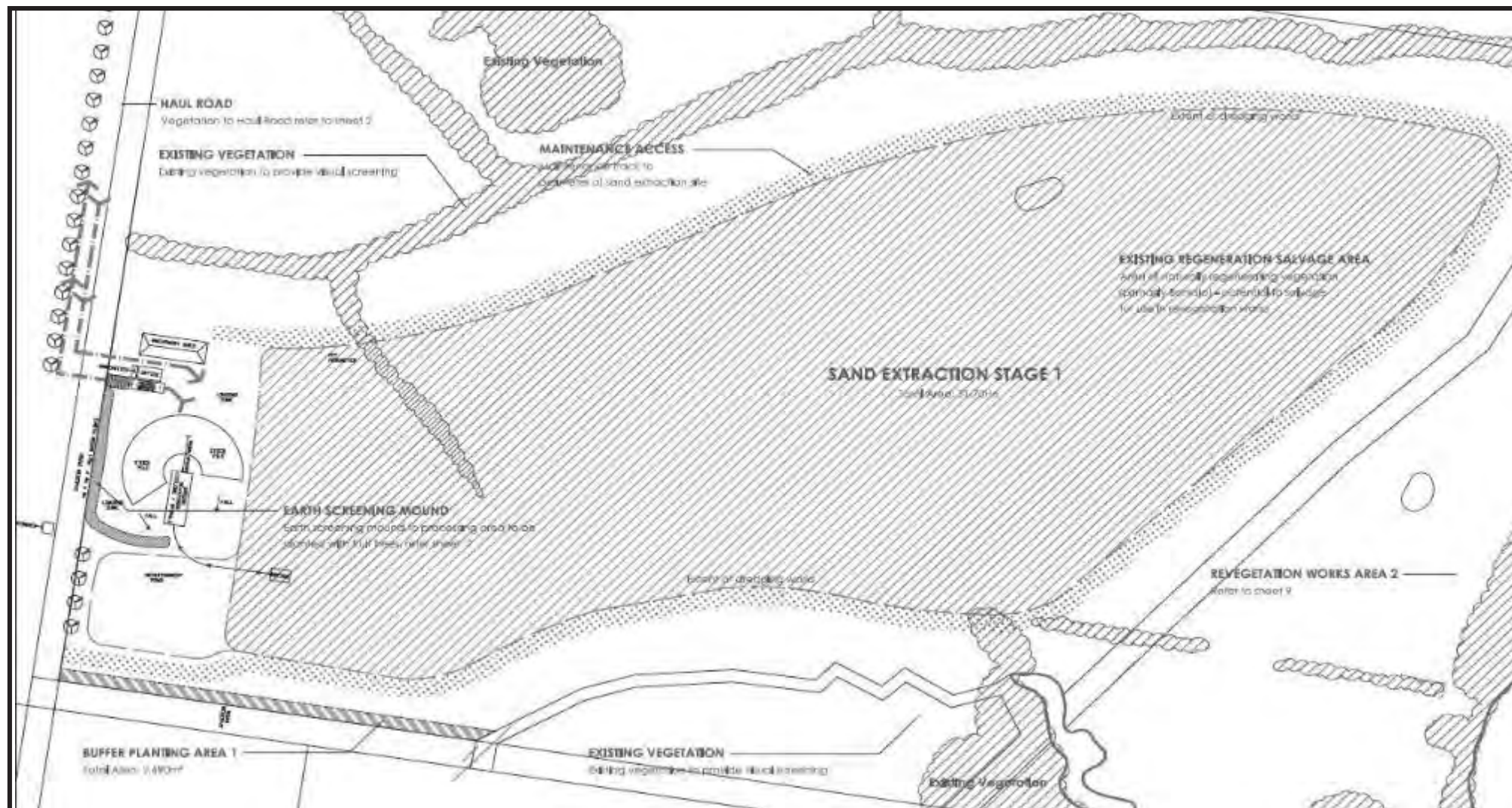


Figure 44: Extraction Lake Buffer Zone Location

BUFFER PLANTING AREA 1 Total Area: 0.34Ha (34 MODULES)								
CANOPY TREES								
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY			
ban inf	Banksia integrifolia	Coast Banksia	10 min 3 species per row	45LTH	340			
cas gla	Casuarina glauca	Swamp Oak						
car inf	Caryota intermedia	Pink Bloodwood						
euc gra	Eucalyptus grandis	Blooded Gum						
euc fer	Eucalyptus tereticornis	Forest Red Gum						
euc mic	Eucalyptus microcorys	Tallow Wood						
euc sid	Eucalyptus siderophloia	Ironbark						
lop seu	Lophostemon scirvoldens	Swampbox						
lop con	Lophostemon confertus	Brush Box						
mel qui	Melaleuca quinquevrvia	Paperbark						
syn gla	Syzygium moorei	Watermelon Tree						
SUBCANOPY TREES								
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY			
ala exc	Alphitonia excelsa	Red Ash	20 min 4 species per row	300MM	480			
acr pil	Acronychia oblongifolia	Yellow Wood						
aca mel	Acacia melanoxylon	Blackwood						
cup ana	Cupaniopsis anacardioides	Tuckeroo						
cry foa	Cryptocaria foetida	Cryptocaria						
cal sal	Callistemon salignus	Willow Saltbush						
dub myo	Dubautia myoporoides	Corkwood						
ala obo	Baeocarpus obovatus	Hard Quandong						
ala obo	Baeocarpus reticulatus	Blueberry Ash						
fic obl	Ficus oblqua	Small-headed fig						
hib il	Hibiscus illicius	Cotton Tree						
li aus	Litsea Australis	Laurel						
pal ale	Palystia elegans	Caterywood						
pit und	Pitoparium undulatum	Sweet Pittosporum						
EARTH SCREENING MOUND Total Area: 0.14Ha								
CANOPY TREES								
CODE	PLANT SPECIES	COMMON NAME	SPACING	SIZE				
ban inf	Citrus sinensis	Orange Tree	3 METER CENTRES	45LTH				
cas gla	Davidsonia jerseyana	Davidson Plum						
car inf	Mangifera indica	Mango Tree						
euc fer	Persea americana	Avocado Tree						

Figure 45: Buffer Zone Planting List



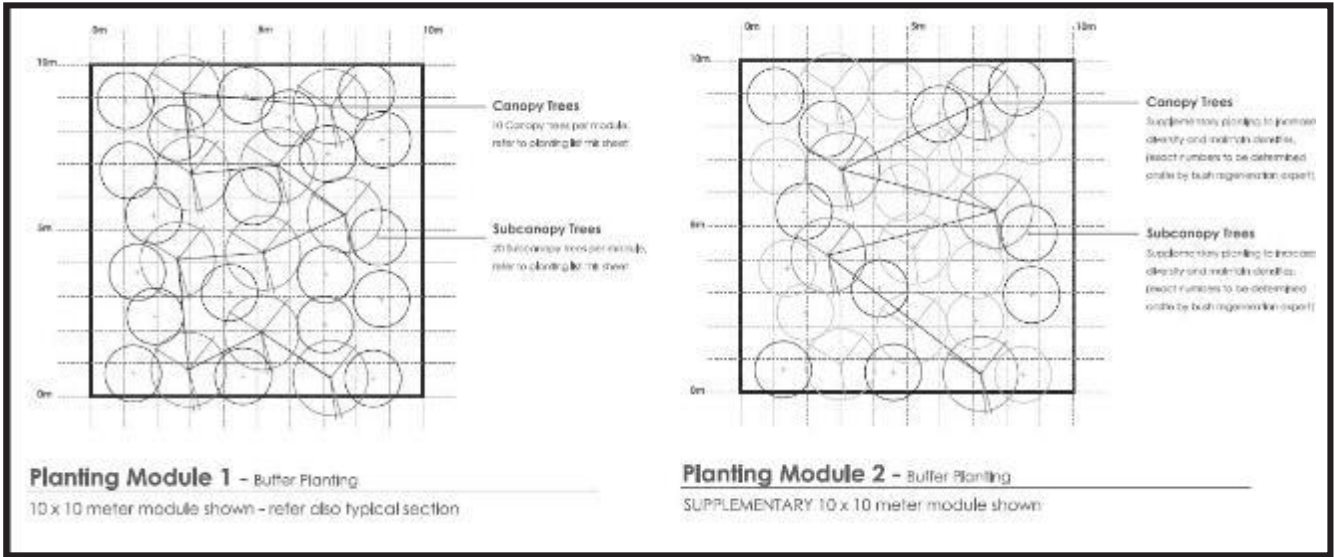


Figure 46: Buffer Zone Planting Module

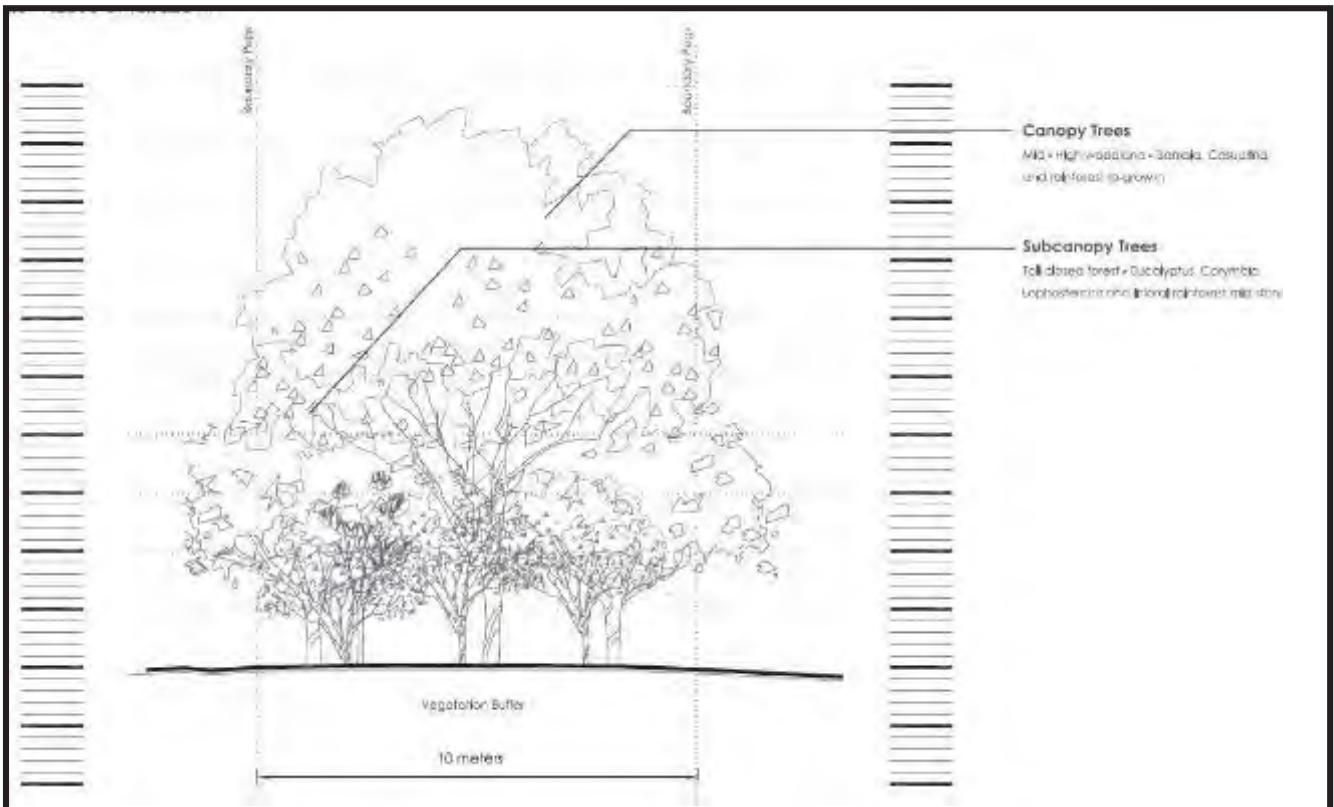


Figure 47: Buffer Zone Planting Profile

*FUTURE AGRICULTURAL USE*

As previously mentioned, the proposed future use for the land surrounding the extraction lakes is for agricultural use, in particularly the plantation of fruiting trees (i.e. Avocado trees). The proposed agricultural use will provide additional foraging and refuge for fauna species within the locality.

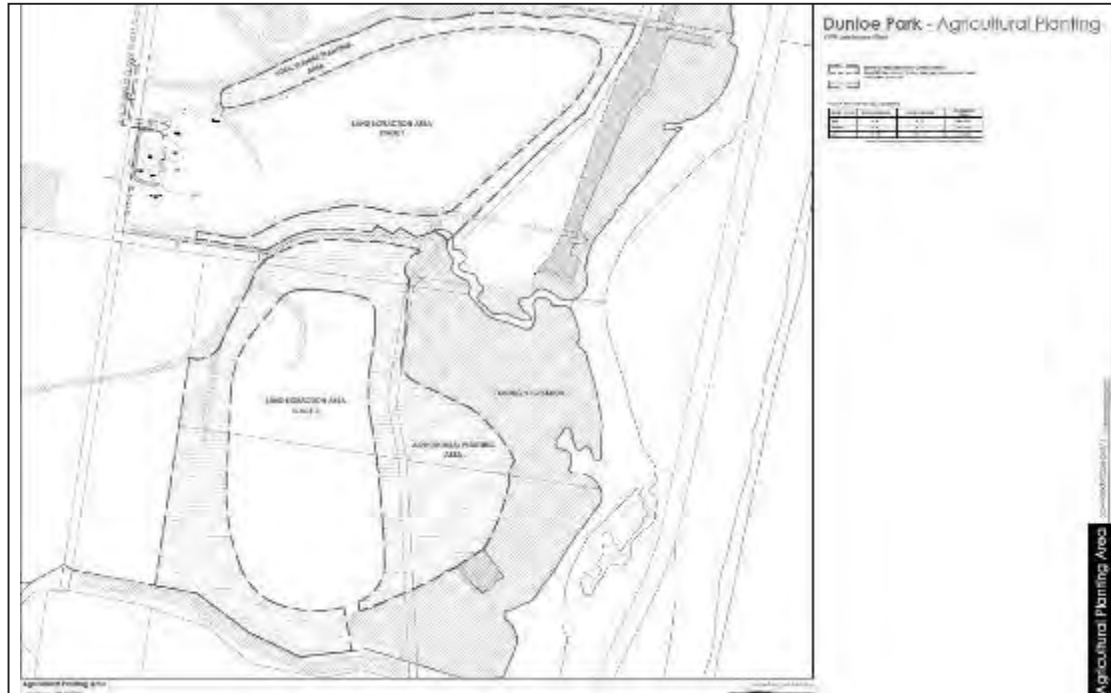


Figure 48: Areas Proposed for Future Agricultural Use

### 4.3.3 REVEGETATION TECHNIQUES

#### *Direct Planting (Landscaping)*

Landscaping is the most common method of revegetation however, it does require establishment, maintenance watering, mulching and weeding and also has the highest cost. The landscaping process within the Buffer Zones should occur as follows:

#### *Short Term Rehabilitation Processes*

- Identify areas on site which require planting following completion of initial weed management works.
- Ensure areas identified are appropriately prepared including:
  - Remove all rubbish including any previously dumped vegetative material, building slabs etc. Any existing hollow logs are to be retained in-situ.
  - Scarification of any compacted soil is to be undertaken to a depth of 200mm to promote aeration of the upper soil layer. No ripping is permitted within the drip zone of existing trees or native regeneration with only hand tools to be utilised for the purposes of pocket planting of shrub/groundcover tubestock.
  - Unwanted matter (i.e. stones, concrete, rubbish, rubble, sticks >20mm dia) encountered are to be removed.
  - Application of 'osmocote' sustained release fertiliser in granule form or equivalent to topsoil etc).
  - Undertake follow-up weed treatment following a period of two weeks to remove individuals which may have germinated from soil bank resources.
  - Erect temporary fencing/signage to inform that the relevant location is now a rehabilitation area. This will assist in reducing accidental damage to plant stock, introduction of additional weeds and dumping of rubbish. If stock are to be grazed within adjacent paddock areas then an exclusion fence is to be erected to keep cattle out of the rehabilitation zone. Any such fence is to include a minimum 0.5m gap at ground level to allow continued passage of native fauna.
- Plant selected native species at densities documented within **Attachment 1** and **Figures 45** and **46** above.

#### *Medium to Long Term Rehabilitation Processes*

- Maintain and monitor area in accordance with the section entitled 'Monitoring and Maintenance'.

#### 4.4 MAINTENANCE, MONITORING AND REPORTING

##### *Maintenance*

##### *Short-Term Rehabilitation Processes*

- Planting areas (determined on a staged basis in accordance with **Section 4.3** above) are to be regularly watered for a period of twelve weeks. If during routine inspection of the rehabilitation zones there is evidence of poor plant health due to drought stress than additional watering shall be undertaken
- Recurrent weeds within rehabilitation zones are to be removed as they occur quarterly for the first five years of assisted regeneration for each rehabilitation stage
- Replacement planting of stock loss shall occur as required to achieve the performance criteria listed in subsequent section of this report

##### *Medium- and Long-Term Rehabilitation Processes*

- Recurrent weeds within rehabilitation zones are to be removed as they occur and six-monthly thereafter for the life of the development
- Fences (where required due to cattle grazing in adjacent paddocks) are to be inspected quarterly for structural integrity and maintained as necessary
- Locational survey pegs of the rehabilitation zone boundaries are to be inspected quarterly and maintained/replaced as necessary
- Existing 4wd tracks within the EPZs are to be maintained quarterly to allow continued vehicle access for maintenance and emergency rural fire brigade vehicles
- A slashed/grazed zone of 25-30 m is to be maintained on the development side of the rehabilitation zones to reduce to risk of bushfire spread from the pasture grasslands.

##### *Monitoring*

The success of a regeneration project can be assessed by systematic visual monitoring of rehabilitation areas. This need not be an overly time-consuming process and the data generated can then be used to compare the success of various treatments. The measurements to be monitored are:

- Average height of plants within rehabilitation areas (height in metres for tree, shrub and groundcover species)
- Dominant species (qualitative description of dominant species within tree, shrub and ground layer)
- Canopy cover percentage (%)
- Canopy and upper strata species diversity
- Percentage (%) cover of ground cover and leaf litter
- Health of vegetation within rehabilitation areas (per **Section 4.6** below)



- Area of ground cover covered by weed species (area in square metres)
- Percentage of planted specimens survived
- Incidence of recruitment, both exotic and native (species and quantity estimates of new species noted [i.e. A = abundant, R = relatively common, I = isolated/scarce])
- Native fauna presence (native fauna species recorded via observation, track or trace during vegetation inspections are to be noted)
- Fuel load – a visual assessment of fuel load based upon “Overall fuel hazard assessment guide” (Tolhurst *et al.*, 2010).

The simplest of all methods of monitoring a site is to establish permanent photo points and take photographs at regular intervals, and to regularly (i.e. six-monthly, annually) traverse the rehabilitation area(s). In this regard, each management stage of each rehabilitation zone shall be photographed in accordance with the below sections (for the life of the project) to provide a visual indication of plant growth (height and extent) and weed presence. Photographs shall be taken at the SW, SE, NW, NE corners of each monitoring site (50m x 20m quadrat or 50m x 8m quadrat (for rehabilitation area 4)).

The below monitoring forms are to be completed on an annual basis (excluding Forms A: Routine Monitoring & B: Condition Monitoring which are to be completed on a six-monthly basis for the first 10 years) for each of the rehabilitation zones.

Note that monitoring form C is to commence inspection and completion similar to the staging schedule contained in **Attachment 1**. These inspections shall commence in the year prior to the first planting module (pioneer species) trigger and continue thereafter (has already commenced). **Table 5** summarises the trigger for relevant inspections and form completion for forms C. Forms A, B and the visual monitoring photos are to be undertaken every six months for every rehabilitation zone. These monitoring efforts will inform maintenance requirements (particularly with regard to weed management). The relevant staging of monitoring (and assessment against performance criteria, trigger for maintenance and/or correction actions) requirements are tabulated below. Note that a less intensive regime is proposed following a five year period for each stage (i.e. when the rehabilitation zones are likely to be relatively stable):

Table 5: Monitoring Triggers

REHAB ZONE	STAGE	YEAR									
		1	2	3	4	5	6	7	8	9	10+
1A	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
1B	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
	4	R	R	√R	√R	√R	√R	XS	XS	XS	XS
	5	R	R	R	√R	√R	√R	√R	XS	XS	XS
1C	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
2A	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS

REHAB ZONE	STAGE	YEAR									
		1	2	3	4	5	6	7	8	9	10+
2B	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
2C	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
	4	R	R	√R	√R	√R	√R	XS	XS	XS	XS
3	1	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
4	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2										
	3	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
		√R	√R	√R	√R	XS	XS	XS	XS	XS	XS

'R' denotes that routine and condition monitoring shall be undertaken six monthly during this year. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

'√' denotes that quantitative and qualitative inspections shall be undertaken six monthly including completion of forms C. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

'S' denotes that routine and condition monitoring shall be undertaken annually during this year. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

'X' denotes that quantitative and qualitative inspections shall be undertaken annually including completion of forms C. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

Please note that form content has been adapted from Kanowski, J., Catterall, C. P., Freebody, K. and Harrison, D. A. (2008) *Monitoring Revegetation Projects for Biodiversity in Rainforest Landscapes. Toolkit Version 2*. Report to the Marine and Tropical Sciences Research Facility. Reef and Rainforest Research Centre Limited, Cairns.

**FORM A: ROUTINE REHABILITATION MONITORING SHEET**

General Management	Weeds	Vegetation regeneration
<p>Has there been a fire within the last quarter? _____</p> <p>Do the bushfire trails or adjacent pasture areas require slashing or maintenance to reduce fire risk? _____</p> <hr/> <p>Is there evidence of rubbish dumping within the rehabilitation zones? _____</p> <hr/> <p>Is there evidence of plant theft within the rehabilitation zone? _____</p> <hr/> <p>Does it appear that the rehabilitation zone has been utilised for stockpiling, vehicle parking, building waste dumping, cattle grazing or person traffic? _____</p> <hr/> <p>If yes, acknowledge below what works were undertaken to rectify/restore and the date _____</p>	<p>Have any areas of weeds re-established within the rehabilitation zones during the last quarter? _____</p> <hr/> <p>What species? _____</p> <hr/> <p>What management was undertaken to eradicate these weeds? _____</p> <hr/> <p>If management was undertaken acknowledge that such was performed in accordance with the approved rehabilitation management plan. _____</p> <hr/>	<p>Natural regeneration is occurring in (record height range estimate):</p> <ul style="list-style-type: none"> <li>- Tree species _____</li> <li>- Shrub species _____</li> <li>- ground covers _____</li> </ul> <p>What are the dominant species within each layer?</p> <ul style="list-style-type: none"> <li>- Tree _____</li> <li>- Shrub _____</li> <li>- ground covers _____</li> </ul> <p>Have you noticed any new native plant species since the last monthly inspection? _____</p> <p>If yes name the species or take a photograph _____</p> <p>Acknowledge that the required routine photographs have been taken within the rehabilitation zones</p>
<p><b>Biodiversity</b></p> <p>Have you spotted native fauna within the rehabilitation zone during inspection?</p> <p>If yes, what types?</p> <p>Koala _____</p> <p>Kangaroo/wallaby _____</p> <p>Possums/gliders _____</p> <p>Small mammal (i.e. bandicoot, echidna) _____</p> <p>Reptiles (i.e. snakes/lizards) _____</p> <p>Birds of prey _____</p> <p>Large nectar feeding birds (i.e. lorikeets, parrots, cockatoos) _____</p> <p>Small tree and ground birds (i.e. finches, fairy wrens, treecreepers) _____</p> <p>Glossy Black Cockatoos _____ Other _____</p>	<p><b>Modifications</b></p> <p>Have there been any structural additions (eg. new tracks, buildings) to the rehabilitation zones since the last visit?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>What actions were undertaken to remove any illegal modifications?</p> <p>_____</p> <p>_____</p> <p><b>Condition of fences</b></p> <ul style="list-style-type: none"> <li>- Good</li> <li>- Need minor repair</li> <li>- Poor (need replacement)</li> </ul>	<p>Are any of the following performance criteria exceeded (refer Section 4.6 below)?</p> <p>Declared Weeds? _____</p> <p>Extent of other Weeds? _____</p> <p>Survival Rate of Plants? _____</p> <p>Condition of Plants? _____</p> <p>Canopy Coverage? _____</p> <p>Tree, Small Tree &amp; Shrub Diversity? _____</p> <p>Groundcover Coverage? _____</p> <p>General Coverage/Success? _____</p> <p>If yes, what corrective action was performed (i.e. plant showed drought stress and so watering was undertaken, plant was dead so a replacement plant was pocket planted, canopy plant coverage was not achieved so relevant pioneer plants were pocket planted).</p>

## FORM B: SITE CONDITION

(TO BE UNDERTAKEN WITH ROUTINE PHOTO MONITORING, WEED MANAGEMENT AND REVIEW OF COMPLIANCE WITH PERFORMANCE CRITERIA)

### *Protocol for assessing site condition*

The steps in condition assessment are listed below. A pro-forma for assessing site condition, based on this protocol, is provided on the following pages.

1. Obtain any previous condition assessment of the site, and other relevant documentation of the site.
2. Conduct a field inspection of the site. Based on the table below determine whether all or part of the site is:
  - **OK** ('on track' towards target conditions, requires only routine maintenance);
  - **Uncertain** (significant problems identified, requires intervention); or
  - **Poor** (major problems identified, likely to fail without major intervention).

If outcomes vary across a site, divide the site into zones, and record outcomes for each zone separately.

3. Make overall comments on the condition of the site.
4. Determine whether the condition of the site has changed since last assessment, and comment on any changes.
5. Complete the table describing site condition in detail. Where outcomes vary across the site, divide the site into zones ('A' = OK, 'B' = uncertain; 'C' = poor) and record outcomes for each zone separately. Comment on the attributes of each zone, particularly the factors that appear to be affecting outcomes, such as the canopy species mix and cover, regeneration/stocking rates and heights, weeds, disturbance or maintenance.
6. Make recommendations for maintenance, where relevant. The rating system is closely linked to maintenance requirements:
  - Zone A** = routine maintenance only required;
  - Zone B** = additional maintenance required, more than routine (need to describe);
  - Zone C** = major maintenance effort required (need to describe).

Note that what comprises 'routine' maintenance will often change, e.g. from regular spraying to spot-checking and control of weeds, as sites mature. However, after major disturbance, routine maintenance may revert to regular broad-scale weed control.

7. If desired, calculate an overall 'site condition' score. This score reflects the proportion of the site in good, uncertain or poor condition, and ranges from 0% (when the entire site is in poor condition) to 100% (when the entire site is 'on track' to target conditions).

Various intermediate scores are possible (e.g. a score of 50% could mean 50% of the site is 'OK' and the rest 'poor'; it could also mean that 40% is 'OK', 20% 'uncertain', and the rest 'poor').



To calculate the score, multiply the percentage of the site zoned as A, B or C by a suggested 'condition rating' for each zone: Zone A (OK) = 1; Zone B (uncertain) = 0.5; Zone C (poor) = 0), and add the products.

**CRITERIA FOR ASSESSING CONDITION OF YOUNG REVEGETATED SITES, BEFORE INITIAL CANOPY CLOSURE.**

Rating / zone	Status	Canopy cover	Ground cover	Problem weeds	Tree survival	Maintenance requirements
<b>A</b>	<b>OK</b> On track to target conditions	Developing well towards closed canopy	Leaf litter, mulch or soil around trees; grass/ weeds not suppressing tree growth (i.e. sparse around trees)	Not present or minor occurrence	<b>High</b> (at least 90%)	Routine maintenance only
<b>B</b>	<b>Uncertain</b> if will develop towards target conditions. Significant problems.	Not developing well towards closure, or outcomes are patchy	Grass/ weed cover sufficiently dense to suppress the growth of planted trees, at least in places	If present, have the potential to impede site development	<b>Moderate</b> (60-90%), or patchy	Extra effort required to fix problems, additional to routine maintenance
<b>C</b>	<b>Poor</b> Major problems. Likely to fail.	Poorly developed. Unlikely to achieve closure	Dense cover of grass/ weeds which is likely to strongly suppress tree growth	May be common, or likely to impede site development	<b>Poor</b> (less than 60%)	Major effort required to address problems.

**PROFORMA FOR ASSESSING SITE CONDITION**

**PROJECT DESCRIPTION** *Note: where options are given, put an 'X' next to the appropriate term(s):*

Project name:		Project ID:
Site name:		Site ID:
Type of on-grounds: Assisted Natural Regeneration	Years since site commenced:	When was this site last assessed?
Current assessment conducted by:	Date of current assessment:	
Overall comments on site condition:		
Has the condition of the site changed since last assessment? YES ..... or NO ..... <i>If Yes, briefly describe changes in this box, and provide details in table below.</i>		

**DETAILED DESCRIPTION OF SITE CONDITION** *Complete table as per monitoring schedule, or if conditions have changed since last assessment.*

Rating/ zone	Area (ha)	% of site	Location and factors affecting outcomes	Canopy cover (%)	Ground cover	Problem weeds	Tree survival or Recruitment	Other comments	Suggested maintenance
A = OK on track towards target									(should be routine: describe if necessary)
B = Uncertain significant problems									(describe)
C = Poor major problems, likely to fail									(describe)
<b>Overall Condition Score (ranges from 0-100%)</b> <i>Multiply percentage of site occupied by each zone (A, B or C), by the condition rating for each zone (A = 1; B = 0.5; C = 0), and add the products: e.g. (70% x 1) + (20% x 0.5) + (10% x 0) = 80%</i>									..... %



**Photos:**

Insert photo	Insert photo
<b>SW</b>	<b>SE</b>

Insert photo	Insert photo
<b>NW</b>	<b>NE</b>

*Reporting*

An annual report is to be prepared documenting all monitoring/review requirements of this rehabilitation strategy including:

- Six monthly/annual visual monitoring results and photographs as outlined above
- Six monthly/annual completion of the required monitoring forms (Forms A-B)
- Six-monthly/annual rehabilitation monitoring and completion of the required forms (Form C) for relevant stages of the four rehabilitation zones.
- Any incidences of non-compliance with the performance criteria (refer **Section 4.6** below)
- Corrective actions implemented in response to performance criteria non-compliance
- A work log of all monitoring/maintenance (and corrective action where required) activities performed during the preceding 12 months. This log shall include type of work (i.e. weed inspection, planting quantities, monthly photo-monitoring etc), the work trigger contained within this rehabilitation strategy (i.e. routine quarterly monitoring/maintenance or corrective action as a result of performance criteria non-compliance etc), number of personnel utilised, hours of work performed and any problems/issues identified through the preceding maintenance/monitoring 12-month period.



#### 4.5 BUSHFIRE RISK ASSESSEMENT

All land managers in NSW have a legislated responsibility to prevent the occurrence of bushfires on land under their control. Land managers have an additional responsibility to extinguish a fire on their land (if possible) and notify an appropriate authority if the fire is beyond control without assistance. These responsibilities are detailed in the Sections 63 and 64 of the *Rural Fires Act 1997* (NSW Government, 2019). The legislative responsibility for bushfire management and mitigation further extends towards requirements for providing a safe workplace for employees and visitors in accordance with the *Work, Health and Safety Act 2011* (NSW Government, 2011).

This section considers the potential consequence for fire to affect personnel associated both within and external to the property. The highest priority asset is life and safety. Life and safety assets refer to employees, contractors, visitors associated with the sand extraction activities and residents in the adjacent rural properties. Human settlement assets constitute isolated rural homesteads which, in the main, include scattered rural properties adjacent to Dunloe park landholdings. Infrastructure, Cultural Heritage and environmental assets should be considered for protection through mitigation of bushfire threat.

Mitigation of bushfire threat on the Dunloe Park landholdings will be achieved by the implementation of the following measures:

1. **The construction and maintenance of Asset Protection Zones (APZs).** As recommended by the NSW Rural Fire Service document "Planning for Bushfire Protection 2019 (PBP) (Section 8.3.6), a 10-metre-wide (minimum) Asset Protection Zone (APZ) should be provided around all fixed infrastructure assets. The APZ should be maintained for the life of the development to the standards prescribed by PBP Appendix 4.
2. **Management of ignition sources.** Ignition sources which may be controlled such as hot works, operational activity and arson will be mitigated by the use of administrative controls such as Hot works policy, limiting potential ignitions by the cessation or reduction of operations on elevated fire danger days and education, provided by risk assessments, site induction training and policy. Uncontrolled risks, such as lightning or site external bushfires entering the Dunloe Park landholdings will be mitigated by increased vigilance on elevated fire danger days and following storm activity.
3. **Management of access for mitigation and suppression operations.** Access for attending emergency services will be of the standard prescribed by PBP (minimum).
4. **Provision of water supplies for firefighting efforts.** Water supply will be available from onsite water storages (dams). The quantity of available water should be monitored and if found to be insufficient, alternative sources of water (tanks, 20,000 L minimum) should be provided.
5. **Prescribed burning or mechanical reduction of vegetation to reduce fuel hazards and increase ecological values.** Fuel loads in undisturbed areas will be monitored on an annual basis (minimum). If found to be excessive or nearing excessive levels, the North Coast Bushfire Management Committee will be contacted to devise mitigation methods.
6. **Risk Assessment of operational activity.** The continuation of works on extreme and catastrophic fire danger rated days will be the subject of a risk assessment and consequent actions to reduce the risk of bushfire ignition or danger to life and safety.

#### 4.6 ENVIRONMENTAL PROTECTION ZONE PERFORMANCE CRITERIA

The following performance criteria are to be achieved within the EPZs:

- Existing native vegetation and areas of natural regeneration to be retained
- All rubbish/vegetation dumping, non-approved structures etc are removed from the EPZs
- No declared weeds are present
- Cattle and domestic animals are excluded
- A significant reduction in the presence of weed species is evident. In practice it is noted that the removal of all individuals of all weed species for 100% of the time is unachievable. Therefore, it is considered appropriate that the following performance criteria be adopted:
  - All large weed/ornamental trees are treated;
  - No weed shrubs/trees older than three months of age are present.
  - Densities of such shrubs/trees is not to exceed 1 per 20 m<sup>2</sup>
  - Scattered groundcover weed species may occur but not in any covering an area greater than 5 m<sup>2</sup>
- A survival rate of the following minimum standards are to apply for all planted trees, shrubs and groundcovers:
  - One year following planting: 90%
  - Three years following planting: 90%
  - Five years following planting: 85%
- A growth rate of the following minimum standards is to apply for all planted trees, shrubs and groundcovers and for natural regenerated plants within the rehabilitation zones:

Table 6: Growth Rate Targets (Height)

GROWTH RATE TARGETS (HEIGHT)			
Strata	Time following initial planting		
	1 yr	3 yr	5yr
Groundcovers (prostrate)	100mm	100-250mm	250mm+ or mature height (i.e. <i>Xyris</i> at mature height would be below 250mm)
Groundcovers (grasses, sedges etc)	100mm	100-300mm	300-1000mm or mature height (i.e. <i>Sporobolus</i> at mature height would be below 300mm)
Shrubs	250mm	450-500mm	1000-2000mm or mature height
Trees	650mm	2-3m	4m+

- Planted stock to exhibit fair or healthy conditions:

Table 7: Plant Stock Conditions Guide

Condition	Descriptor
Healthy	Leaves green, no abnormal leaf loss
Fair	Leaves green, some yellowing of leaves, but <20% of canopy affected
Poor	Many leaves yellow or brown, substantial reduction in canopy extent since last measurement
Dead	Leaves brown or absent, little of the canopy remaining

- Inappropriate public access to the EPZs is to be effectively restricted (through fencing or signage). During routine monitoring (refer **Section 4.4** above) the EPZs are also to be inspected for the following evidence of access related impacts:
  - Litter and/or rubbish dumping
  - Stock theft
  - Bicycle/pedestrian tracks/trails
  - Soil compaction
  - Fence signage vandalism/removal
  - Cattle access and associated damage (i.e. grazing, trampling etc.).

#### ADDITIONAL PERFORMANCE REQUIREMENTS: ASSISTED NATURAL REGENERATION AREAS

The areas to be managed for natural regeneration area are described in **Section 4.3.1**. Please note that compliance with the below-listed performance requirements (in which non-compliance will trigger a selected type of supplementary planting) is to be assessed at the specified time-frame for each individual management stage within each of the defined three Rehabilitation Zones/Areas (refer **Attachment 1** for staging schedules).

##### *Performance requirements: Canopy Coverage*

Natural regeneration canopy coverage will not be considered achieved for any one area if it does not contain a canopy or small tree typical to the community (refer **Section 4.3.1** modules) within an area equal to or greater than 4 m<sup>2</sup> (i.e. if an area 2m x 2m does not contain any juveniles of required canopy tree/small tree than natural regeneration canopy cover is considered to be unsuccessful at that particular location).

In the event that such a location is deemed to occur then supplementary (pioneer species) planting shall be undertaken within the patch in accordance with **Section 4.3.1**.

For example, a patch of 10 m<sup>2</sup> within Rehabilitation Zone 1B is noted to be regenerated with native ground covers and/or shrubs but no tree species typical to the listed 'Swamp Sclerophyll' community occur. In this instance 5 x trees/small trees from the Rehabilitation Zone 1B are to be pocket planted at 75mm pot sizes within the patch.

N.B. Please note that the trigger for pioneer plantings for Rehabilitation Zones 1A and 2B shall relate to an area of 4 m<sup>2</sup> having less than 4 plants of rush/sedge/fern (due to the ecologically dominant layer being rush/sedges rather than trees). In this instance pocket planting of 75mm tubes of the listed rush/sedge/ferns from the 'Wetland' community shall be undertaken at 1 metre centres within the identified gap.

*Performance requirements: Tree, Small Tree and Shrub Diversity within Natural Regeneration*

Diversity within the upper strata (trees, small trees and shrubs) of natural regeneration shall be required to achieve the following:

*Table 8: Community Diversity Guide*

Community Type (Forests/Open Forests)	Canopy Tree minimum Diversity per 100 m <sup>2</sup>	Small Trees/Shrubs minimum Diversity per 100 m <sup>2</sup>	Applicable Rehab Zones
Swamp Sclerophyll	3	3	1B, 1C, 2C
Swamp Sclerophyll, Swamp She-oak, Banksia	3	3	2A,
Swamp Sclerophyll, Swamp-oak	3	3	3

*Table 9: Coastal Community Diversity Guide*

Community Type	Rushes/sedges/ferns Per 100 m <sup>2</sup>	Applicable Rehab Zones
Coastal Wetland	Not applicable*	1A, 2B

Please note that Rehabilitation Zones 1A and 2B shall be exempt from this diversity performance requirement given that wetland communities naturally exhibit areas of mono-specific aquatic plant growth.

*Performance requirements: Groundcover Coverage*

Natural regeneration groundcover coverage will not be considered achieved for any one area if it does not contain native ground cover or leaf litter from the upper strata (grass, sedge, fern, bracken etc.) within an area equal to or greater than 2.25 m<sup>2</sup> (i.e. if an area 1.5m x 1.5m does not contain any ground covers or natural leaf litter layer than natural regeneration of ground covers is considered to be unsuccessful at that particular location). In this instance groundcovers from the relevant Rehabilitation Zone module are to be planted at 75mm pot sizes within the patch.

Please note that this performance requirement does not apply to Rehabilitation Zones 1A and 2B. Rush/sedge/fern coverage within these coastal wetland regeneration zones are addressed through 'canopy coverage' above.

*Performance requirements: General Coverage/Success of Natural Regeneration*

Natural regeneration coverage will not be considered achieved for any one area if it contains a bare or denuded area greater than 6.25 m<sup>2</sup> (i.e. if an area 2.5m x 2.5m is bare than natural regeneration has been unsuccessful at that particular location). In this instance full planting of the relevant module for that particular Rehabilitation Zone shall be required.



## 4.7 CORRECTIVE ACTIONS

The following corrective actions are to be implemented in instances of non-compliance with the performance requirements:

- If rubbish or litter is found within an EPZ it is to be immediately removed
- Where weed re-establishment is noted additional removal/management works are to be instigated in accordance with **Section 4.1**
- Where planted specimens fail to strike or plantings do not achieve the set survival percentages then supplementary plantings are to be undertaken. Where it is considered that a particular species has failed due to non-suitability or repeated failure within the planting environment a suitable native plant replacement species is to be discussed with and approved by Council's ecologist
- If regular increases in height and crown cover extend are not recorded within the monitoring period a horticulturalist/arborist is to be employed to identify likely causes and to recommend measures (i.e. fertiliser application, increased watering etc) to encourage increased growth
- If retained or planted vegetation show signs of ill health (i.e. poor or dead), a horticulturalist/arborist is to be employed to identify likely causes and to recommend mitigation measures to improve regeneration conditions
- If access related impacts are evident (refer **Section 4.6** above) the following actions are to be implemented:
  - Cattle are to be removed
  - Removed/damaged plants is to be replaced via planting the relevant module to the rehabilitation area/zone
  - If damage to fencing or signage or the viewing platform is recorded the structures are to be repaired to pre-existing condition and Council notified regarding the recorded damage/vandalism
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'canopy coverage' requirements then supplementary (pioneer species) planting shall be undertaken in accordance with **Section 4.3.1**
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'diversity' requirements then supplementary (tree, small tree and shrub diversity species) planting shall be undertaken in accordance with **Section 4.3.1**
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'groundcover coverage' requirements then supplementary (groundcover species) planting shall be undertaken in accordance with **Section 4.3.1**
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'general coverage' requirements then full planting of the relevant module for that particular Rehabilitation Zone shall be required

Please note that compliance against the relevant ‘assisted regeneration’ performance requirements (in which non-compliance will trigger a selected type of supplementary planting) is to be assessed at the specified time-frame for each individual management stage within each of the defined three Rehabilitation Zones/Areas (refer **Attachment 1** for staging schedules)

N.B. Please note that it is considered likely that unanticipated adaptive management procedures may be necessary throughout the course of the rehabilitation program (i.e. extension of watering regime during times of low rainfall, alteration to weed management measures if unsuccessful for a certain species, etc). Any such amendment to the management regime contained within this document shall be undertaken in consultation with a qualified ecologist.

#### 4.8 VISUAL AMENITY SCREENING

Visual amenity screening of the project has been outlined with Buffer Zone plantings in **Sections 4.3.1** (Rehabilitation Area 4 Stages 1, 2, and 3 – which act as wildlife corridors and buffer zones) and **Section 4.3.2**. Details of species and staging are provided in those sections.

In addition, there is a visual and noise screen provided by the Earth Screening Mound along with street tree planting along the haul road at western entrance to the project. These buffer zones are designed to provide visual screening of the sand extraction works from adjoining properties to the north, west and south. Remnant natural vegetation provides screening to the east.

The citrus plantings along the road will serve to provide a visual screen and aid in dust suppression from haul rucks when the project is in operation.

#### 4.9 COMPLETION CRITERIA

Rehabilitation of the EPZs will be considered to be complete when the following criteria have been met or considered to be on trajectory to meet i.e. when monitoring shows consistent increase toward these criteria. The table below refers to Swamp Sclerophyll (1B, 1C, 2C), Swamp Sclerophyll, Swamp She-oak, Banksia (2A) and Swamp Sclerophyll, Swamp-oak (3) EPZs.

Table 10: Completion Criteria (1B, 1C, 2C, 2A and 3 EPZ)

Criterion		Target	Comments
Diversity	Canopy	Minimum 3 species from each stratum per 100 m <sup>2</sup>	Species to be selected from Attachment 1 specific to each Zone
	Small Trees and Shrubs		
Foliage Cover	Canopy	Approaching 30%	Will increase as individual trees mature
	Small Tree and shrubs	Approaching 30%	
	Groundcover	Approaching 90%	
	Weeds	Significant reduction, no significant increase	Eradication not possible – monitoring to determine coverage
Density	Canopy	An average of 1 per 4 m <sup>2</sup>	Juveniles and adults
	Small Tree and shrubs		
	Groundcover	An average of 1 per 2.25 m <sup>2</sup>	

	Criterion	Target	Comments
Survival of planted stems	All strata	85%	Assessed after 5 years
Growth Rates	Canopy	4m +	Monitoring will indicate continuing growth – may not be achieved during the life project
	Small Tree and shrubs	Mature height	Monitoring will indicate continuing growth – species dependent
	Groundcover	Mature height	Species dependent
Weeds	Listed and environmental weeds	None present	Woody weeds mainly
	Grasses, forbs and herbs	Reduction in coverage only	
Self-Sustaining Ecosystem	All strata	Evidence of self-sustaining ecology	i.e. flowers, buds, seeds and propagules, seedlings
Bare Soil	All EPZs	Lees than 10%	No areas greater than 6.25 m of bare soil

Criteria for the wetland EPZs 1A and 2B do not have canopy, small trees, or shrubs, with the ecologically dominant layer being rush/sedge/ferns rather than trees. Therefore, in areas that are not open water, density should be 1 plant per sq metre.

The Buffer Zones, planted within first 12 months of the start of each stage of the project, have no mandated completion criteria. But given their stated purpose of screening the works from surrounding areas, survival of planted canopy trees and subcanopy trees as per **Attachment 1** (Sheet 2 and Sheet 11), would require 100% survival.

## 5.0 FAUNA HABITAT ENHANCEMENT

Enhancement of fauna habitat values within the EPZ is proposed to increase the potential for native fauna to continue to utilise the area. This will be achieved through the implementation of the following mechanisms:

- **Suitable habitat:** it is considered that revegetation of Swamp Sclerophyll, Swamp Oak and Banksia Open Forests with Littoral Rainforest elements will (over time) provide potential habitat for a number of threatened fauna species recorded onsite and elsewhere in the region including:

Table 11: Suitable Habitat Requirements

Species	Habitat Requirements
<p style="text-align: center;">Osprey (<i>Pandion haliaetus</i>)</p>	<p>This species is associated with water-based habitats including estuaries, coastal wetlands, rivers and streams. The Osprey is predominately a coastal raptor frequenting estuaries, bays, inlets, islands and rocky cliffs within all Australian states except for Tasmania and sporadically within Victoria (DEC, 2005; NPWS, 2002). It is noted however, that the species sometimes inhabits inland islands (Pizzey and Knight, 1997; Readers Digest, 2002). Within suitable environment it usually constructs a nest in an overhanging large tree or upon elevated man-made structures such as platforms or telegraph poles.</p> <p>The species preys almost exclusively on fish by usually hunting alone and traversing the water's surface for prey which it secures by swooping over the waters surface or plunging below (Readers Digest, 2002; Clancy, 2005). Studies of prey middens on Lizard Island within the Great Barrier Reef also noted that occasional Terns and crustaceans are sourced for food (Smith, 1985).</p> <p>The eastern forests (Communities 1 &amp; 4-9) fringing Mooball Creek and the surrounding estuarine/riparian habitats including Wooyung Nature Reserve are considered to provide suitable habitat for the Osprey. The 15 ha of rehabilitation proposed is unlikely to significantly benefit the osprey with the exception of expanding the width of existing riparian buffers to Mooball Creek.</p>
<p style="text-align: center;">Glossy Black-Cockatoo (<i>Calyptorhynchus lathami</i>)</p>	<p>Minor potential occurs for the Glossy Black Cockatoo to frequent the site due to the limited presence of foraging materials (<i>Allocasuarina</i> spp.) and suitable nesting trees (large hollow within a live or dead Eucalypt: 10-20 m, Depth: 40-120 cm, Entry: ~21cm: Inside Dia: ~23cm (Forshaw, 1981; Gibbons and Lindenmayer, 2002)) are considered to be largely absent. Suitable habitat is considered to be limited to the NW Brushbox/Blackbutt Forests on Bedrock although <i>Allocasuarina</i> presence is very sparse.</p> <p>Over the balance of the site <i>Allocasuarinas</i> are generally absent although <i>Casuarina glauca</i> is very common.</p> <p>Plantings of <i>Allocasuarina</i> will increase foraging resources for the cockatoo onsite. Plantings of eucalypts may also provide potential nest hollows in the 60-100 year timeframe.</p>



Species	Habitat Requirements
<p>Black-necked Stork (<i>Ephippiorhynchus asiaticus</i>)</p>	<p>The species is generally associated with wetlands, mudflats, mangroves, swamps and floodplains while it may also sometimes be found in open woodland environs where a grassy understorey is present (NPWS, 2002, Readers Digest, 2002; DEC, 2005).</p> <p>Irrigated lands are also occasionally a foraging resource and it has also been recorded foraging in artificial wetlands of sewerage treatment plants (ERM, 2001).</p> <p>Suitable habitat for the species is considered to occur within the eastern interconnected forest remnants adjacent Mooball Creek (Communities 1 &amp; 4-9) although there is an absence of large areas standing water within these communities. The shallow reaches of the creek itself may function as a foraging locality for the species and overhanging trees may be utilised as nest sites. The 15ha of rehabilitation proposed is unlikely to significantly benefit the stork with the exception of expanding the width of existing riparian buffers to Mooball Creek and providing alternate future options for nesting trees. Creation of large lakes may increase potential foraging in the future (following completion of extraction).</p>
<p>Koala (<i>Phascolarctos cinereus</i>)</p>	<p>This species primarily occurs within Eucalypt Forest and Woodlands containing a suitable density of favoured food trees within coastal eastern and southeastern Australia. The suitability of forest and woodland communities as habitat for Koalas is influenced by the size and species of trees present, soil nutrients, climate, rainfall and the size and disturbance history of the habitat patches (Reed <i>et al.</i>, 1990 in NPWS, 1999).</p> <p>Whilst a limited abundance of favoured Koala foraging trees (principally <i>E. robusta</i>, <i>E. tereticornis</i>, <i>E. microcorys</i>) were recorded on site and favoured habitat (Eucalypt Forest) was restricted to the fragmented patches of Brushbox Forest on Bedrock (Community 3) and small copses of Blackbutt Forest (Community 2) the Koala was recorded during survey. Two individuals were recorded during spotlighting within the largest of the western Brushbox Forest remnants with an additional individual recorded during diurnal survey.</p> <p>Surveying of the eastern forest remnants (interconnected Communities 1 &amp; 4-9) did not locate any Koalas with a general absence of suitable foraging resources and preferred habitat type noted. Extension of forest remnants through revegetation and incorporation of favoured foraging trees will increase potential habitat for the koala.</p> <p>The surveys have informed the Koala Management Plan (Appendix of Landscape Management Plan).</p>
<p>Little Bentwing Bat (<i>Miniopterus australis</i>)</p>	<p>This species utilises well-timbered habitats including rainforest, <i>Melaleuca</i> swamps and dry sclerophyll forests where it feeds on insects within the canopy and requires caves, mines, stormwater drains and/or tree hollows to roost (Strahan eds, 2002). Potential habitat for the species occurs in association with the remnant forest patches on site (Communities 1-3 &amp; 4-6).</p> <p>15 ha of potential habitat for the Little Bentwing Bat will occur in association with revegetation works.</p>

Species	Habitat Requirements
<p>Red Goshawk (<i>Erythrotriorchis radiatus</i>)</p>	<p>This raptor utilises coastal-subcoastal tall forests/woodlands, savanna traversed by forested rivers and rainforest fringes (Marchant and Higgins, 1993; NPWS, 2002; NPWS, 1999). In NSW, the goshawk is associated with frequent mixed subtropical rainforest, <i>Melaleuca</i> swamp forest and open eucalypt forest along coastal rivers (Debus 1993 in NPWS, 2002). Nesting is restricted to tall trees within proximity of a creek, river or wetland (NPWS, 1999; NT Parks and Wildlife Commission, 2002). Hunting occurs for medium-large birds within open forests and riparian/gallery forests over a very large home range of up to 200km<sup>2</sup> (Blakers <i>et al.</i>, 1984, Aumann and Baker-Gabb, 1991, Czechura and Hobson, 2000; NPWS, 2002).</p> <p>It is considered that potential habitat for this species occurs in association with the eastern connected forests fringing Mooball Creek. It is noted that these remnants (~27 ha) are highly unlikely to sustain an individual goshawk which would occupy a much larger home range. It is noted that previous records of Goshawks from the region (NPWS database) are limited to a 1957-87 record within Billinudgel Reserve to the south. If this was an accurate record and Red Goshawks persist it could be considered reasonably likely that they would hunt within the Mooball Creek environments to the east of the site.</p> <p>The 15 ha of rehabilitation proposed is unlikely to significantly benefit the goshawk with the exception of expanding the width of existing riparian buffers to Mooball Creek. However, provision of an additional 15 ha of forest is, over time, likely to result in an increased abundance of forest birds which provide potential prey for the goshawk.</p>
<p>Long-nosed Potoroo (<i>Potorous tidactylus</i>)</p>	<p>Long-nosed Potoroos are generally restricted to areas with an annual rainfall greater than 760 mm where they inhabit dry and wet sclerophyll forests and woodland with a heathy understorey (Johnson in Strahan, 2002; DEC, 2005). The preferred habitat in north eastern NSW is dry and wet open shrubland (Mason 1997, DEC, 2005, Johnston in Strahan, 2002). In all habitats the species requires relatively thick groundcover growing on friable soils (Bennett, 1993). Within these areas the Potoroo digs for its food the main component of which is hypogeal fungi with other important items including hard-bodied arthropods, vascular plant tissues, seeds and fleshy fruits (Bennett &amp; Baxter, 1989; Claridge <i>et al.</i>, 1993)</p> <p>Within the site the eastern forests occur on sandy, friable soils although a thick, heathy groundcover is mostly absent. Some areas of Casuarina Forest (Community 8) and Swampbox Forest on sand (Community 4) do have small patches of dense grass, bracken and lantana growth which may provide potential habitat. Trapping, spotlighting and regular traverse of such areas failed to record the species. One noted recorded occurs from the region in association with Billinudgel Reserve further south which is mapped as containing more suitable shrubland/heathland complexes on sand (NPWS, 2001).</p> <p>The 15 ha of revegetation is considered unlikely to be beneficial for potoroos given their absence from the site and absence of terrestrial corridors of favoured habitat between the site and existing known population locations.</p>
<p>Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)</p>	<p>This species forages on a variety of fruits, flowers and pollen. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (Eby 1995). It additionally utilises cultivated fruit crops and urban gardens.</p> <p>This species was recorded mostly within the interconnected eastern forests (Communities 1 &amp; 4-9) on flowering <i>Melaleucas</i> and <i>Banksias</i> and fruiting <i>Figs</i> and <i>Acronychias</i>. It was also recorded within the western forests on bedrock (Communities 2 &amp; 3) and the open grassland/pasture with scattered trees (Community 10) on flowering <i>Eucalypts</i> and fruiting <i>Figs</i>.</p> <p>15ha of potential habitat for the flying fox will occur in association with revegetation works. Favoured heavily flowering trees and fruiting species will provide an additional source for foraging.</p>

Species	Habitat Requirements
<p>Red-legged Pademelon (<i>Thylogale stigmata</i>)</p>	<p>This macropod species is known to inhabit dense forest vegetation (usually rainforest) but is also known from wet sclerophyll forest and occasionally in dry vine-thickets (DEC, 2005; Vernes <i>et al.</i>, 1995, Johnson and Vernes, 1994). A dense understorey is required for shelter and refuge from predators although it will forage in pastures adjacent the forested edges as well as browse grasses, fruits, fungi and shrubs within the forest interior (DEC, 2005). The home range individual is 1-4ha (Johnson and Vernes in Strahan, 2002) with a study of fragmented rainforest in north Qld noting the range to be larger during diurnal periods than nocturnal periods.</p> <p>Within the site potential habitat is considered to be limited to the eastern patches of Littoral Rainforest although the understorey whilst structurally diverse in the mid and upper strata is not as dense within the ground layer which is dominated by leaf litter and woody debris. Thickets of grass, shrub/heath, bracken/fern and/or rushes/sedges are isolated. Spotlighting and regular diurnal traverses (particularly proximate to mammal trapping lines) failed to detect the species presence.</p> <p>The 15 ha of revegetation is considered unlikely to be beneficial for pademelons given their absence from the site and absence of terrestrial corridors of favoured habitat between the site and existing known population locations.</p>
<p>Black Flying-fox (<i>Pteropus alecto</i>)</p>	<p>The Flying-fox forages on the nectar and pollen of native trees and fruits of native rainforest trees and vines as well as ornamental and orchard trees/crops. The preferred food includes the blossoms of Eucalypts, paperbarks and turpentines. Other native and introduced blossoms and fruits are also eaten (Strahan eds, 2002; Nicola and Hall, 2004).</p> <p>15 ha of potential habitat for the flying fox will occur in association with revegetation works. Favoured heavily flowering trees and fruiting species will provide an additional source for foraging.</p>
<p>Square-tailed Kite (<i>Lophoictinia isura</i>)</p>	<p>This species typically prefers the coastal forested and wooded lands of tropical and temperate Australia where it appears to occupy large hunting ranges of more than 100 km<sup>2</sup> (Marchant and Higgins 1993; NPWS, 1999; DEC, 2005). A common feature of the kite's habitat is the presence of profuse eucalypt blossom and attendant nectarivorous/passerine birds which are the favoured prey of the kite (Readers Digest, 2002; NPWS, 1999).</p> <p>It is considered unlikely that the species would inhabit the site due to the absence of large tracts of eucalypt forest/woodlands. Some potential occurs in association with the eastern connected forests fringing Mooball Creek which at its upper extent is proximate to the previous record of the kite in the region at Billinudgel Reserve (NPWS database). If this was an accurate record and the Kite persists in this habitat it could be considered likely that they would hunt within the Mooball Creek environments to the east of the site.</p> <p>The 15 ha of rehabilitation proposed is unlikely to significantly benefit the kite with the exception of expanding the width of existing riparian buffers to Mooball Creek. However, provision of an additional 15 ha of forest is, over time, likely to result in an increased abundance of nectarivorous/passerine birds which provide potential prey.</p>

Species	Habitat Requirements
<p>Rose-crowned Fruit Dove (<i>Ptilinopus regina</i>)</p>	<p>This species generally occurs within sub-tropical rainforest, camphor laurel and occasionally wet sclerophyll and swamp forests which contain suitable fruiting species for foraging (DEC, 2005; Recher et al, 1995). As an obligate frugivore a high proportion of fruiting species (figs, lillipillis, laurels etc) is necessary and as such rainforest habitats are favoured. The species is considered a partial migrant and moves north in autumn/winter and returning in spring/summer to breed (Recher et al, 1995).</p> <p>Within the site it is considered that preferred habitat is limited to the Littoral Rainforest (Community 1) in the eastern areas of the site which contain the highest density of fruiting species. Avifauna survey including call playback failed to detect the species although the survey was limited by the time of year performed.</p> <p>Incorporation of littoral rainforest type fruiting species will provide an additional source for foraging within the rehabilitation zone.</p>
<p>Common Planigale (<i>Planigale maculata</i>)</p>	<p>This species is known to inhabit a broad range of habitats incorporating a dense ground cover layer including rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas (Redhead in Strahan, 2002; Lewis, 2005).</p> <p>Potential habitat is considered to occur within the interconnected eastern forests on sand (Communities 1 &amp; 4-9) which incorporate suitable understorey cover and diversity. Pitfall trapping within these areas failed to record the species.</p> <p>The 15 ha of revegetation is considered unlikely to be beneficial for planigales given their absence from the site and absence of terrestrial corridors of favoured habitat between the site and existing known population locations. However, if planigales occur (but were unrecorded during previous survey) the rehabilitation of 15 ha of native vegetation on sandy, friable soils will provide increase potential habitats and dispersal zones for the species.</p>
<p>Common Blossom Bat (<i>Syconycteris australis</i>)</p>	<p>This species is one of the smallest members of the flying fox family (Pteropodidae) and is considered to be a specialist pollen feeder favouring Banksia, Melaleuca, Callistemon and certain species of Eucalypt (Strahan eds, 2002). Required habitats include Coastal rainforest, heathlands and Melaleuca swamps. The presence of Melaleuca Forest (Community 6) on site and extensive areas of Melaleuca Forest and Eucalypt Forest within the adjacent reserve indicates the species may be a potential occurrence.</p> <p>15 ha of potential habitat for the blossom bat will occur in association with revegetation works. Favoured heavily flowering trees (particularly banksias) will provide an additional source for foraging.</p>
<p>Eastern Bentwing (<i>Miniopterus schreibersii oceanensis</i>)</p>	<p>This species usually forages on insects within intact, well timbered forest complexes and have been found to roost within caves, tunnels, stormwater culverts or disused mining areas (Strahan eds, 2002; DEH, 2005). They utilise a broad range of habits including wet and dry sclerophyll forest, open woodland, paperbark forests, rainforests and open grasslands (North &amp; Pasic, 2006).</p> <p>15 ha of potential habitat for the bentwing bat will occur in association with revegetation works.</p>

Species	Habitat Requirements
<p>Mangrove Honeyeater (<i>Lichenostomus fasciogularis</i>)</p>	<p>In NSW this species primary habitat is mangrove forest where a few colonies exist at scattered localities, including the Tweed, Richmond and Clarence River estuaries and Stuarts Point south of Macksville (DEC, 2005). The honeyeater has also been recorded from other coastal forest types including casuarinas and paperbark forest (DEC, 2005).</p> <p>Within the site the eastern Mangrove areas (Community 9) fringing Mooball Creek is considered to provide suitable habitat for the species. The 15ha of rehabilitation proposed is unlikely to significantly benefit the honeyeater with the exception of expanding the width of existing riparian buffers to Mooball Creek</p>
<p>Brolga (<i>Grus rubicunda</i>)</p>	<p>The Brolga inhabits the large open swamplands/wetlands of coastal and subtropical coastal Australia where it may form flocks of several hundred individuals during the breeding season (Readers Digest, 2002). Studies conducted in southern NSW and Northern Victoria (Charles Sturt University, 2000) indicates that most Brolga breeding sites were large (&gt;50 ha) remnant wetlands with extensive areas of water around 30 cm deep. More than 90% of breeding sites were dominated by Canegrass (<i>Eragrostis australasica</i>, <i>E. infecunda</i>) or Spike-rushes (<i>Eleocharis</i> species), with emergent vegetation cover usually around 25% and 90 cm in height. DEC (2005) notes that the species may also forage within grassed paddocks or ploughed fields.</p> <p>The 15 ha of rehabilitation proposed is unlikely to significantly benefit the brolga with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).</p>
<p>Bush-hen (<i>Amaurornis olivaceus</i>)</p>	<p>This species favors coastal rivers and inlets from the Clarence River, north. It prefers densely overgrown margins of permanent terrestrial freshwater wetlands such as creeks and rivers, billabongs, ponds, swamps, waterholes, dams, lakes and roadside ditches (Muranyi and Baverstock, 1996).</p> <p>Potential habitat is considered to occur within the area in association with Mooball Creek and adjacent forest remnants (Communities 1 and 4-9). The 15 ha of rehabilitation proposed is unlikely to significantly benefit the hen with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).</p>
<p>Bush Stone-curlew (<i>Burhinus grillarius</i>)</p>	<p>This species is widespread throughout predominately coastal Australia where its preferred habitat consists of open forest-woodlands containing a grassy understorey with fallen timber and leaf litter (Readers Digest, 2002; NPWS, 2006). Foraging however, has been noted to occur over a broader spectrum of habitats including paddocks, grasslands, domestic areas (gardens, sports fields, [golf courses, residential areas pers. obs] etc), estuarine areas (mudflats, saltmarsh, mangrove forest, swamp oak, melaleuca forest) (NPWS, 1999; 2006).</p> <p>Potential habitat is present on the site in association with the eastern and western forested remnants (Communities 1-8). It is also considered that the open paddock/pasture areas (Community 10) provide potential foraging habitat as the species is known to utilise domestic areas and be tolerant of human presence/disturbance.</p> <p>15 ha of potential habitat for the curlew will occur in association with revegetation works.</p>



Species	Habitat Requirements
Beach Stone-curlew <i>(Esacus neglectus)</i>	<p>This species is distributed throughout coastal western, northern and eastern Australia from Norwest Cape to the Manning River (Readers Digest, 2002). Within this area it utilised open beaches, islands, reefs and sand/mudflats (NPWS, 2005; 1999; 2002) where it forages on crabs and other hard shelled marine invertebrates (Readers Digest, 2002).</p> <p>Mudflat and sandy beach areas are present adjacent the site to the east in association with Mooball Creek and Wooyung Nature Reserve. The 15 ha of rehabilitation proposed is unlikely to significantly benefit the curlew with the exception of expanding the width of existing riparian buffers to Mooball Creek.</p>
Grass Owl <i>(Tyto capensis)</i>	<p>This species is generally recorded within tussock-grasslands but has also been noted to occur within heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, mangrove fringes, grassy gaps between trees and crops and sugar cane plantation (Garnett and Crowley 2000; Pizzey and Knight, 1997). Within these habitats it sources a wide range of prey including birds, insects and terrestrial mammals. However, it feeds predominately on rodents and its population numbers can fluctuate wildly with the rise and fall of prey populations (Olsend and Doran, 2002). The fall of primary prey species following plague events (during which owl breeding increases) can result in widespread dispersal by the Owls with starvation also noted as the forage base reduces (Debus <i>et al.</i>, 1998).</p> <p>The 15 ha of rehabilitation proposed is unlikely to significantly benefit the grass owl with the exception of expanding the width of existing riparian buffers to Mooball Creek which contains marginal areas of habitat.</p>
Large-footed Myotis <i>(Myotis adversus)</i>	<p>The Myotis roosts within caves, tunnels, hollow-bearing trees, bridges, buildings and dense tree foliage always in close proximity to permanent water (NPWS, 2002; Richards, 2002). It forages over waterbodies where it scoops insects and small fish from the water surface or catches insects aerially (DEH, 2005; Menkhorst, 1996; Richards, 2002). It has been recorded foraging over small creeks, coastal rivers, estuaries, lakes and inland rivers (Law &amp; Anderson, 1999) and other smaller waterbodies including farm dams (Law <i>et al.</i>, 1998).</p> <p>Within the site potential foraging habitat is associated with the eastern forests fringing Mooball Creek (Communities 1 &amp; 4-9) and the creekline itself. The 15 ha of rehabilitation proposed is unlikely to significantly benefit the myotis with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).</p>
Wallum Froglet <i>(Crinia tinnula)</i>	<p>This species is generally associated with Melaleuca Forest, Heathland or sedgeland containing acidic tannin-stained water in the coastal zone of SE Qld and NE NSW (Robinson, 1993; Qld Frog Society, 1999). Potential habitat is considered to occur in the eastern portions of the site in association with Paperbark and Paperbark/Swamp Oak Forests (Communities 6 and 7) which contain occasional freshwater soaks with sedge/rushes (Baumea, Juncus, Phragmites etc). Significant areas of Paperbark Forest are also present to the north of the site in association with an extensive SEPP 14 wetland area.</p> <p>Expansion of swamp sclerophyll habitats on coastal sands may increase the extent of potential habitat in the local area for the froglet.</p>

Species	Habitat Requirements
<p>Wallum Sedge-frog (<i>Litoria olongburensis</i>)</p>	<p>This species is known from ephemeral wetlands and acid swamps containing sedgeland, banksias (wallum) and melaleuca forest/woodland within the coastal sandy zones of NE NSW and SE QLD (DEH, 2005; NPWS, 2002). During wet periods the frog can be found on emergent vegetation (rushes, sedges, ferns) whilst during drier periods it may be found at the base of such vegetation (DEH, 2005).</p> <p>Potential habitat is considered to occur in the eastern portions of the site in association with Paperbark and Paperbark/Swamp Oak Forests (Communities 6 and 7) which contain occasional freshwater soaks with sedge/rushes (<i>Baumea</i>, <i>Juncus</i>, <i>Phragmites</i> etc). Significant areas of Paperbark Forest are also present to the north of the site in association with an extensive SEPP 14 wetland area.</p> <p>Expansion of swamp sclerophyll habitats on coastal sands may increase the extent of potential habitat in the local area for the sedge frog.</p>
<p>Squirrel Glider (<i>Petaurus norfolcensis</i>)</p>	<p>This species of glider is associated with dry sclerophyll forest and woodlands although in northern NSW and Qld it has been recorded from wet sclerophyll environments (Suckling in Strahan eds, 2002; Lindenmayer 2002). It is considered to be most abundant in associations containing winter flowering Eucalypts and/or environments with a high abundance of Acacia, Banksia species in the lower layers (Smith &amp; Murray, 2003; Menkhorst et al, 1998; Quinn, 1995).</p> <p>Within the canopy of the preferred habitat numerous trees bearing hollows are critical habitat values required to support populations of the species (Quinn, 1995; Smith &amp; Murray, 2003; Lindenmayer, 2002). Gliders are known to regularly swap den trees and utilise a number of such dens (between 6 and 19 den trees per Glider) within their home range (van der Ree, 2000). These results are supported by survey work undertaken by Southern Cross University (June/July 2002) which indicated that 12 radio tracked gliders utilised 37 den trees incorporating live hollow bearing trees and stags (Cited in Warren, 2004).</p> <p>Within the site, favoured habitats are considered to be restricted to the eastern forests (some minor presence of bloodwood and ironbark with <i>Banksia integrifolia</i> relatively common) although the low abundance of suitable hollow-bearing trees and general dry sclerophyll forest may limit the potential of this area to be of significance for the species. Rehabilitation/planting of eucalypts and banksias will increase foraging resources for the glider onsite. Eucalypts may also provide potential nest hollows in the 60-100 year timeframe.</p>
<p>Eastern Long-eared Bat (<i>Nyctophilus bifax</i>)</p>	<p>This species of bat inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest with coastal rainforest and patches of coastal scrub particularly favoured (DEC, 2005; NPWS, 2002). Roosting occurs within tree-hollows, under bark and/or palm fronds and within dense foliage with a seasonal shift in roost sites from rainforest edges (summer) to the rainforest interior (winter) (NPWS, 2002; Parnaby in Strahan, 2002; Lunney et al, 1995).</p> <p>It is considered that the potential habitat for the species on site occurs within the swamp and coastal forests in the eastern areas of the site (Communities 1 &amp; 4-9) which will be retained in association with the proposal. 15 ha of potential habitat for the long-eared bat will occur in association with revegetation works</p>

Species	Habitat Requirements
Barred Cuckoo-shrike ( <i>Coracina lineata</i> )	<p>This species has been recorded from a variety of habitats including rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses within Coastal NSW (NPWS, 2002). Foraging requirements include fruiting tree species within in rainforest, wet sclerophyll forest, vegetation remnants or isolated trees (DEC, 2005) and insects captured among foliage (NPWS, 2002).</p> <p>Incorporation of littoral rainforest type fruiting species will provide an additional source for foraging within the rehabilitation zone.</p>
Magpie Goose ( <i>Anseranas semipalmata</i> )	<p>This species favours coastal wetlands and swamps with prolific reed/sedge growth mostly within northern Australia (NPWS, 2002; Tulloch et al, 1981). Breeding is confined to the northern areas in association with large floodplains of creeks/rivers generally within 80km of the coast (Frith and Davies, 1961). Dense sedge/rush growth within shallow waters in these locations is favoured for nest formation (Tulloch et al, 1981; Bayliss and Yeoman, 1990).</p> <p>The 15 ha of rehabilitation proposed is unlikely to significantly benefit the goose with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).</p>
Black Bittern ( <i>Ixobrychus flavicollis</i> )	<p>The species is widely distributed throughout the coastal regions of Australia but is more common in the northern extent of the country. Within its distribution, the species shows a preference for densely vegetated areas within terrestrial and aquatic wetlands. It has been recorded from a variety of vegetation types (including grassland, mangroves, wet sclerophyll forest, rainforest) where permanent water is present (Marchant &amp; Higgins, 1990; Simpson &amp; Day, 1996; NPWS, 2001).</p> <p>Suitable habitat is considered to occur in proximity to the site in association with Mooball Creek and the adjacent estuarine/freshwater communities (Mangroves, Paperbark Forest). The 15 ha of rehabilitation proposed is unlikely to significantly benefit the bittern with the exception of expanding the width of existing riparian buffers to Mooball Creek.</p>
Collared Kingfisher ( <i>Todiramphus chloris</i> )	<p>This species is recorded in coastal Australia from Shark Bay to the Clarence River where it is almost exclusively associated with mangrove and estuarine areas (NPWS, 2005; Readers Digest, 2002). The species is considered possible to occur given the presence of mangrove forest and estuarine communities both on and adjacent the eastern areas of the site.</p> <p>The 15ha of rehabilitation proposed is unlikely to significantly benefit the honeyeater with the exception of expanding the width of existing riparian buffers to Mooball Creek.</p>
Wompoo Fruit Dove ( <i>Ptilinopus magnificus</i> )	<p>This species is confined to mature rainforest and adjacent wet sclerophyll environments in eastern Australia from Cape York to around Coffs Harbour. As an obligate frugivore it requires a high availability of fruiting materials which it generally feeds on in the high canopy (Recher <i>et al.</i>, 1995).</p> <p>Suitable habitat for this species is considered to be largely absent from the site although Community 1: Littoral Rainforest contains species typically favoured by the species (Figs, palms, laurels, lillipillis, barbed-wire vine). Previously clearing of the site in the 1950s limits the height of the canopy (15-20m) of this association which is considered to be lower than typically favoured by the species.</p> <p>Incorporation of littoral rainforest type fruiting species will provide an additional source for foraging within the rehabilitation zone.</p>

Reviewing the above habitat requirements, it is considered that rehabilitation and restoration proposed likely to increase the potential habitat and refuge available for the listed species within the sub-region through the provision of:

- **Foraging resources:** Identified food resources for various significant fauna species will be incorporated within revegetated/rehabilitated areas (i.e. *Allocasuarina* species for glossy black cockatoos, nectar and fruit producing flora species for birds and bats, eucalypts for koalas etc);
- **Cover:** Native understorey regeneration and additional supplementary plantings will provide cover for small native species from predators whilst moving throughout the rehabilitation zones. The locations of the Rehabilitation Zones which aim to close canopy gaps, increase corridor widths, close the gaps between currently isolated remnants and rejoin the riparian habitats of Mooball Creek to the western eucalypt forests on bedrock, will significantly increase dispersal options for native fauna.

### 5.1 FAUNA MANAGEMENT DURING VEGETATION CLEARING

The approved quarry development requires only the minor removal of semi-mature Swamp Oaks and isolated blue gums and areas of pasture grassland in association with preparation and ongoing sand extraction procedures (refer **Figure 49** below).

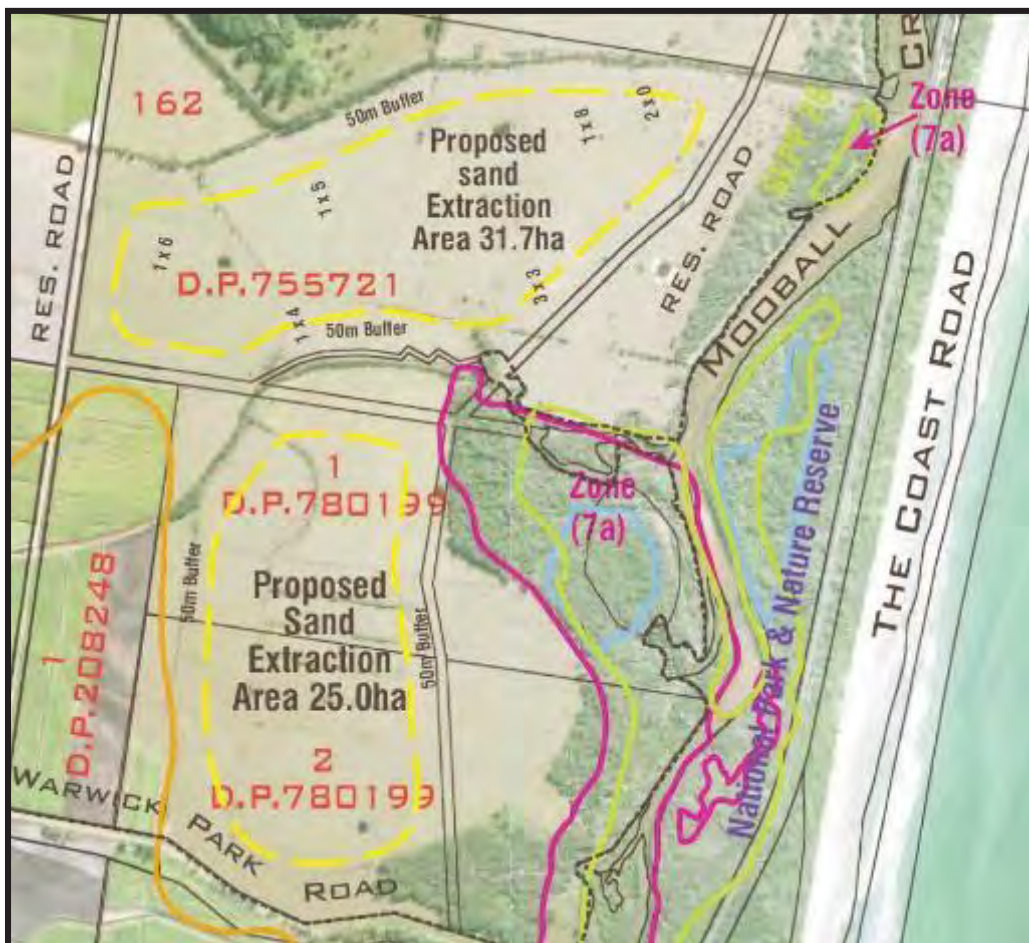




Figure 49: Clearing Zones

Notwithstanding the minor extent of native vegetation removal required, best management practice requires that wildlife whose habitat has been destroyed by human activity, must be considered, through the formation of a fauna management plan (FMP) to address the issue. The following actions will effectively reduce potential fauna mortality due to removal of habitat as part of the proposed vegetation clearing works and through the ongoing operation of the quarry.

### **5.1.1 GENERAL FAUNA MANAGEMENT**

It is intended that, in regard to the clearing process and associated staff, a wildlife spotter-catcher shall confirm that the tree felling operation shall occur in a manner set out below that allows safe dispersal or capture of fauna:

- Clearing of trees, will occur after inspection to confirm absence of current or anticipated fauna activity (e.g. active bird nests, arboreal mammals).
- All static fauna valued trees will be clearly identified with high visibility tape or marker spray paint.
- The static fauna values, specifically hollow-bearing trees, termite mounds or birds nests, will be isolated for a period of 24 hours to encourage dispersal prior to being removed. Techniques applicable to this stage of spotter-catcher duties vary due to the site specifics regarding topography, structure and stature of trees and occupational health and safety limitations.
- Hollow-bearing trees will be accessed and examined with torch, chainsaw, buffer rags with all fauna located during spotter-catcher duties to be assessed for species, injury and maturity prior to immediate release or being placed in a cotton capture bag.
- Captured fauna will be held in suitable ambient conditions prior to release within normal activity times for the animal concerned. All fauna captured will be released in adjacent bushland, containing suitable habitat, outside and within 500 m of the proposed clearing zone.
- Insect bat species located during clearing will be identified prior to release at an appropriate crepuscular time with Anabat recording of calls.
- Any diseased, injured or juvenile fauna located that is incapable of dispersal or release will be taken to an experienced wildlife vet, Wildcare or Currumbin Wildlife Sanctuary for treatment or fostering prior to release.



### 5.1.2 SUCCESSIONAL CLEARING PROTOCOL

As koalas have been previously recorded on the site sequential clearing is recommended despite the unlikelihood of any koalas being present within the clearing zones. In this regard clearing of trees is carried out in a way that ensures koalas (and other animals) living in or near the area being cleared (the clearing site) have enough time to move out of the clearing site without human intervention.

Clearing of trees is to be carried out in a way that ensures, appropriate habitat links are maintained within the clearing site and between the site and its adjacent areas, to allow koalas/fauna living on the site to move out of the site

In this regard it is recommended that clearing be undertaken generally in a south-north (northern sand extraction area) and west-east (southern sand extraction area) direction to enable dispersal to retained bushland. Importantly clearing must not disperse fauna to the south or the west where they may become trapped or disperse into adjacent construction sites and roadways.

No tree in which fauna is present, and no tree with a crown overlapping a tree in which fauna is present, is cleared. A fauna spotter means a person who has demonstrated experience in locating koalas in koala habitats or conducting fauna surveys. Prior to the commencement of, and during felling operations, it is the responsibility of the spotter to identify trees in which a koala or other fauna are present and any trees where their crown overlaps trees in which a koala or other fauna is present and convey this information to the person(s) conducting the clearing.

During this identification process, there will a differentiation between *Complete cover trees* and *See-through trees* where *Complete cover trees* will be retained until the spotter-catcher responsible is certain of absence of fauna prior to the tree being felled.

A *Complete cover tree* is defined as a tree with abundant foliage that does not allow confirmation of absence of fauna without a full 360-degree viewing and if required extended viewing during peripheral clearing operations to detect movement.

A *See-through tree* is defined as sparsely foliated tree where a 360-degree viewing confirms the absence of fauna.

Any tree in which fauna is located (and any adjacent overlapping tree) is to be tagged and excluded from clearing until the fauna has safely dispersed (over the period, to be a minimum of 12 hours, between cessation of works on that day and commencement of works on the subsequent day)

When located, clearing exclusion zones (20m minimum) around the active fauna tree will be set out where no activity can occur for the day's duration to confirm animal safety and allow dispersal. Secondly, fauna response to peripheral human activity will be monitored by spotter-catcher to confirm acceptable disturbance and if required cessation of clearing process within a larger radius (i.e. 50m) to reduce stress to the observed fauna.

The site contractor/foreman is to be clearly shown the identification of all trees and exclusions zones which are not permitted for any day's clearing prior to starting the first piece of construction equipment on that day of clearing.



Opportunistic capture/release is only permitted where an *Un-located Koala/Fauna* interaction occurs. If or when this occurs, all clearing will cease until the spotter-catcher responsible has determined the severity of incident. In circumstances where the animal has had a major stress reaction from close proximity to the clearing process, clearing will be directed away from proximity and the animal's reaction monitored until stress reaction is deemed acceptable. In circumstances where the tree containing the animal has been felled, it will be examined for general alertness, potential injuries to paws, limbs, body, vision, wings, claws, etc. prior to the decision to vet check the animal or hold with observations repeated prior to release and post release monitoring to confirm successful dispersal out of the clearing zone.

An *Un-located Koala/Fauna* is defined as a Koala or other animal that has eluded detection, despite the defined actions of the spotter-catcher responsible occurring (as outlined within the preceding points) and is generally associated with dense vegetation areas or canopies exhibiting dense coppicing.

A Koala Management Plan has been prepared and is an appendix in the Landscape Management Plan. This addresses part of Condition 28.

### **5.1.3 ONGOING FAUNA MANAGEMENT DURING QUARRY OPERATIONS**

Although the quarrying use is well separated from retained fauna habitat areas potential does exist for fauna injury/mortality during ongoing operation of the use as follows:

Potential occurs for vehicle strike along the haulage road, particularly in the northern areas proximate to koala habitat.

The following actions are recommended to minimise the above listed potential impacts:

- In accordance with the Development Consent issued, trucks and machinery are to be confined to defined haulage routes and operate during daylight hours only (7am-5pm weekdays, 7am-12pm weekends) at a maximum speed of 25km/hr (as signed within the site).
- A registered wildlife spotter catcher is to be contacted regarding the presence of any fauna trapped or injured within the quarry zone (including snakes). Any such fauna is to be inspected for species, injury and maturity prior to immediate release in adjacent bushland (depending on time of day) or being placed in a cotton capture bag.

Captured fauna will be held in suitable ambient conditions prior to release within normal activity times for the animal concerned. All fauna captured will be released in adjacent bushland, containing suitable habitat, outside but within 500m of the quarry zone.

- Any diseased, injured or juvenile fauna capture that is incapable of dispersal or release will be taken to an experienced wildlife vet, Wildcare or Currumbin Wildlife Sanctuary for treatment or fostering prior to release.
- Fauna management during quarry operations should be conducted in reference to the Koala Management Plan.

## 5.2 FAUNA NESTBOXES

In accordance with the Development Consent issued fauna boxes are to be installed onsite to increase potential nesting options for the existing assemblage. To potentially allow for a wider range of species to utilise the fauna boxes to be provided it is recommended that boxes be designed in accordance with a variety of specifications. In particular, the following is to be provided targeting a range of arboreal mammals and avifauna:

- 2 x squirrel/sugar glider boxes
- 2 x cockatoo/parrot boxes
- 2 brushtail/ringtail possum boxes
- 1 rosella/lorikeet boxes
- 1 microbat boxes
- 1 owl box
- 1 kingfisher boxes

The purchase, installation and monitoring of the above fauna boxes is to comply with the below requirements:

- Fauna boxes are only to be sourced from a reputable supplier
- Boxes are to be well-insulated, rainproof and facing away from prevailing winds and direct midday summer sunlight
- Boxes are to be located where casual access is difficult to reduce potential vandalism
- Boxes are to be maintained and inspected on an annually basis

### *Fauna Box Reporting*

Within six months of the commencement of the use a brief report is to be prepared containing the following information:

- An accurate graphical representation of each fauna box within the retained vegetation communities and its associated GPS coordinates
- Detail of the type, number and location of each of the 10 fauna boxes
- The installed height of the box from the ground

Every twelve months an inspection and a brief report shall be prepared/undertaken for each of the boxes including:

- A discussion of the maintenance of the fauna boxes over the preceding quarterly period and any associated problems encountered (i.e. vandalism, presence of feral insects, birds or mammals etc) and any resultant corrective actions implemented
- Documentation of any changes to the location of fauna boxes as a result of corrective actions implemented
- Completion of the below monitoring form

ROUTINE FAUNA BOX MONITORING FORM			
<b>Location/Number of Fauna Box</b>			
<b>Description of Fauna Box</b>			
<b>Inspected by</b>		Name:	Signature:
<b>Inspection date</b>		/ /	
Element	N/Y?	Comments/description	Action Required
Empty Box			
Native Fauna Present			
Eggs Present			
Number of eggs			
Colour/description of eggs			
Nest present			
Partial nest present			
Hatchlings/fledglings present			
Box empty but scats/trace present			
Box occupied by pest species (i.e. bees, myna, black rat etc)			
Roof, hinges and/or supports broken or in need of repair/replacement			
Evidence of warping			
Evidence of vandalism			
Other comments/maintenance performed?:			



## 6.0 REFERENCES

Bradley, J. (1988) Bringing back the bush: The Bradley method of bush regeneration. Lansdowne Publishing Pty. Ltd. The Rocks, NSW;

Buchanan, R. A. (1989) Bush Regeneration: Recovering Australian Landscapes. TAFE Student Learning Publications, NSW;

Department of Planning (1991) Urban Bushland. Department of Planning, Sydney.

Department of Environment and Heritage (1999) Suggested Conservation Criteria for Development Assessment for use by Local Government Officers. DEH, Brisbane.

Greening Australia (1995) Local Greening Plans: A Guide for Vegetation and Biodiversity Management. Greening Australia, Canberra;

Mann, M. (2000) Toxicological Impact of Agricultural Surfactants on Australian Frogs (PHD Thesis). Curtin University of Technology, Perth

Nufarm Australia Limited (undated) Roundup Biactive Herbicide by Monsanto NRA Approval No. 48518/1102

Overall fuel hazard assessment guide 4th ed (2010) Fire and adaptive management, Report No 82. Hines F., Tolhurst K.G., Wilson A.A.G., McCarthy G.J. Victorian Government Department of Sustainability and Environment.

Planning for Bushfire Protection 2019. NSW Rural Fire Service. Retrieved from; [https://www.rfs.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0011/86519/DPP1007-Planning-for-Bushfire-Protection-2019-280818-D22.pdf](https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0011/86519/DPP1007-Planning-for-Bushfire-Protection-2019-280818-D22.pdf)

Pulse Penetrant online @ <http://www.nrrbs.com.au/chemicalspulse.htm>

Robertson, M. (1994) Stop Bushland Weeds: A guide to successful weeding in South Australia's bushland. The Nature Conservation Society of South Australia Inc;

Rural Fires Act 1997. NSW Government. Retrieved from [www.legislation.nsw.gov.au](http://www.legislation.nsw.gov.au): <https://www.legislation.nsw.gov.au/#/view/act/1997/65>

Work Health and Safety Act 2011. NSW Government. Retrieved from [www.legislation.nsw.gov.au](http://www.legislation.nsw.gov.au): <https://legislation.nsw.gov.au/view/html/inforce/current/act-2011-010>

## 7.0 ATTACHMENTS

**ATTACHMENT 1:** LANDSCAPING PLANS

**ATTACHMENT 2:** VEGETATION MANAGEMENT PLAN

## ATTACHMENT 1 – LANDSCAPING PLANS

# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Key Plan  
Dunloe Park Sand Extraction  
Scale: 1:5000 at full size A1



Key Plan  
Dunloe Park Sand Extraction  
Scale: 1:5000 at full size A1

## Drawing Schedule

Sheet 1	Drawing Schedule + Key Plan	845-01
Sheet 2	Buffer Planting - Stage 1 Haul Route	845-02
Sheet 3	Buffer Planting - Stage 1 Sand Extraction	845-03
Sheet 4	Rehabilitation Area 1A	845-04
Sheet 5	Rehabilitation Area 1B	845-05
Sheet 6	Rehabilitation Area 1C	845-06
Sheet 7	Rehabilitation Area 2A	845-07
Sheet 8	Rehabilitation Area 2B	845-08
Sheet 9	Rehabilitation Area 2C	845-09
Sheet 10	Rehabilitation Area 3	845-10
Sheet 11	Rehabilitation Area 4 - Stage 1-3	845-11
Sheet 12	Agricultural Area	845-12
Sheet 13	Specifications	845-13

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN		
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - KEY PLAN		
BASE PROVIDED BY			

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	NB

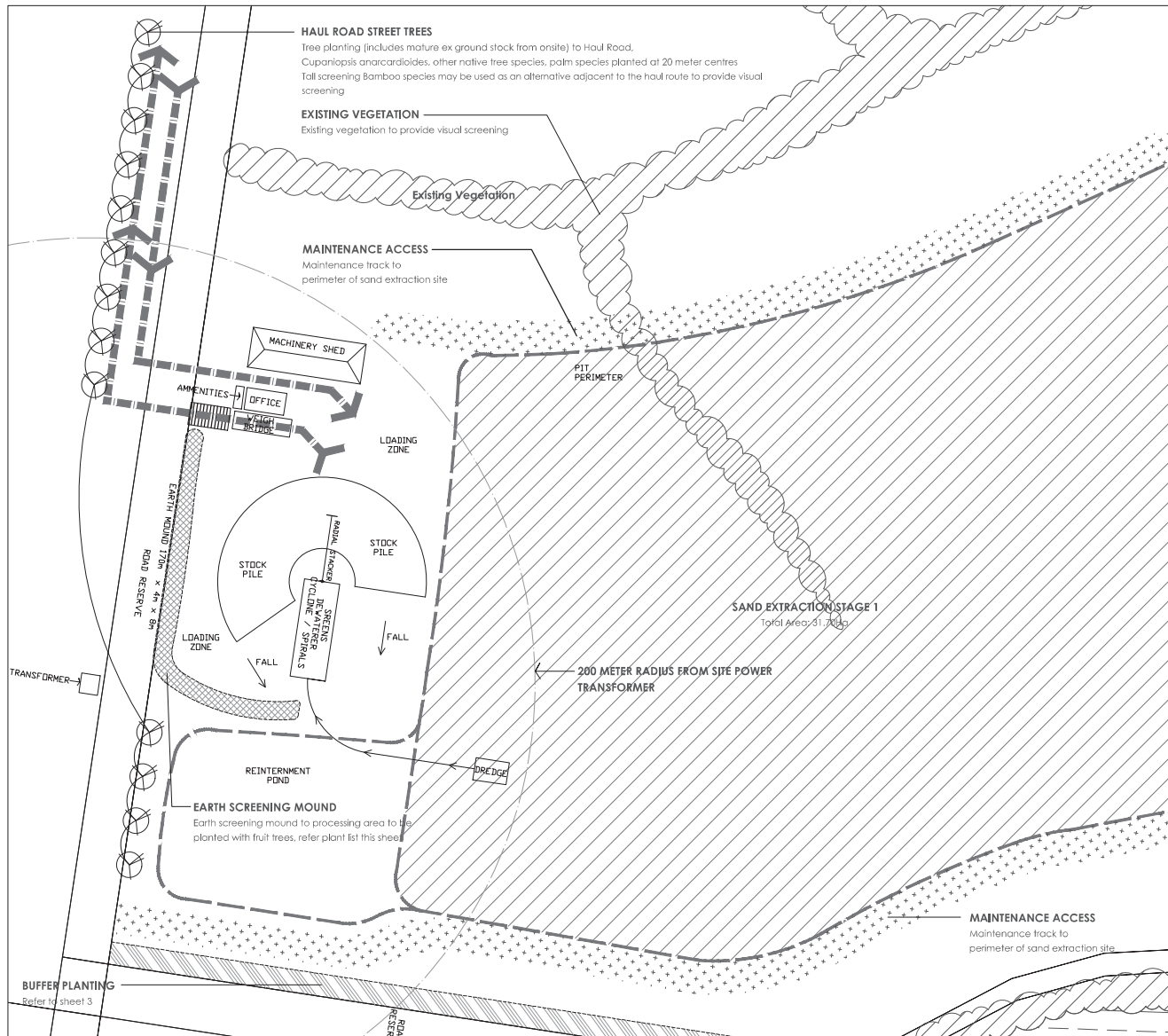
SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO.:	DS_OPW_845_01

CIBIT:	RAMTECH PTY LTD
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Level 1, 2047 Easde Coast Hwy  
 Ready Beach - Phone: 08 2336 1192  
 PO Box 506 North Beach QLD 4218 email: info@planetconsulting.com.au

Telephone: 02 9034 1100  
 Fax: 02 9034 1192  
 email: info@planetconsulting.com.au





**Buffer Planting Area 1 - Earth Screening Mound**  
Total Area: 0.14Ha

Dunloe Park Sand Extraction  
Scale: 1:1000 at full size A1

## Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Buffer Planting - location plan

NIS

### EARTH SCREENING MOUND

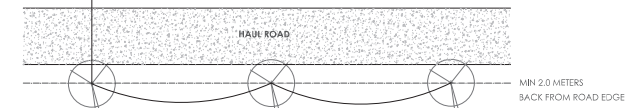
Total Area: 0.14Ha

#### CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	SPACING	SIZE	QTY
ban 04	Citrus sinensis	Orange tree	3 METER CENTRES	45LTR	210
cas gla	Davidsonia jerviana	Davidson Palm			
cor int	Mangifera indica	Mango tree			
euc ler	Persea americana	Avocado tree			

### HAUL ROAD STREET TREES

Tree planting (includes mature ex ground stock from onsite) to Haul Road, Cupaniopsis anacardioides, other native tree species, palm species planted at 20 meter centres



### Planting to Haul Road - Trees at 20 meter centres

NIS

#### Bamboo Screen Planting

Tall screening Bamboo species may be used as an alternative adjacent to the haul route to provide visual screening

PROJECT TITLE  
DUNLOE PARK - REHABILITATION PLAN

DRAWING TITLE  
OPERATIONAL WORKS LANDSCAPE PLAN - BUFFER HAUL ROUTE

BASE PROVIDED BY

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:  
AS SHOWN

DESIGN:  
JB/GD

DRAWN:  
JB

DATE:  
JUNE 2016

CHECKED:  
AS

DRAWING NO:  
DS\_OPW\_B45\_02

CLIENT:  
RAMTECH PTY LTD

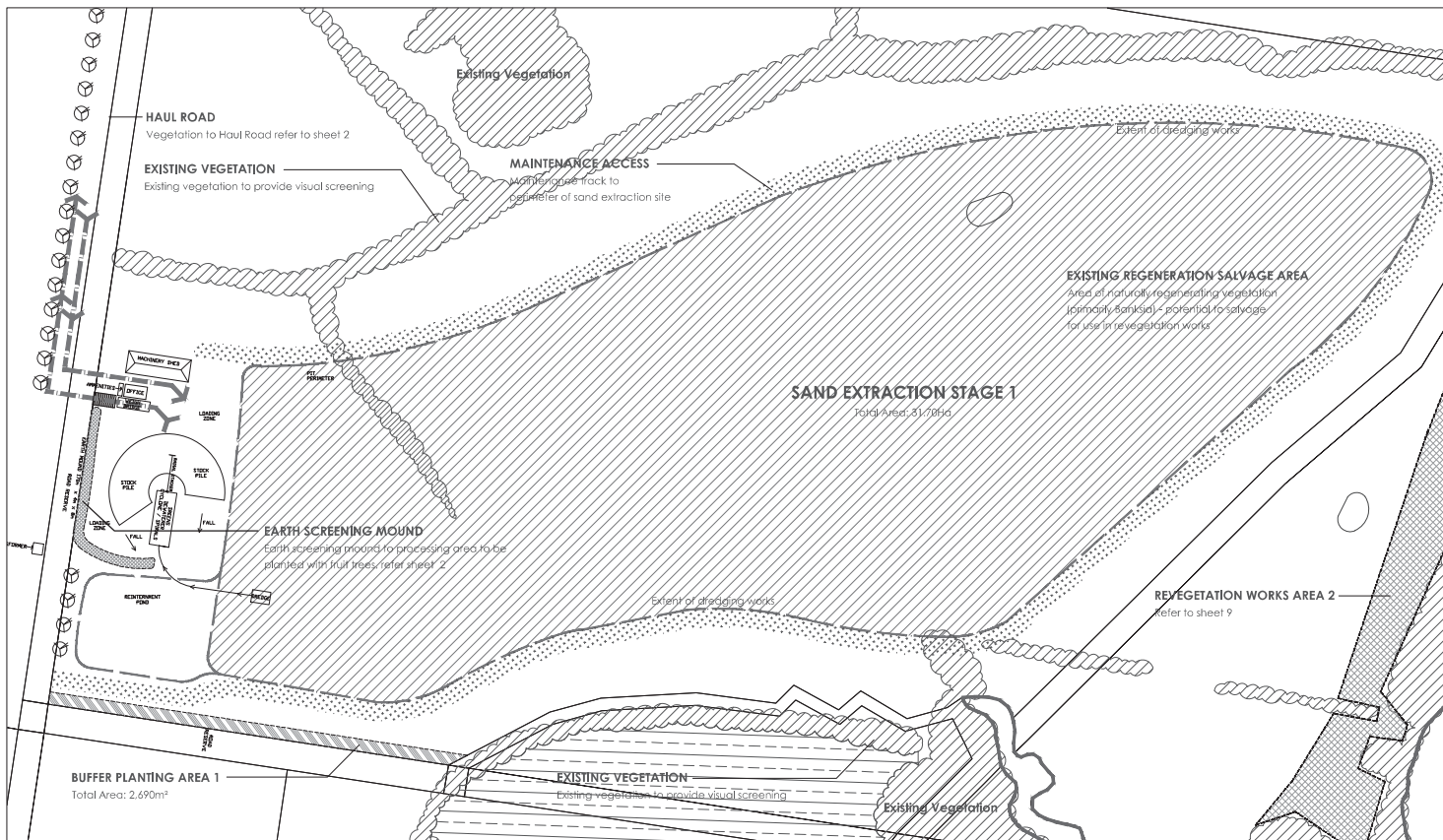
Level 1 2047 Epsom Court Hwy  
Bexley North  
P.O. Box 506 North Beach QLD 4218  
Phone: (07) 5534 1500  
Fax: (07) 5534 1592  
www.planitconsulting.com.au





# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



## BUFFER PLANTING AREA 1 Total Area: 0.34Ha (34 MODULES) CANOPY TREES

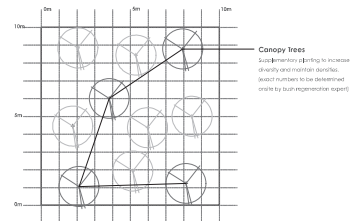
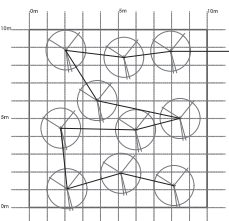
CORB	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
can 01	<i>Acacia integrifolia</i>	Coast Wattle	10	45/11	340
can 02	<i>Callistemon citrinus</i>	Sweep Oats			
can 03	<i>Callistemon linearis</i>	Flue Woodswallow			
can 04	<i>Callistemon grandis</i>	Redroot Gum			
can 05	<i>Callistemon lanceolatus</i>	Forest Red Gum			
can 06	<i>Callistemon microcarpa</i>	Tallow Wood			
can 07	<i>Callistemon obtusifolius</i>	Wattle			
can 08	<i>Callistemon viminalis</i>	Swamp Wattle			
can 09	<i>Callistemon confertus</i>	Brush Box			
can 10	<i>Callistemon salignifolius</i>	Paperbark			
can 11	<i>Callistemon linearis</i>	Watermelon Tree			

## Buffer Planting Area 1

Total Area: 0.34Ha

**EXTENT OF SAND EXTRACTION WORKS**  
Proposed extent of sand extraction works

**EXTENT OF BUFFER PLANTING WORKS**  
Rehabilitation Works - 10 meter buffer  
Total Area: 0.34 Ha  
Boundary of Buffer Planting Area to be pegged out by surveyor prior to commencement of works.  
Flag to be at the corner / golf pipe to minimum 1 meter above ground painted yellow.

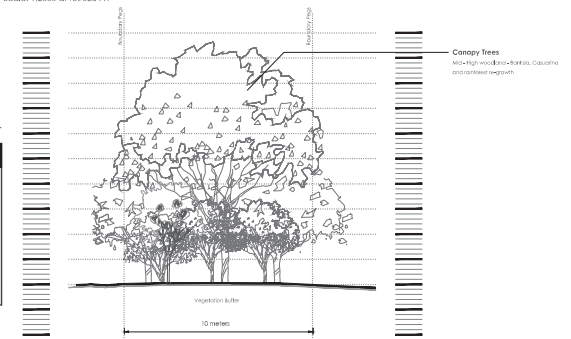


## Works Schedule Buffer Planting

Stage	0 - 6 months	6 - 12 months	Year 1+
<b>Buffer Planting</b> Total Area: 3.10Ha	<b>PLANTING MODULE 1</b> Canopy/Subcanopy Trees 10 Canopy trees per module 20 Subcanopy trees per module refer to planting list this sheet Potential for indigenous plant stocks (refer native plant) to be translocated to achieve planting densities	<b>PLANTING MODULE 2</b> Supplementary planting to increase diversity and maintain densities. (exact numbers to be determined onsite by bush regeneration expert)	<b>Natural Regeneration Weed Management</b> Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09

**Notes:**  
Site subject to effects of frost  
All existing tracks and trails: routes to remain

Dunloe Park Sand Extraction  
Scale: 1:2000 or full size A1



PROJECT TITLE  
DUNLOE PARK - REHABILITATION PLAN

DRAWING TITLE  
OPERATIONAL WORKS LANDSCAPE PLAN - BUFFER PLANTING STAGE 1

BASE PROVIDED BY

NO	DATE	REVISION	BY
01	04/14	OPW REVISED	MB

SCALE:  
AS SHOWN

DESIGN:  
JB/GD

DRAWN:  
JB

DATE:  
JUNE 2016

CHECKED:  
AS

DRAWING NO:  
DS\_OPW\_845\_03

CLIENT:  
RAMTECH PTY LTD

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**PLANIT**  
CONSULTING





# Dunloe Park - Rehabilitation Plan

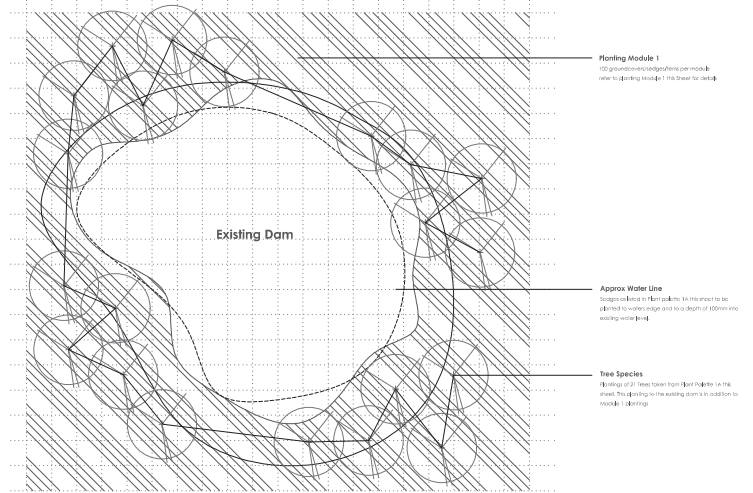
OPW Landscape Plans



Rehabilitation Area 1A - location plan  
Dunloe Park Sand Extraction  
NTS

**REHAB 1.0 BOUNDARY PEGS**  
Boundary of rehabilitation area to be pegged out by surveyor prior to commencement of works. Pegs to be set parallel to guide pipe to minimum 1 meter above ground points yellow with rotation to match as indicated on these plans. Existing vegetation line to form all other boundaries as indicated (N/S sheet).

**FENCES**  
Boundary of rehabilitation area to be fenced if cattle one to be introduced to adjacent grazing areas.



Callout 1 - Existing Dam  
To be planted as part of Stage 1 works  
Vegetation Type: Fresh-water Wetland  
Dunloe Park Sand Extraction  
Scale: 1:100 at full size A1

Rehabilitation Area 1A  
Total Area: 1.85Ha  
Vegetation Type: Fresh-water Wetland  
Dunloe Park Sand Extraction  
Scale: 1:1000 at full size A1

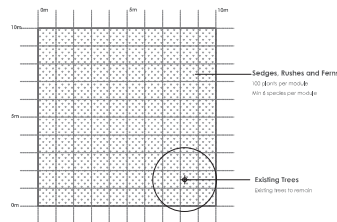
**TREES - TO DAM**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
001-01	<i>Castanea glauca</i>	Swamp Oak			
001-02	<i>Callistemon salignus</i>	Willow Redback	1	140MM	21
001-03	<i>Lophospermum austroricum</i>	Swampbox			
001-04	<i>Melaleuca squamearia</i>	Paperbark			

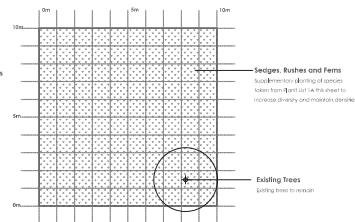
**REHABILITATION AREA 1A (185 MODULES)**

**SEDGES, BUSHES & FERNS**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
001-05	<i>Baumea juncea</i>	Bare Tussock			
001-06	<i>Baumea teretica</i>	Redgrass			
001-07	<i>Microsorum indorum</i>	Redspotted Fern			
001-08	<i>Carex lasiocarpa</i>	Parakeet			
001-09	<i>Cyperus polytrichus</i>	Bunchy Sedge			Stage 1 1500
001-10	<i>Bambusa tulungensis</i>	Bamboo			
001-11	<i>Microsorum laetevirens</i>	Red Fern			Stage 2 1500
001-12	<i>Gahnia aspera</i>	Saw Sedge			
001-13	<i>Juncus tenuis</i>	Sea Rush			
001-14	<i>Juncus subulata</i>	Common Rush			
001-15	<i>Phalaris fasciculata</i>	Tussock			
001-16	<i>Phragmites australis</i>	Common Reed			Stage 3 1500
001-17	<i>Scheuchzeria palustris</i>	Clubrush			
001-18	<i>Scheuchzeria palustris</i>	Clubrush			
001-19	<i>Spermatococcus vaginatus</i>	Salt Grass			
001-20	<i>Lygodium australe</i>	Spotted Fern			
001-21	<i>Xanthorrhoea tenax</i>	Red Iron			



Planting Module 1 - Freshwater Wetland  
PIONEER SPECIES PLANTING 10 x 10 meter module  
NTS



Planting Module 2 - Freshwater Wetland  
SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module  
NTS

## Rehabilitation Schedule

Stage	Year 1	Year 2	Year 3	Year 4	Year 5+
Stage 1 Total Area: 0.55Ha	<b>PLANTING MODULE 1</b> Species selected from Rehabilitation Area 1A species list. Each module to contain 100 grommets as listed dependent on natural regeneration performance as determined by Regeneration expert.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.
Stage 2 Total Area: 0.55Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING Species list selected from Rehabilitation Area 1A species list. Each module to contain 100 grommets as listed dependent on natural regeneration performance as determined by Regeneration expert.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.
Stage 3 Total Area: 0.73Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09.	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING Species list selected from Rehabilitation Area 1A species list. Each module to contain 100 grommets as listed dependent on natural regeneration performance as determined by Regeneration expert.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity.

**PROJECT TITLE**  
DUNLOE PARK - REHABILITATION PLAN

**DRAWING TITLE**  
OPERATIONAL WORKS LANDSCAPE PLAN - AREA 1A

**BASE PROVIDED BY**

NO	DATE	REVISION	BY
01	06/14	OPW REVISED	MB

SCALE:	DATE:
AS SHOWN	JUNE 2016
DESIGN:	CHECKED:
JB/GD	AS
DRAWN:	DRAWING NO:
JB	DS_OPW_R45_04

**CUSTOMER:**  
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Brisbane, Queensland  
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Fax: 07 5554 1193  
P.O. Box 504, Northey Street, QLD 4018  
www.opwlandscapeplans.com.au

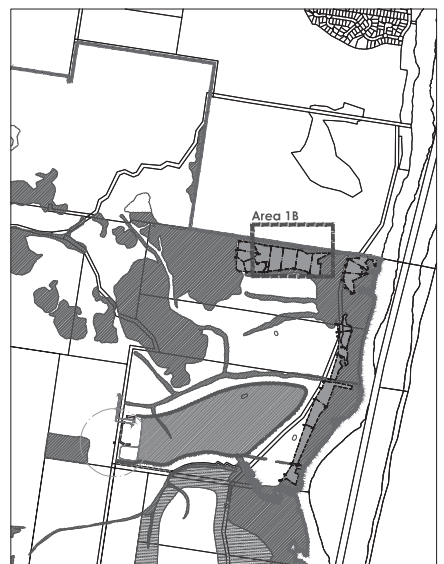
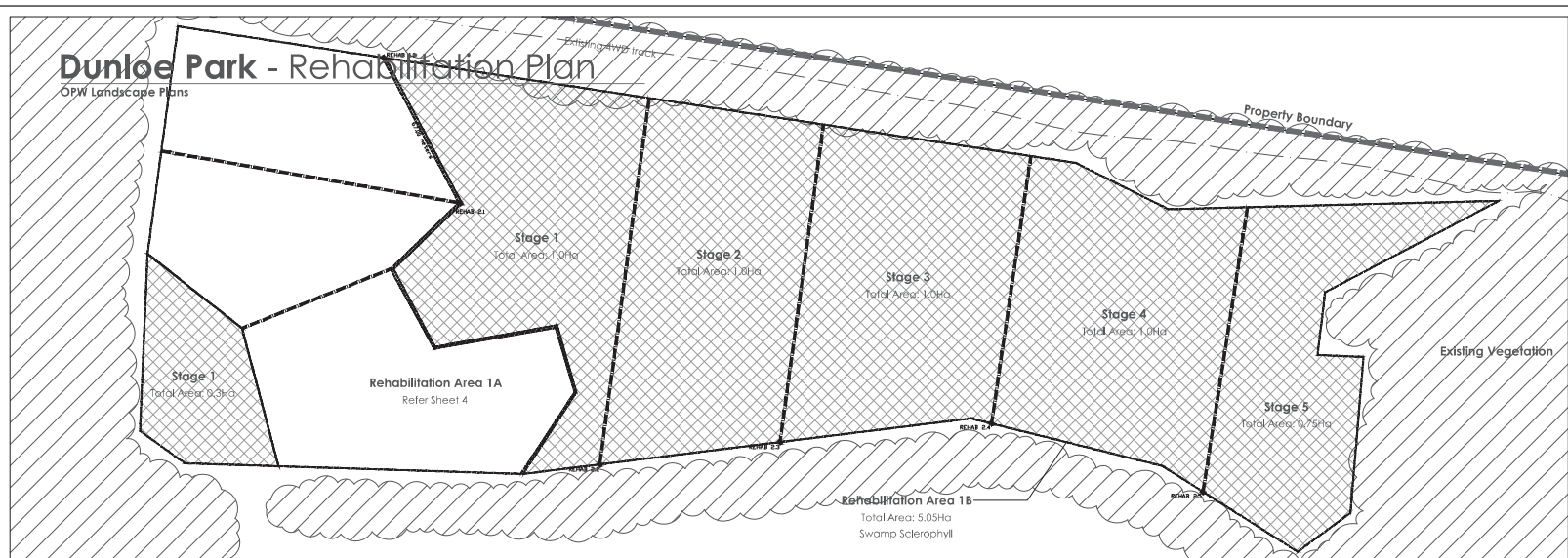
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Phone: 07 5554 1192  
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**PLANIT CONSULTING**



# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



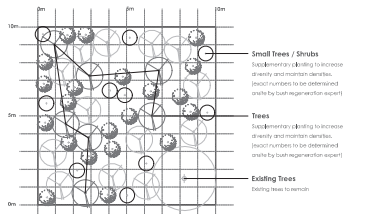
**Rehabilitation Area 1B**  
 Total Area: 5.05Ha  
 Vegetation Type: Swamp Sclerophyll + Littoral Rainforest Understorey

Dunloe Park Sand Extraction  
 Scale: 1:1000 at full size A1

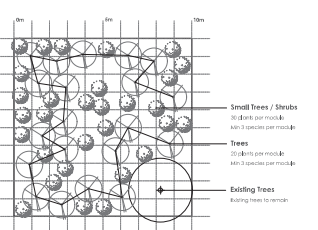
**Rehabilitation Area 1B - location plan** Dunloe Park Sand Extraction  
 NTS

**BOUNDARY FDS**  
 Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star gilded / gold spike to minimum 1 meter above ground pointed yellow with signpost to match or nailed on these (8mm). Existing vegetation line to form all other boundaries as indicated this sheet.

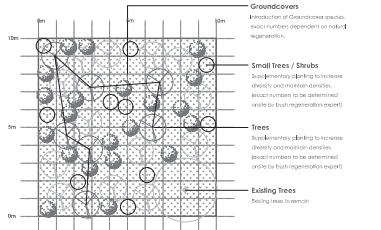
**FENCES**  
 Boundary of rehabilitation areas to be fenced 7 cattle one to be introduced to adjacent grazing areas.



**Planting Module 2 - Swamp Sclerophyll**  
 SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module  
 NTS



**Planting Module 1 - Swamp Sclerophyll**  
 PIONEER SPECIES PLANTING 10 x 10 meter module  
 NTS



**Planting Module 3 - Swamp Sclerophyll**  
 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module  
 NTS

**REHABILITATION AREA 1B**  
 TOTAL AREA: 5.05Ha (505 MODULES)  
**TREES - module 1, 2 and 3**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
col-01	Callistemon salignus	White Bullbush			Stage 1 2000
col-02	Corymbia hemistriata	Tree Sheo-bush			Stage 2 2000
col-03	Eucalyptus tereticornis	Blue Gum	20	75MM TUBE	Stage 3 2000
col-04	Eucalyptus robusta	Swamp Mahogany			Stage 4 2000
col-05	Melicope quinquangula	Paperbark			Stage 5 2000
col-06	Scaevola taccada	Swamp Tea			Stage 5 2000

**SMALL TREES / SHRUBS - module 1, 2 and 3**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
col-07	Allocasuarina torulosa	Forest Oak			Stage 1 2000
col-08	Acrocalymma latifolium	Black Acacia			Stage 2 2000
col-09	Banksia integrifolia	Coastal Banksia			Stage 3 2000
col-10	Cupressus microcarpa	Lackered			Stage 4 2000
col-11	Dalmanella myrsinoides	Carlewood			Stage 5 2000
col-12	Howea forsteri	Howea			Stage 5 2000
col-13	Myrsine longifolia	Long-leaved Mistle-Tree			Stage 5 2000
col-14	Phoradendron australe	Forest Fitzroya			Stage 5 2000
col-15	Scyphium coccineum	Red Bell			Stage 5 2000
col-16	Rosastrum caninum	Tree Heath			Stage 5 2000

**GROUNDCOVERS - module 3 only**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
col-17	Microseris debilis	Maidie			Stage 1 2000
col-18	Microseris latifolia	Swamp Maidie			Stage 2 2000
col-19	Cymbopogon setosus	Parrotgrass			Stage 3 2000
col-20	Cymbopogon polytrichoides	Blue Parrotgrass			Stage 4 2000
col-21	Diuris cordata	Blue Fox Lily			Stage 5 2000
col-22	Diuris spaldingii	Swamp Fox Lily			Stage 5 2000
col-23	Diuris cordata	Blue Fox Lily			Stage 5 2000
col-24	Diuris spaldingii	Swamp Fox Lily			Stage 5 2000
col-25	Diuris cordata	Blue Fox Lily			Stage 5 2000
col-26	Diuris spaldingii	Swamp Fox Lily			Stage 5 2000
col-27	Diuris cordata	Blue Fox Lily			Stage 5 2000
col-28	Diuris spaldingii	Swamp Fox Lily			Stage 5 2000
col-29	Diuris cordata	Blue Fox Lily			Stage 5 2000
col-30	Diuris spaldingii	Swamp Fox Lily			Stage 5 2000

**Rehabilitation Schedule**

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Stage 1 Total Area: 1.01Ha	<b>PLANTING MODULE 1</b> Pioneer species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management
Stage 2 Total Area: 1.01Ha	<b>Natural Regeneration</b> Weed Management	<b>PLANTING MODULE 1</b> Pioneer species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 3</b> Supplementary species planting Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management
Stage 3 Total Area: 1.01Ha	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>PLANTING MODULE 1</b> Pioneer species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 3</b> Supplementary species planting Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management
Stage 4 Total Area: 1.01Ha	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>PLANTING MODULE 1</b> Pioneer species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 3</b> Supplementary species planting Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management
Stage 5 Total Area: 0.97Ha	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>Natural Regeneration</b> Weed Management	<b>PLANTING MODULE 1</b> Pioneer species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 2</b> Supplementary species planting Weed Management	<b>PLANTING MODULE 3</b> Supplementary species planting Weed Management	<b>Natural Regeneration</b> Weed Management

<b>PROJECT TITLE</b> DUNLOE PARK - REHABILITATION PLAN	<b>NO</b> 01	<b>DATE</b> 06/16	<b>REVISION</b> OPW REVISED	<b>BY</b> MB
<b>DRAWING TITLE</b> OPERATIONAL WORKS LANDSCAPE PLAN- AREA 1B				
<b>BASE PROVIDED BY</b>				

<b>SCALE</b> AS SHOWN	<b>DATE</b> JUNE 2016
<b>DESIGN</b> JB/GD	<b>CHECKED</b> AS
<b>DRAWN</b> JB	<b>DRAWING NO</b> DS_OPW_045_05

<b>CLIENT</b> RAMTECH PTY LTD
----------------------------------

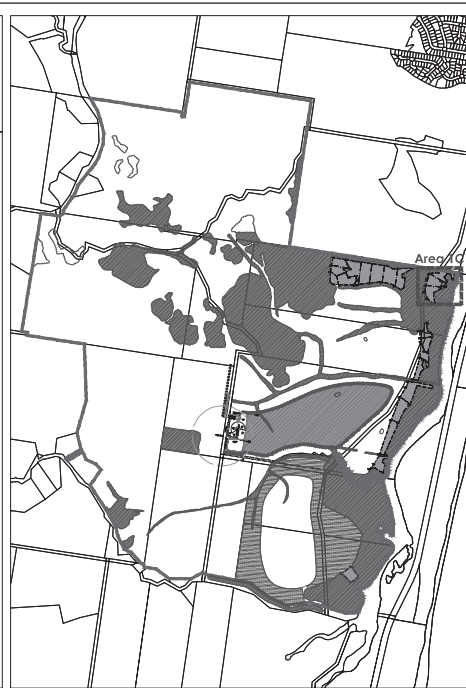
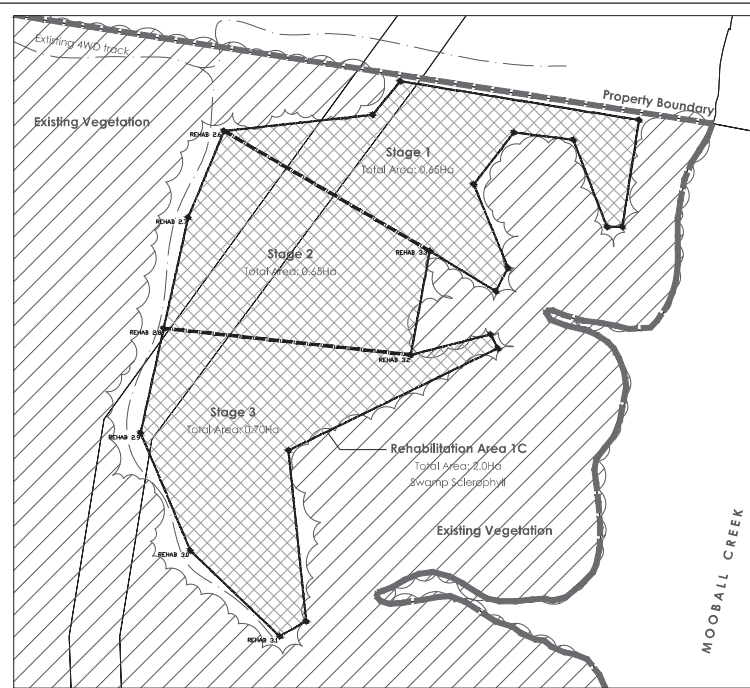
<b>UNIT 1 2047 Ebbel Creek Road Bentley WA 6107 PO Box 504 Nobby Beach QLD 4818</b>	<b>Telephone: 07 5594 1500 Fax: 07 5594 1502 email: info@planetconsulting.com.au</b>
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rehabilitation area 1b  
opw landscape plans  
Dunloe Park Rehabilitation  
Sheet 04/13

# Dunloe Park - Rehabilitation Plan

## OPW Landscape Plans



**Rehabilitation Area 1C**  
Total Area: 2.0Ha  
Vegetation Type: Swamp Sclerophyll + Littoral Rainforest Understorey

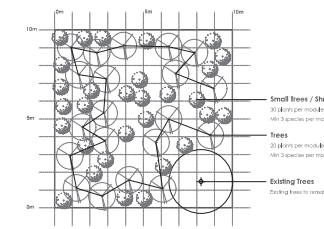
Dunloe Park Sand Extraction  
Scale: 1:1000 at full size A1

**Rehabilitation Area 1C - location plan**

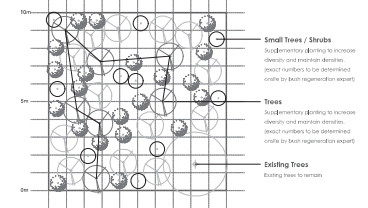
Dunloe Park Sand Extraction  
N15

**REHAB 10 BOUNDARY PEGS**  
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be 300mm x 100mm pipe to minimum 1 meter above ground, painted yellow with notation to match as noted on these plans. Existing vegetation (to be) to form of other boundaries as indicated in this sheet.

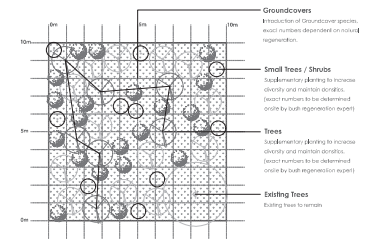
**FENCES**  
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.



**Planting Module 1 - Swamp Sclerophyll**  
PIONEER SPECIES PLANTING 10 x 10 meter module  
N15



**Planting Module 2 - Swamp Sclerophyll**  
SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module  
N15



**Planting Module 3 - Swamp Sclerophyll**  
SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module  
N15

**REHABILITATION AREA 1C**  
TOTAL AREA: 2.0Ha (200 MODULES)  
TREES + module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
0104H	<i>Casuarina vulgaris</i>	White Sedgepod			Stage 1 (10)
0104I	<i>Corymbia imbricata</i>	Pink Bloodwood			Stage 2 (10)
0104J	<i>Eucalyptus tereticornis</i>	Blue Gum	30	75MM DIA	Stage 3 (10)
0104K	<i>Acacia saligna</i>	Swamp Wattle			Stage 1 (10)
0104L	<i>Melaleuca cajuputi</i>	Paperbark			Stage 2 (10)
0104M	<i>Lophosiphon succulentus</i>	Swamp Box			Stage 3 (10)

**SMALL TREES / SHRUBS + module 1, 2 and 3**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
0104N	<i>Allocasuarina teretifolia</i>	Ferned Oak			Stage 1 (10)
0104O	<i>Acrocalymma angustatum</i>	Beach Acacia			Stage 2 (10)
0104P	<i>Casuarina imbricata</i>	Coralwood			Stage 3 (10)
0104Q	<i>Cupressus macrocarpa</i>	Tuckeroo			Stage 1 (10)
0104R	<i>Dalmanella myrsinoides</i>	Carrikeria			Stage 2 (10)
0104S	<i>Leptosiphon succulentus</i>	Swamp Box			Stage 3 (10)
0104T	<i>Wickiopsis leucostachya</i>	Wickiopsis			Stage 1 (10)
0104U	<i>Phlegonum vulgatum</i>	Ferned Paperbark			Stage 2 (10)
0104V	<i>Syzygium oleosum</i>	Blue Lilly			Stage 3 (10)
0104W	<i>Tricorypha laevis</i>	Tree Heath			Stage 1 (10)

**GROUNDCOVERS + module 3 only**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
0104X	<i>Austrobaileya saligna</i>	Willywilly			Stage 1 (10)
0104Y	<i>Blechnum indicum</i>	Bungall Fern			Stage 2 (10)
0104Z	<i>Carex lasiocarpa</i>	Fernpod			Stage 3 (10)
0105A	<i>Cyrtocarpus polystachyus</i>	Mat Sedge			Stage 1 (10)
0105B	<i>Diuris cordata</i>	Blue Fairy Lily			Stage 2 (10)
0105C	<i>Quercus laevis</i>	Swamp Oak			Stage 3 (10)
0105D	<i>Hibiscus scaberrimus</i>	Swamp Vine			Stage 1 (10)
0105E	<i>Leptocarpus viridiflorus</i>	Native Saxifrage			Stage 2 (10)
0105F	<i>Lomandra longifolia</i>	Manilla			Stage 3 (10)
0105G	<i>Phlegonum vulgatum</i>	Ferned Paperbark			Stage 1 (10)
0105H	<i>Schoenus paludosus</i>	Clayton			Stage 2 (10)
0105I	<i>Zyris complanata</i>	Yellowed Grass			Stage 3 (10)

**Rehabilitation Area 1C - species list**

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7+
<b>Stage 1</b> Total Area: 0.65Ha	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet. Exact numbers to achieve diversity as noted dependent on natural regeneration (determined on-site by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
<b>Stage 2</b> Total Area: 0.65Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet. Exact numbers to achieve diversity as noted dependent on natural regeneration (determined on-site by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
<b>Stage 3</b> Total Area: 0.71Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet. Exact numbers to achieve diversity as noted dependent on natural regeneration (determined on-site by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. Pioneer species + "Tree" and "Small Tree" selected from Rehabilitation Area 1C species list in this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09

<b>PROJECT TITLE</b> DUNLOE PARK - REHABILITATION PLAN
<b>DRAWING TITLE</b> OPERATIONAL WORKS LANDSCAPE PLAN - AREA 1C
<b>BASE PROVIDED BY</b>

NO	DATE	REVISION	BY
01	06/14	OPW REVISED	MB

<b>SCALE:</b> AS SHOWN	<b>DATE:</b> JUNE 2016
<b>DESIGN:</b> JB/GD	<b>CHECKED:</b> AS
<b>DRAWN:</b> JB	<b>DRAWING NO.:</b> DS_OPW_845_06

<b>CLIENT:</b> RAMTECH PTY LTD
-----------------------------------

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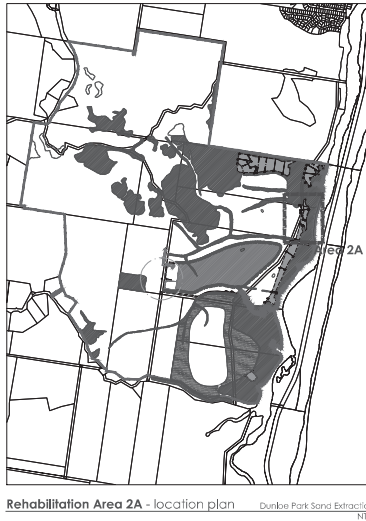
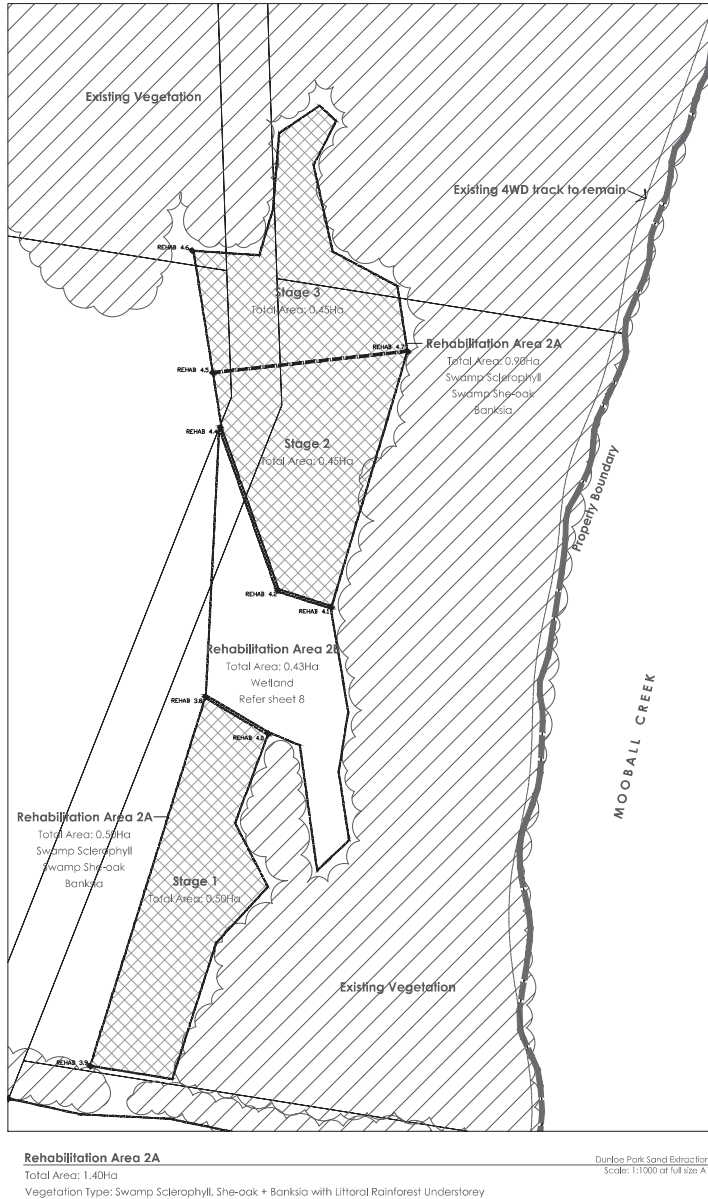


Dunloe Sand Extraction  
opw landscape plans  
sheet 1C.01.3



# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Rehabilitation Area 2A - location plan Dunloe Park Sand Extraction NIS

## Rehabilitation Area 2A - species list

REHABILITATION AREA 2A

TOTAL AREA: 1.40ha (140 MODULES)

TREES - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban-rl	<i>Banksia integrifolia</i>	Coastal Banksia	20	1000	Stage 1
cal-rl	<i>Callistemon salignus</i>	White Bottlebrush	1000 (10000)	75MM TUBE	Stage 2
ban-rl	<i>Banksia integrifolia</i>	Coastal Banksia	20	1000	Stage 1
cal-rl	<i>Callistemon salignus</i>	White Bottlebrush	1000 (10000)	75MM TUBE	Stage 2

## SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1
scm-rl	<i>Acroceia hemilampra</i>	Broad-leaved Elgum	100	1000	Stage 1

## GROUNDCOVERS - module 3 only

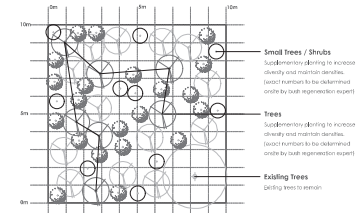
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1
od-rl	<i>Adiantum nigellum</i>	Wedge Mistlehrill	100	1000	Stage 1

## Rehabilitation Schedule Area 2A

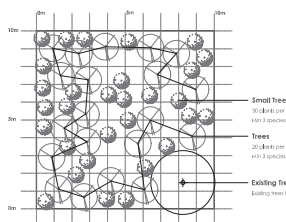
Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7+
Stage 1 Total Area: 0.51ha	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet. Exact numbers to achieve densities as listed dependent on natural regeneration (determined onsite by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
Stage 2 Total Area: 0.45ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet. Exact numbers to achieve densities as listed dependent on natural regeneration (determined onsite by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
Stage 3 Total Area: 0.45ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet. Exact numbers to achieve densities as listed dependent on natural regeneration (determined onsite by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Tree' and 'Small Tree' selected from Rehabilitation Area 2A species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09

**REHAB 10 BOUNDARY FENCES**  
Boundaries of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star packed / grid-like to minimum 1 meter centre ground corners yellow with rotation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated this sheet.

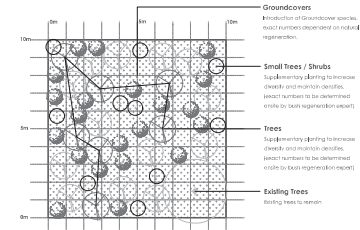
**FENCES**  
Boundaries of rehabilitation areas to be fenced if conditions to be introduced to adjacent grazing areas.



Planting Module 2 - Swamp Sclerophyll, She-oak + Banksia  
SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module



Planting Module 1 - Swamp Sclerophyll, She-oak + Banksia  
PIONEER SPECIES PLANTING 10 x 10 meter module



Planting Module 3 - Swamp Sclerophyll, She-oak + Banksia  
SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module

PROJECT TITLE DUNLOE PARK - REHABILITATION PLAN	NO DATE REVISION BY 01 06/16 OPW REVISED MB	SCALE AS SHOWN	DATE JUNE 2016	CUSTOMER RAMTECH PTY LTD
DRAWING TITLE OPERATIONAL WORKS LANDSCAPE PLAN - AREA 2A		DESIGN JB/GD	CHECKED AS	
BASE PROVIDED BY		DRAWN JB	DRAWING NO. DS_OPW_B45_07	

NO DATE REVISION BY	01 06/16 OPW REVISED MB

SCALE AS SHOWN	DATE JUNE 2016
DESIGN JB/GD	CHECKED AS
DRAWN JB	DRAWING NO. DS_OPW_B45_07

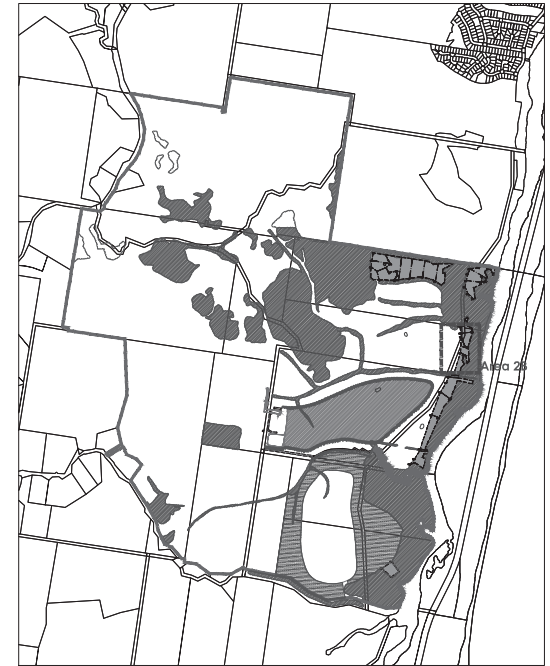
CUSTOMER RAMTECH PTY LTD
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Level 1 2047 Ebbel Creek Hwy  
Bentley Western Australia 6107  
Phone: 08 9438 1100  
Fax: 08 9438 1102  
email: info@plantconsulting.com.au



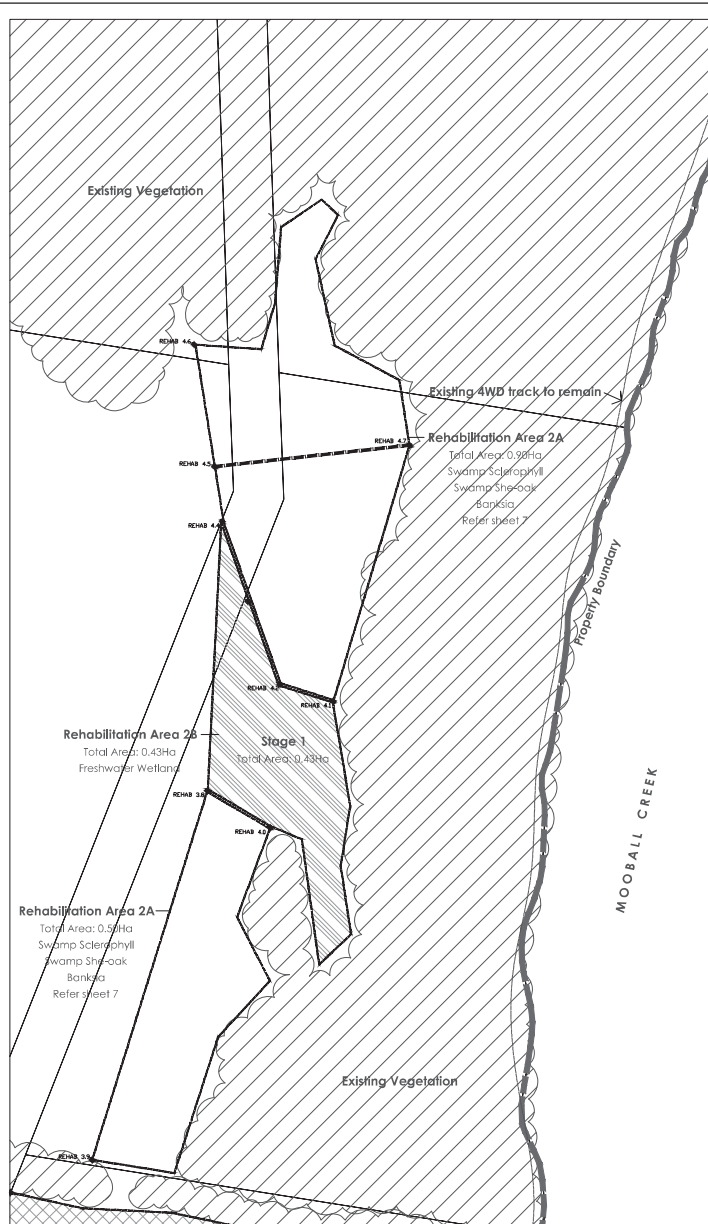
# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Rehabilitation Area 2B - location plan

Dunloe Park Sand Extraction NTS



**Rehabilitation Area 2B**  
Total Area: 0.43Ha  
Vegetation Type: Coastal Wetland

Dunloe Park Sand Extraction  
Scale: 1:1000 at full size A1

**REHAB 1.0 BOUNDARY PEGS**  
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be 500mm diameter galv pipe to minimum 1 meter above ground pointed yellow with redation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated the sheet.

**FENCES**  
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.

## Rehabilitation Area 2B - species list

REHABILITATION AREA 2B  
TOTAL AREA: 0.43Ha (43 MODULES)

### SEDGES, RUSHES + FERNS

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SEED	QTY
bae jun	Boerhaavia juncea	Bare Twigrush			
bae ter	Boerhaavia teretica	Twigrush			
Ma her	Blacoum radicum	Blagwill Fern			
Can cas	Cortella casatica	Flowerwort			
Crab sed	Cyperus polystachyos	Bunchy Sedge			
Ree ter	Fimbristylis teruginea	Rusty Fringededge			
Ree pol	Fimbristylis polystachya	Fuzz Rush			
gah sed	Gahnia aspera	Saw Sedge	100	75MM TUBE	Stage 1 4300
Jun kra	Juncus kraussii	Sedegrass			
Jun vil	Juncus villosus	Common Rush			
Phl jun	Phyllocladus teranigra	Kingweeb			
Phr cas	Phragmites australis	Common Reed			
Sch val	Schoenoplectus valisaria	Clayrush			
Sch bl	Schoenoplectus littoralis	Clayrush			
Spe vir	Sporobolus virginicus	Soft Couch			
Tri ab	Tripsacch dactyloides	Sheep's Arrow Grass			
Xyl com	Xyris complanata	Heliotis			

## Rehabilitation Schedule Area 2A

Stage	Year 1	Year 2	Year 3	Year 4
<b>Stage 1</b> Total Area: 0.43Ha	<b>PLANTING PHASE 1</b> PIONEER SPECIES PLANTING 150 Groundcover/sedges/herbs from species list this sheet to be distributed module - exact numbers dependent on natural regeneration to be determined onsite by regeneration report.	<b>PLANTING PHASE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity and maintain seed density.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	▶▶▶▶▶ On-going monitoring and maintenance as per Rehabilitation Plan ▶▶▶▶▶			

PROJECT TITLE DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE OPERATIONAL WORKS LANDSCAPE PLAN - AREA 2B
BASE PROVIDED BY

NO	DATE	REVISION	BY
01	04/14	OPW REVISED	MB

SCALE AS SHOWN	DATE JUNE 2016
DESIGN JB/GD	CHECKED AS
DRAWN JB	DRAWING NO. DS_OPW_B45_08

C/UNIT RAMTECH PTY LTD
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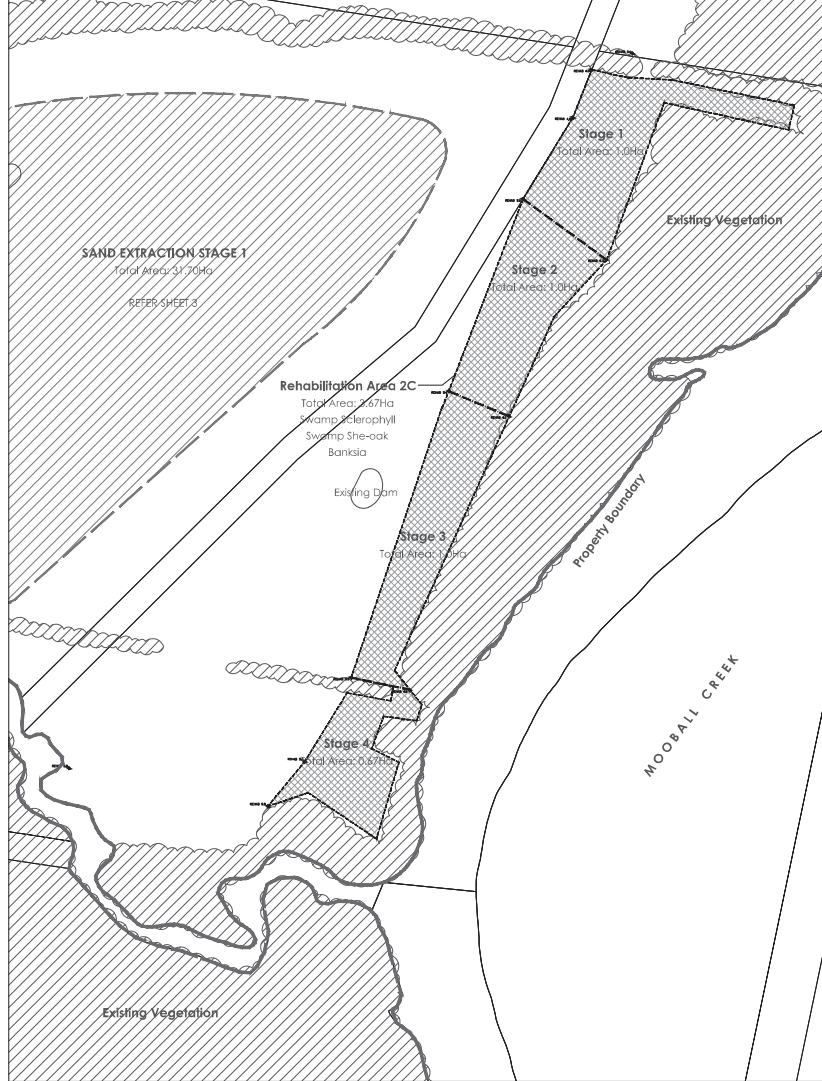
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Telephone: (07) 5534 1500  
Fax: (07) 5534 1502  
email: info@planetconsulting.com.au





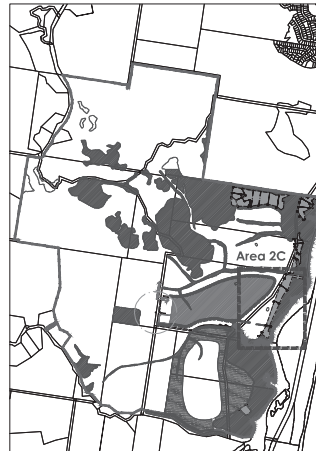
# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



**Rehabilitation Area 2C**  
Total Area: 3.67Ha  
Vegetation Type: Swamp Sclerophyll with Littoral Rainforest Understorey

Dunloe Park Sand Extraction  
Scale: 1:2000 at full size A1



Rehabilitation Area 2C - location plan

## Rehabilitation Area 2C - species list

### REHABILITATION AREA 2C

TOTAL AREA: 3.67Ha (347 MODULES)

#### TREES - module 1, 2 and 3

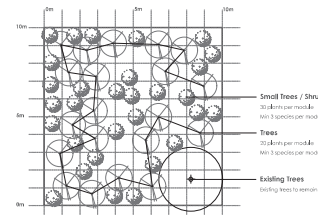
CODE	PLANT SPECIES	COMMON NAME	NO. TREES (MODULE)	SEE	QTY	STAGE
tree 01	Banksia integrata	Coastal Banksia	50	Table 1.1	75000 TREES	Stage 1
tree 02	Callistemon salignus	White Forsteria	50	Table 1.1	75000 TREES	Stage 1
tree 03	Leucadendron corymbosum	Swamp Oak	50	Table 1.1	75000 TREES	Stage 1
tree 04	Podocarpus neriifolius	Flindersia	50	Table 1.1	75000 TREES	Stage 1

## REHAB 10 BOUNDARY PEGS

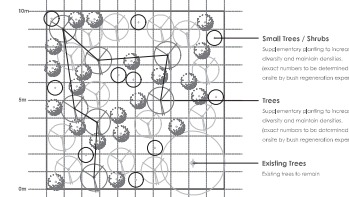
Boundary of Rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / gully pipe to minimum 1 metre above ground (marked yellow with reflection to match as noted on these plans. Existing vegetation line to form of all other boundaries as indicated this sheet.

## FENCES

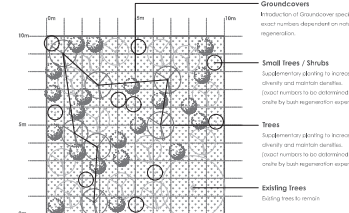
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas. 1 grazing areas.



**Planting Module 1 - Swamp Sclerophyll, She-oak + Banksia**  
PIONEER SPECIES PLANTING 10 x 10 meter module



**Planting Module 2 - Swamp Sclerophyll, She-oak + Banksia**  
SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module



**Planting Module 3 - Swamp Sclerophyll, She-oak + Banksia**  
SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module

## SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO. TREES (MODULE)	SEE	QTY	STAGE
tree 05	Arctostaphylos	Black-bellied BUSH	30	Table 1.1	75000 TREES	Stage 1
tree 06	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 07	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 08	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 09	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 10	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 11	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 12	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 13	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 14	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 15	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 16	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 17	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 18	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 19	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1
tree 20	Callistemon salignus	Coast Banksia	30	Table 1.1	75000 TREES	Stage 1

## GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO. TREES (MODULE)	SEE	QTY	STAGE
tree 21	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 22	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 23	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 24	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 25	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 26	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 27	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 28	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 29	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1
tree 30	Arctostaphylos	Black-bellied BUSH	10	Table 1.1	75000 TREES	Stage 1

## Rehabilitation Schedule Area 2C

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8+
Stage 1 Total Area: 1.08ha	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	Natural Regeneration Weed Management	Natural Regeneration Weed Management	Natural Regeneration Weed Management	Natural Regeneration Weed Management
Stage 2 Total Area: 1.07ha	Natural Regeneration Weed Management	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	Natural Regeneration Weed Management	Natural Regeneration Weed Management	Natural Regeneration Weed Management
Stage 3 Total Area: 1.08ha	Natural Regeneration Weed Management	Natural Regeneration Weed Management	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	Natural Regeneration Weed Management	Natural Regeneration Weed Management
Stage 4 Total Area: 0.57ha	Natural Regeneration Weed Management	Natural Regeneration Weed Management	Natural Regeneration Weed Management	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCREASE DIVERSITY AND MAINTAIN BANKSIA. Plant numbers to be determined by the contractor in consultation with the Rehabilitation Area 2C species list.	Natural Regeneration Weed Management

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 2C
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	04/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO.:	DS_OPW_045_09

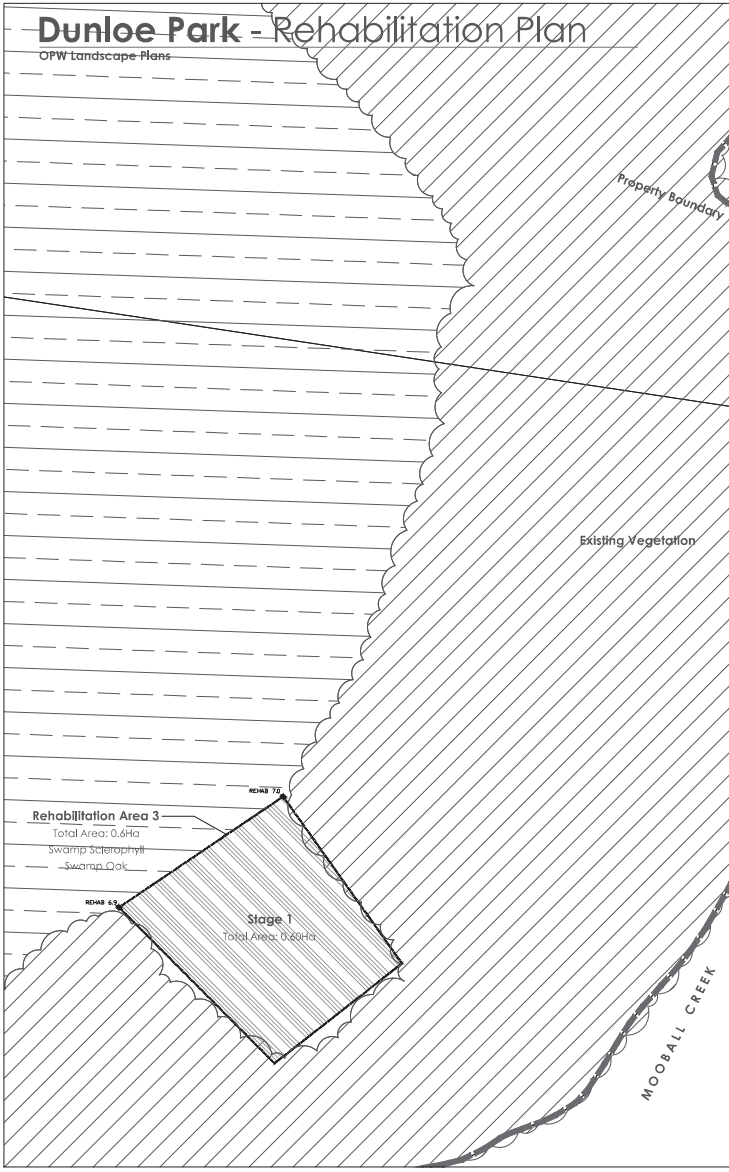
CUSTOMER:	RAMTECH PTY LTD
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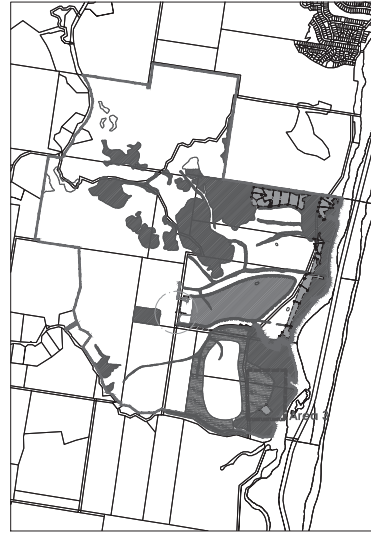
# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



**Rehabilitation Area 3**  
Total Area: 0.6Ha  
Vegetation Type: Swamp Sclerophyll, She-ock +Ultral Rainforest Understorey

Dunloe Park - Sand Extraction  
Scale: 1:1000 or full size A1



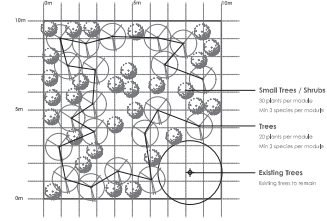
**Rehabilitation Area 3 - location plan**  
NTS

### Rehabilitation Area 3 - species list

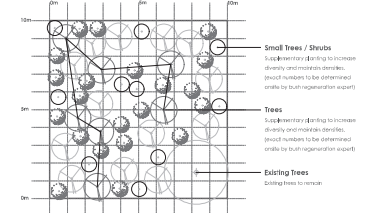
**REHABILITATION AREA 3**  
**TOTAL AREA: 0.60HA (40 MODULES)**  
**TREES - module 1, 2 and 3**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
oak gl	<i>Casuarina glauca</i>	Swamp Oak	50		
oak sh	<i>Callitris velutina</i>	White Barked Ironbark	1000000 (1000000) (1000000)	75MM TUBE	Stage 1
top oak	<i>Spodopogon sphaeroides</i>	Swamp Elm			
map oak	<i>Myrica asplenifolia</i>	Paperbark			

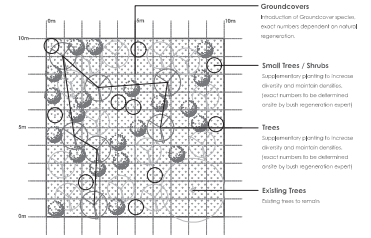
- REHAB 10 BOUNDARY PEGS**  
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / golf pipe to minimum 1 metre above ground (pickets yellow with redletter 'S' on red on rod) as noted on these plans. Existing vegetation line to form all other boundaries as indicated on this sheet.
- FENCES**  
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.



**Planting Module 1 - Swamp Sclerophyll, She-ock +Ultral Rainforest**  
**PIONEER SPECIES PLANTING** 10 x 10 meter module  
NTS



**Planting Module 2 - Swamp Sclerophyll, She-ock +Ultral Rainforest**  
**SUPPLEMENTARY SPECIES PLANTING** 10 x 10 meter module  
NTS



**Planting Module 3 - Swamp Sclerophyll, She-ock +Ultral Rainforest**  
**SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS** 10 x 10 meter module  
NTS

**SMALL TREES / SHRUBS - module 1, 2 and 3**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
oak imp	<i>Acacia implex</i>	Black Acacia			
oak sh	<i>Allocasuarina broadb</i>	Black She-ock			
oak sh	<i>Banksia integrifolia</i>	Coast Banksia			
oak sh	<i>Callistemon bairdii</i>	Swamp Callistemon			
oak myr	<i>Dichroa myrsinoides</i>	Corkwood	50	75MM TUBE	Stage 1
oak sem	<i>Geelia semi-glauc</i>	Wild Geelia			
oak oye	<i>Allocasuarina pyramidalis</i>	Yellow She-ock			
oak sh	<i>Paranephrolepis</i>	Coast Grass			
oak gl	<i>Phellodendron glaberr</i>	Iron Wattle			
oak sh	<i>Felicitya elegans</i>	Calf-weed			

**GROUNDCOVERS - module 3 only**

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
oak sh	<i>Adiantum hypoleucum</i>	Rough Maidenhair			
oak sh	<i>Asplenium nidus</i>	Maiden			
oak sh	<i>Eleocharis acicularis</i>	Swamp Fern	50	75MM TUBE	NTS
oak sh	<i>Chorizandra repens</i>	Yellow Buttons			
oak sh	<i>Drosera peltata</i>	Swamp Lily			
oak sh	<i>Gratiola caprea</i>	Swamp Sedge			
oak sh	<i>Gonolobus crassifolia</i>	Swamp Goad			
oak sh	<i>Isotria medeoloides</i>	Swamp			

### Rehabilitation Schedule Area 3

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6+
Stage 1 Total Area: 0.60Ha	<b>PLANTING MODULE 1</b> PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet. Exact numbers for 'Trees' and 'Small Trees' identified as noted dependent on natural regeneration (as determined onsite by Regeneration expert)	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet.	<b>PLANTING MODULE 2</b> SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet.	<b>PLANTING MODULE 3</b> SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09

**PROJECT TITLE**  
DUNLOE PARK - REHABILITATION PLAN

**DRAWING TITLE**  
OPERATIONAL WORKS LANDSCAPE PLAN - AREA 3

**BASE PROVIDED BY**

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

**SCALE:** AS SHOWN

**DATE:** JUNE 2016

**DESIGN:** JB/GD

**CHECKED:** AS

**DRAWN:** JB

**DRAWING NO:** DS\_OPW\_845\_10

**CLIENT:** RAMTECH PTY LTD

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Dunloe Park Rehabilitation Plan 18 of 21

rehabilitation area 3

opw landscape plans

# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans

REHABILITATION AREA 4 - STAGE 1  
Total Area: 9.688M<sup>2</sup> (9.7 MODULES)

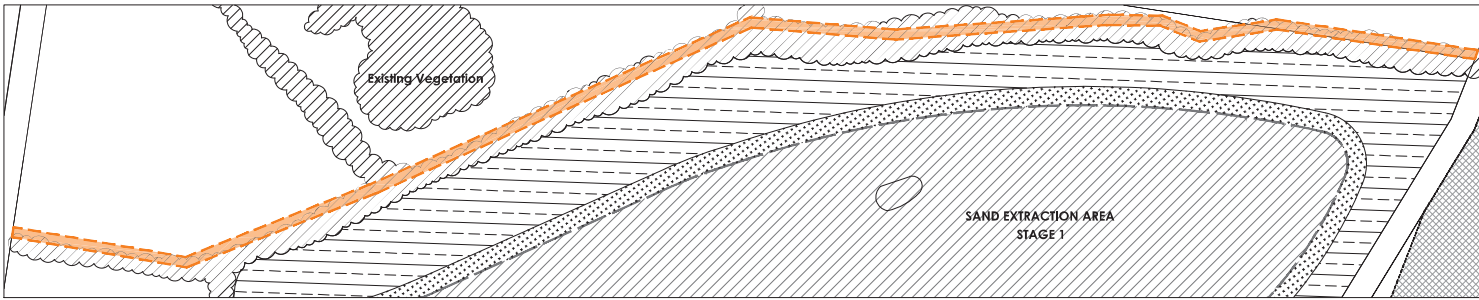
CANOPY TREES					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban nf	Banksia integrifolia	Coast Banksia	10 NO. 10 SIZES PER MODULE	400R	910
can gb	Casuarina glauca	Swamp Oak			
can nf	Casuarina nemoralis	Pin Eucalypt			
exc gra	Eucalyptus grandis	Roadside Gum			
exc hr	Eucalyptus haecloxi	Forest Red Gum			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
lsp sav	Lopholaimon sav-velans	Savannah			
lsp can	Lopholaimon canaliculatus	Brush Box			
met qui	Mitella quinquemaria	Parakeet			

REHABILITATION AREA 4 - STAGE 2  
Total Area: 5.432M<sup>2</sup> (5.5 MODULES)

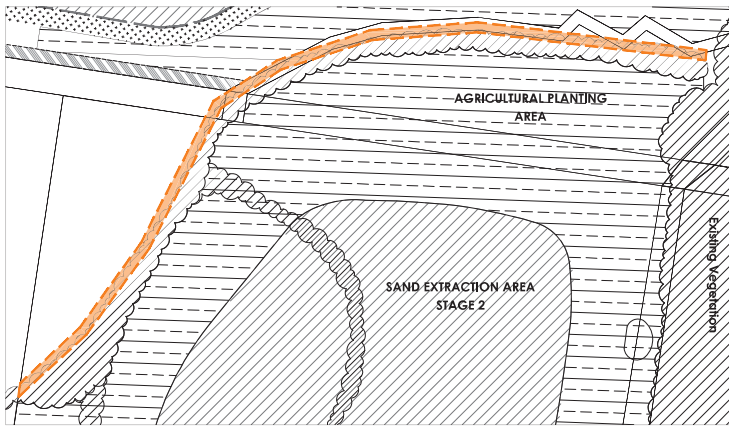
CANOPY TREES					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban nf	Banksia integrifolia	Coast Banksia	10 NO. 10 SIZES PER MODULE	400R	550
can gb	Casuarina glauca	Swamp Oak			
can nf	Casuarina nemoralis	Pin Eucalypt			
exc gra	Eucalyptus grandis	Roadside Gum			
exc hr	Eucalyptus haecloxi	Forest Red Gum			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
lsp sav	Lopholaimon sav-velans	Savannah			
lsp can	Lopholaimon canaliculatus	Brush Box			
met qui	Mitella quinquemaria	Parakeet			

REHABILITATION AREA 4 - STAGE 3  
Total Area: 6.585M<sup>2</sup> (6.6 MODULES)

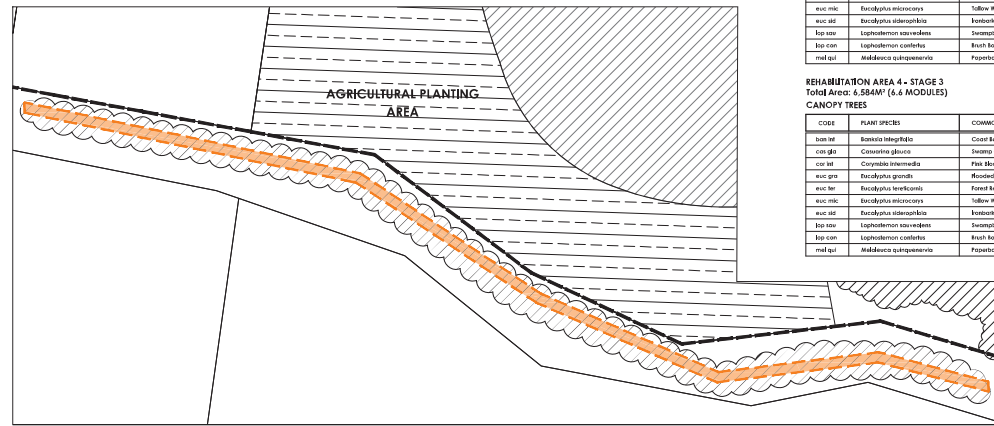
CANOPY TREES					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban nf	Banksia integrifolia	Coast Banksia	10 NO. 10 SIZES PER MODULE	400R	460
can gb	Casuarina glauca	Swamp Oak			
can nf	Casuarina nemoralis	Pin Eucalypt			
exc gra	Eucalyptus grandis	Roadside Gum			
exc hr	Eucalyptus haecloxi	Forest Red Gum			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
exc mc	Eucalyptus microcarpa	Yellow Wood			
lsp sav	Lopholaimon sav-velans	Savannah			
lsp can	Lopholaimon canaliculatus	Brush Box			
met qui	Mitella quinquemaria	Parakeet			



Rehabilitation Planting Area 4 | STAGE 1  
Total Area: 9.688M<sup>2</sup>



Rehabilitation Planting Area 4 | STAGE 2  
Total Area: 5.432M<sup>2</sup>

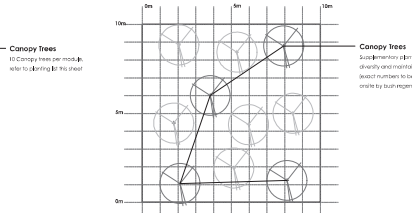
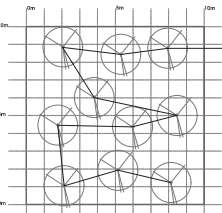


Rehabilitation Planting Area 4 | STAGE 3  
Total Area: 6.585M<sup>2</sup>

Rehabilitation Planting Area 4  
Total Area: 21.705M<sup>2</sup>

**EXTENT OF REHABILITATION PLANTING WORKS**  
Rehabilitation Works: 18 meter wide buffer to northern sides of creek  
Stage 1: 9.688M<sup>2</sup>  
Stage 2: 5.432M<sup>2</sup>  
Stage 3: 6.585M<sup>2</sup>

Boundary of Buffer Planting Area to be pegged out by surveyor prior to commencement of works.  
Pegs to be star pickets / galv pipes to minimum 1 meter above ground painted yellow.



Planting Module 1  
10 x 10 meter module shown - refer also typical section

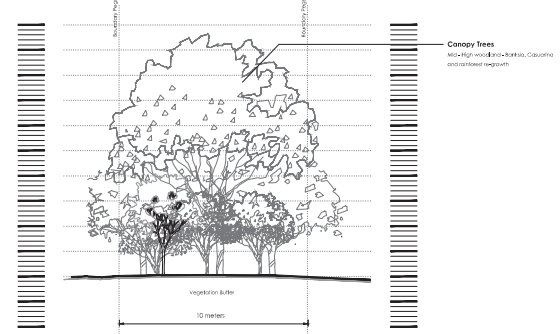
Planting Module 2  
SUPPLEMENTARY 10 x 10 meter module shown

## Works Schedule Rehabilitation Planting

Stage	0 - 6 months	6 - 12 months	Year 1+
Rehabilitation Planting Total Area: 21.705M <sup>2</sup>	<b>PLANTING MODULE 1</b> Canopy/Subcanopy Trees 10 Canopy trees per module 20 Sub-canopy trees per module refer to planting list this sheet Potential for indigenous plant stocks (prefer native plants) to be translocated to achieve planting densities	<b>PLANTING MODULE 2</b> Supplementary planting to increase diversity and maintain densities. (exact numbers to be determined onsite by bush regeneration expert)	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	On-going monitoring and maintenance as per Rehabilitation Plan		

Notes:  
Site subject to periods of frost  
All existing tracks and trails: route to remain

Dunloe Park Sand Extraction  
Scale: 1:2000 of full site A1



Typical Buffer Profile  
Refer to Plant Modules and Species Listings this sheet for details  
1:100 at full size A1

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN		
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - REHABILITATION PLANTING AREA 4 STAGE 1-3		
BASE PROVIDED BY			

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
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DRAWN:	JB	DRAWING NO.:	DS_OPW_845_11

CLIENT:	RAMTECH PTY LTD
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# Dunloe Park - Agricultural Planting

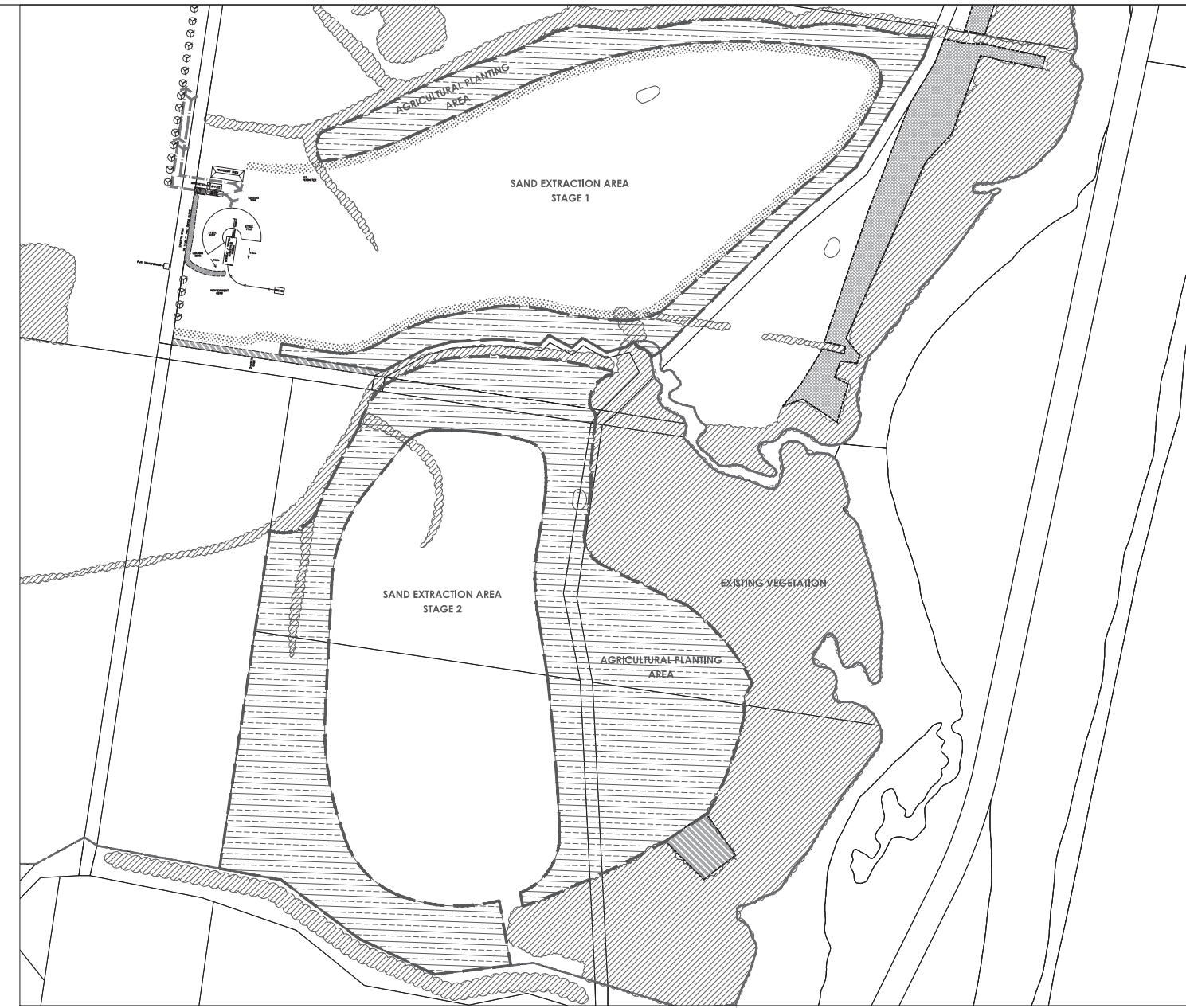
OPW Landscape Plans

**EXTENT OF REHABILITATION PLANTING WORKS**  
 Rehabilitation Works: 1 Truiling trees (eg. Hosi Avocado trees)  
 Total Area: 396.975M<sup>2</sup>

Table 1. Row and Tree Spacing Options

DENSITY OPTION	ROW SPACING (M)	TREE SPACING (M)	NO. TREES PER HECTARE
High	4 x 8	4 x 4	268 x187
Medium	8 x 8	4 x 2	167 x 260
Low	10 x 12	10 x 12	49 x 100

Density information source: Australian Avocado Growers' Federation Section 6



**Agricultural Planting Area**  
 Total Area: 396.975M<sup>2</sup>

Dunloe Park Sand Extraction



Agricultural Planting Area opw landscape plans Dunloe Park Sand Extraction sheet 12 of 13

<b>PROJECT TITLE</b>	DUNLOE PARK - REHABILITATION PLAN
<b>DRAWING TITLE</b>	OPERATIONAL WORKS LANDSCAPE PLAN - AGRICULTURAL PLANTING AREA
<b>BASE PROVIDED BY</b>	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

<b>SCALE:</b>	AS SHOWN	<b>DATE:</b>	JUNE 2016
<b>DESIGN:</b>	JB/GD	<b>CHECKED:</b>	AS
<b>DRAWN:</b>	JB	<b>DRAWING NO.:</b>	DS_OPW_845_12

<b>CLIENT:</b>	RAMTECH PTY LTD
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# Dunloe Park - Rehabilitation Plan

OPW Landscape Plans

## REVEGETATION SPECIFICATION

### GENERAL NOTES:

ALL WORKS TO BE CARRIED OUT BY A QUALIFIED BUSH REGENERATION EXPERT WITH AS A MINIMUM, A DIPLOMA OF HORTICULTURE AND 5 YEARS DEMONSTRATED EXPERIENCE IN BUSH REGENERATION. EVIDENCE OF QUALIFICATIONS WILL BE REQUIRED TO BE SUBMITTED TO THE SUPERINTENDANT FOR APPROVAL PRIOR TO THE COMMENCEMENT OF THE CONTRACT PERIOD.

ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH:

- (1) NOXIOUS WEEDS ACT 1993
- (2) THREATENED SPECIES ACT 1995
- (3) PESTICIDES ACT 1999
- (4) NATIVE VEGETATION CONSERVATION ACT 1997
- (5) GOLD COAST CITY COUNCIL STANDARDS AND RELEVANT AUSTRALIAN STANDARDS

TO BE READ IN CONJUNCTION WITH REHABILITATION AND REVEGETATION MANAGEMENT PLAN PREPARED BY PLANIT CONSULTING FEBRUARY 2009

### SITE PREPARATION

#### 1.1 VERIFY BOUNDARIES OF REVEGETATION AREAS

THE CONTRACTOR IS TO ASSESS THE SITE REVEGETATION AREAS IN ORDER TO ASCERTAIN A CLEAR CONSTRUCTION BOUNDARY. ALL BOUNDARIES WILL BE MARKED OUT BY QUALIFIED SURVEYOR PRIOR TO WORK COMMENCEMENT. MARKER PEGS TO HAVE NOTATION AS PER THESE PLANS.

#### 1.2 WEED REMOVAL

REFER TO REHABILITATION MANAGEMENT PLAN PREPARED BY PLANIT CONSULTING SECTION 4.1

#### 1.3 SOIL CULTIVATION

- AS REQUIRED WITHIN BUFFER PLANTING TO SAND EXTRACTION STAGE 1

CULTIVATE BY RIPPING TO THE DEPTHS SPECIFIED BELOW TO LOOSEN AND AERATE GROUND. DO NOT DISTURB EXISTING NATIVE TREE AND PLANT ROOTS. REMOVE UNWANTED MATTER INCLUDING STONES, RUBBISH AND RUBBLE EXCEEDING 20MM IN DIAMETER AND STICKS AND WEEDS BROUGHT TO THE SURFACE DURING CULTIVATION. FINELY CULTIVATE THE SURFACE AND RAKE FREE OF CLODS. DO NOT REMOVE LARGE LOGS UP TURNED STUMPS ETC AS THIS NATURAL DEBRI FORMS FAUNA HABITAT STRUCTURE

### 2.00 PLANTING

#### 2.1 THE WORKS

PLANTING WORK COMPRISES:

- SUPPLY AND INSTALLATION OF ALL GROUND COVER SHRUBS AND TREES AS SPECIFIED ON PLAN AS DETAILED IN 'REHABILITATION SCHEDULE'. EXACT NUMBERS OF PIONEER PLANTS AND SUPPLEMENTARY PLANTS TO BE DETERMINED ON SITE BY BUSH REGENERATION EXPERT - IN STRICT ACCORDANCE WITH SECTION 4 OF THE REHABILITATION/REVEGETATION MANAGEMENT PLAN PREPARED BY PLANIT CONSULTING FEBRUARY 2009

#### 2.2 PLANTS

PLANTS SHALL BE VIGOROUS, WELL ESTABLISHED, OF GOOD FORM, NOT SOFT OR FORCED, HARDENED OFF, FREE FROM DISEASE AND PESTS WITH LARGE HEALTHY ROOT SYSTEMS AND NOT POT BOUND, THE ROOT SYSTEM SHALL BE WELL BALANCED IN RELATION TO THE SIZE OF THE PLANT.

PLANT CONTAINERS SHALL BE OF AN APPROPRIATE SIZE AND FREE FROM WEEDS. PLANTS SHALL NOT EXHIBIT SIGNS OF BEING STRESSED AT ANY STAGE DURING THEIR DEVELOPMENT DUE TO INADEQUATE WATERING, EXCESSIVE SUNLIGHT, PHYSICAL DAMAGE OR HAVE RESTRICTED GROWTH DUE TO NURSERY ROWS. NO SUBSTITUTIONS SHALL BE MADE UNLESS APPROVED BY THE LANDSCAPE DESIGNER.

KEEP PLANTS IN GOOD CONDITION DURING STORAGE. PREVENT DRYING OUT OR DAMAGE FROM ANY CAUSE INCLUDING FROST, WIND, SUN, THEFT, VERMIN ETC.

#### 2.3 PLANTING

ENSURE PLANTS CAN BE WATERED IN AT TIME OF PLANTING. DO NOT ALLOW PLANTS TO BE INSTALLED ON A DAY THEY CANT BE WATERED.

PLANTING TO BE EXECUTED IN ACCORDANCE WITH THE RELEVANT PLANTING DETAIL. DO NOT PLANT INTO DRY OR MUDDY SOIL OR IN EXTREME WEATHER CONDITIONS. ENSURE PLANT ROOT SYSTEMS ARE MOIST WHEN REMOVED FROM CONTAINER AND NOT ALLOWED TO DRY OUT AND PLANTING AREA HAS BEEN THOROUGHLY WATERED. PLANT OUT WITH A MINIMUM DISTURBANCE TO ROOT BALL ENSURING FINISHED COMPACTED SOIL LEVELS COINCIDE WITH THE NATURAL SOIL LEVEL OF THE PLANT. PLANT, STAKE, TIE AND MULCH ACCORDING TO DETAIL DRAWINGS AND THEN DEEP SOAK THE WHOLE OF THE PLANTING AREA.

#### 2.4 DEPTH OF PLANTING

WHEN THE PLANT IS IN ITS FINAL POSITION IN ITS HOLE THE TOP SOIL LEVEL OF THE PLANT ROOT BALL SHALL BE LEVEL WITH THE FINISHED SURFACE OF THE SOIL SURROUNDING THE HOLE.

#### 2.5 PLACING

WHEN THE HOLE APPEARS TO BE THE CORRECT SIZE, AND NOT BEFORE REMOVE THE PLANT FROM THE CONTAINER WITH MINIMUM DISTURBANCE TO THE ROOT BALL AND PLACE IN ITS FINAL POSITION, IN THE CENTRE OF THE HOLE AND PLUMB.

#### 2.6 BACKFILLING

BACKFILL WITH SITE TOPSOIL. LIGHTLY TAMP DOWN THE MIXTURE TO ENSURE NO AIR POCKETS ARE LEFT IN PLANTING HOLE.

#### 2.7 PLANTING FERTILIZER

'OSMOCOTE' SUSTAINED RELEASE FERTILISER IN GRANULE FORM OR APPROVED EQUIVALENT SUITABLE FOR NATIVE PLANTS SHALL BE ADDED TO THE SITE TOPSOIL AS PER MANUFACTURERS DIRECTION.

#### 3.00 MAINTENANCE - 52 WEEKS

##### 3.1 GENERAL

THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHMENT MAINTENANCE AND DEFECTS LIABILITY CLAUSES FOR 52 WEEKS FOLLOWING COMPLETION OF THE LANDSCAPE CONSTRUCTION.

##### 3.2 MIN. MAINTENANCE REQUIREMENTS:

###### WATER

REGULARLY WATER THE PLANTS TO ENSURE ESTABLISHMENT WITH WATER TRUCK.

###### WEEDING

REFER TO SECTION 4 OF THE REHABILITATION PLAN PREPARED BY PLANIT CONSULTING FEBRUARY 2009

###### REPLACEMENTS

REPLACE ALL PLANTS THAT ARE UNHEALTHY OR DEAD. REPLACEMENTS SHALL BE IDENTICAL IN SIZE AND SPECIES. REFER CORRESPONDING PLANT LISTS FOR SUBSTITUTIONS WHERE REQUIRED.

###### SOIL SUBSIDENCE

MAKE GOOD IF DUE TO WORKMANSHIP OF LANDSCAPE CONTRACTOR.

###### PROTECTION

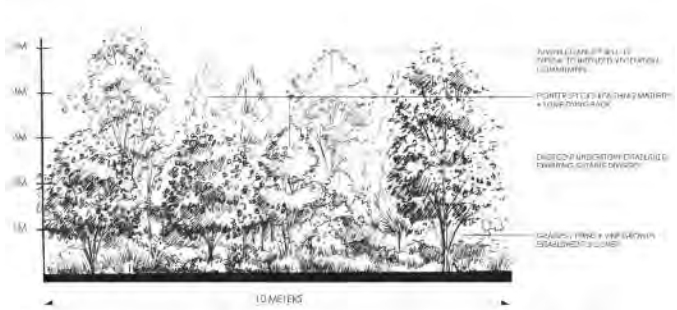
PROTECT PLANTED AREAS FROM DAMAGE, EITHER MALICIOUS, IRRESPONSIBLE OR ACCIDENTAL. AREAS OF REHABILITATION TO BE FENCED IF CATTLE ARE TO BE GRAZING ON ADJACENT PASTURE LANDS.



ASSISTED REGENERATION PROFILE: YEAR 1 - 2



ASSISTED REGENERATION PROFILE: 2: 4 YEARS



PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN		
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - SPECIFICATIONS		
BASE PROVIDED BY			

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
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DRAWN:	JB	DRAWING NO.:	DS_OPW_845_13

CUSTOMER:	RAMTECH PTY LTD
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Level 1, 2047 Eagle Creek Hwy, Beauden Beach, QLD 4218  
 Telephone: (07) 5634 1500  
 Fax: (07) 5634 1502  
 Email: info@planetconsulting.com.au





## ATTACHMENT 2 – VEGETATION MANAGEMENT PLAN

This Vegetation Management Plan (VMP) has been prepared for both the clearing of all vegetation situated within approved sand quarrying areas and retention and protection of all other native vegetation on the Dunloe Park site.




Approved Quarrying Extraction and Compound Areas

The VMP is to be used as a tool during the construction and operational phases of the development, identifying tasks to be undertaken, the timing of such works and responsible parties for supervision/implementation of vegetation removal/retention on the site.

This plan identifies appropriate vegetation protection methods and site rehabilitation strategies to retain and enhance wildlife habitat and also addresses the necessary removal of vegetation as described above. Strict implementation of the following methodologies will ensure that no retained vegetation will pose any detrimental impacts to future built components on the site.

<b>Element</b>	<b>Vegetation Management</b>
<b>Objectives</b>	<ul style="list-style-type: none"><li>• To remove native and exotic vegetation located within approved quarrying and compound areas</li><li>• To retain and protect all other native vegetation communities and trees within the Dunloe Park site</li><li>• To minimise tree-clearing impacts on native fauna.</li><li>• To revegetate the rehabilitation and buffer areas</li></ul>

Element	Vegetation Management
<b>Action</b>	<ul style="list-style-type: none"> <li>• Tree-clearing zones are to be clearly delineated on-site to ensure that all areas affected by this VMP are readily identifiable.</li> <li>• Vegetation to be retained within 20 metres of the approved clearing/works zones are to be tagged/marked/delineated for easy identification (do not use permanent paints or similar) i.e. trees and/or areas of vegetation to be retained are to be clearly fenced similar to below:           <div data-bbox="548 556 1356 1081" style="text-align: center;">  </div> </li> <li>• The contractor/developer must adequately protect from damage any vegetation on private and/or public property which is not designated for removal in association with this development.</li> <li>• Tree-clearing, fauna spotter-catcher and environmental consultants working in conjunction with Civil Works Contractors on this project are to be informed of all provisions specified under this VMP.</li> <li>• Cleared vegetation is to be disposed of in accordance with accepted measures. This includes mulching for future site-landscaping purposes and/or removal of millable timber where appropriate.</li> <li>• Remaining debris not disposed of in either of the above methods is to be removed off-site by the owner to an approved green-waste disposal facility.</li> </ul>

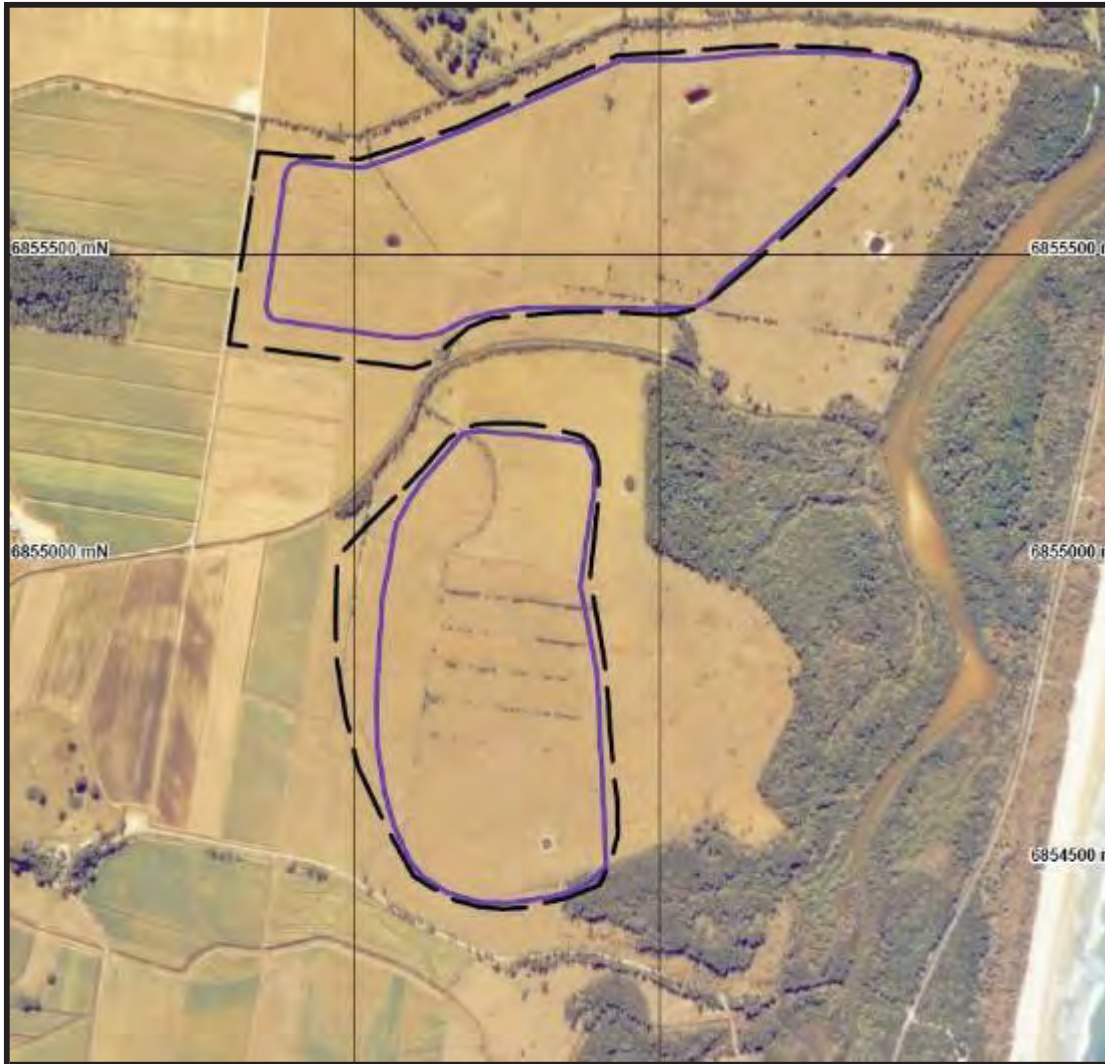


Element	Vegetation Management
<b>Action</b>	<ul style="list-style-type: none"> <li>• The following activities are not permitted within the drip zones of vegetation to be retained on or offsite:               <ul style="list-style-type: none"> <li>- Storage and mixing of materials;</li> <li>- Vehicle parking;</li> <li>- Liquids disposal;</li> <li>- Machinery repairs or refueling;</li> <li>- Site office and/or shed erection;</li> <li>- Lighting of fires;</li> <li>- Rubble, soil or debris stockpiling; and</li> <li>- Excavation.</li> </ul> </li> <li>• No trees on Council property are to be removed, pruned or injured prior to obtaining necessary Council consent.</li> <li>• If root/crown damage (or other significant disturbance) to retained vegetation areas occurs/is required during approved earthworks/quarrying activity on the site, treatment by a suitably qualified Arborist (ie root truncations, crown thinning) is to be implemented.</li> <li>• A recognised fauna spotter-catcher is to ensure safe dispersal of fauna into areas of retained vegetation during clearing works in accordance with Section 5.1 of the Rehabilitation and Revegetation Management Plan.</li> <li>• Effective sediment and erosion control devices are to be identified and provided at earthworks boundaries in accordance with the prepared Environmental Management Plan.</li> <li>• Areas disturbed as a result of tree-clearing and/or earthworks are to be stabilised. Stabilisation is to occur within ten days of completion of works.</li> <li>• Revegetation and rehabilitation is to occur in accordance with the Rehabilitation and Revegetation Management Plan.</li> </ul>

Element	Vegetation Management															
<b>Performance Indicators</b>	<ul style="list-style-type: none"> <li>• Tree-clearing activities are restricted to identified areas.</li> <li>• Native plants within the identified retention zones are protected.</li> <li>• Sediment and erosion control devices are installed and maintained in accordance with the EMP.</li> <li>• Retained vegetation on and/or offsite is to demonstrate healthy conditions: <table border="1" data-bbox="532 562 1279 953"> <thead> <tr> <th><i>Grade</i></th> <th><i>Condition</i></th> <th><i>Descriptor</i></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Healthy</td> <td>Leaves green, no abnormal leaf loss</td> </tr> <tr> <td>2</td> <td>Fair</td> <td>Leaves green, some yellowing of leaves, but &lt;20% of canopy affected</td> </tr> <tr> <td>3</td> <td>Poor</td> <td>Many leaves yellow or brown, substantial reduction in canopy extent since last measurement</td> </tr> <tr> <td>4</td> <td>Dead</td> <td>Leaves brown or absent, little of the canopy remaining</td> </tr> </tbody> </table> </li> <li>• Rehabilitation and buffer zones are managed in accordance with the Rehabilitation and Revegetation Management Plan.</li> <li>• No fauna injury or mortality occurs during the clearing/construction phase</li> </ul>	<i>Grade</i>	<i>Condition</i>	<i>Descriptor</i>	1	Healthy	Leaves green, no abnormal leaf loss	2	Fair	Leaves green, some yellowing of leaves, but <20% of canopy affected	3	Poor	Many leaves yellow or brown, substantial reduction in canopy extent since last measurement	4	Dead	Leaves brown or absent, little of the canopy remaining
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<b>Person Responsible</b>	<ul style="list-style-type: none"> <li>• The owner/developer/site manager is responsible for informing all contractors, sub-contractors, consultants and government authorities working on the site of the provisions of this VMP.</li> <li>• A suitably qualified consultant is responsible for the supervision and implementation of clearing works.</li> <li>• A recognised fauna spotter-catcher is to be contracted for fauna capture/relocation as necessary.</li> <li>• A suitably qualified consultant is responsible for the supervision and implementation of all rehabilitation works.</li> <li>• A suitably qualified Arborist is responsible for assessing and implementing any remediation works to damaged vegetation retained within protection zones areas if/where required.</li> <li>• A suitably qualified consultant is responsible for installing and monitoring erosion and sediment control devices.</li> </ul>
<b>Reporting and Reviewing</b>	<ul style="list-style-type: none"> <li>• A suitably qualified consultant is responsible for reporting to the developer where actions specified in this VMP are not undertaken and/or compromised.</li> <li>• The developer is responsible for reporting to Council where actions specified in this VMP are not implemented</li> <li>• Routine and specified monitoring of fauna, weeds, revegetation and rehabilitation zones is to occur as stipulated in the Rehabilitation and Revegetation Management Plan.</li> </ul>
<b>Corrective Action</b>	<ul style="list-style-type: none"> <li>• If vegetation not identified for removal is disturbed during the operational works phase, the need for supplementary rehabilitation works is to be negotiated between the developer and Council.</li> <li>• If retained trees show signs of ill health (i.e. poor or dead), likely causes are to be determined, methods of mitigating such effects are to be identified in consultation with a suitably qualified Arborist and Council officers, and mitigation measures to improve growth conditions are to be put in place.</li> <li>• Where a tree shows signs of any loss in structural integrity or a potentially unsafe condition, then in the opinion of a suitably qualified Arborist and Council officers the tree shall be either stabilised or removed to avoid any future risk.</li> <li>• Where sediment and erosion control structures fail, likely causes are to be identified and additional measures installed.</li> </ul>

This Vegetation Management Plan (VMP) has been prepared for both the clearing of all vegetation situated within approved sand quarrying areas and retention and protection of all other native vegetation on the Dunloe Park site.




#### Approved Quarrying Extraction and Compound Areas

The VMP is to be used as a tool during the construction and operational phases of the development, identifying tasks to be undertaken, the timing of such works and responsible parties for supervision/implementation of vegetation removal/retention on the site.

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Element	Vegetation Management
<b>Objectives</b>	<ul style="list-style-type: none"> <li>• To remove native and exotic vegetation located within approved quarrying and compound areas</li> <li>• To retain and protect all other native vegetation communities and trees within the Dunloe Park site</li> <li>• To minimise tree-clearing impacts on native fauna.</li> <li>• To revegetate the rehabilitation and buffer areas</li> </ul>



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# **Appendix B** – Agency consultation





Our Ref: DOC19/676169  
Your Ref: 06\_0030

GHD  
230 Harbour Drive  
Coffs Harbour NSW 2450

Attention: Mr Ben Luffman

Dear Mr Luffman

**Subject: Dunloe Quarry MOD 2 - Landscape and Aboriginal Cultural Heritage Management Plans**

Thank you for your letter dated 8 August 2019 about the amended management plans for the Dunloe Quarry MOD 2 seeking comments from the Biodiversity and Conservation Division (BCD) of the NSW Department of Planning, Industry and Environment. I appreciate the opportunity to provide input.

The Biodiversity and Conservation Division was formerly part of the Office of Environment and Heritage (OEH) but now forms part of the new Environment, Energy and Science Group in the Department of Planning, Industry and Environment (see <https://www.dpie.nsw.gov.au>).

We have reviewed the documents supplied and advise there are several issues apparent with the Landscape Management Plan (LMP), particularly the koala management plan, which lacks adequate detail. The main issues include:

- a) no description of the author qualifications in the Landscape Management Plan (LMP);
- b) insufficient or incorrect references to approval conditions and document sections;
- c) lack of supporting information in the Koala Management Plan (KMP);
- d) the need to refine koala management, monitoring and contingency measures.

These issues are discussed in detail in **Attachment 1** to this letter.

Prior to finalising the landscape and Aboriginal cultural heritage management plans we recommend that GHD:

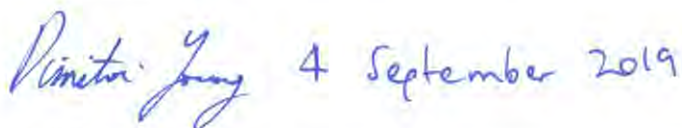
1. Revises the Landscape Management Plan to:
  - a) include the relevant qualifications and experience of the contributors to demonstrate compliance with Project Approval 27(a); and
  - b) indicate in Table 2.1 that Project Approval Condition 28 clauses (h) and (i) are addressed in Appendix C.



2. Revises the Rehabilitation and Revegetation Management Plan to include Project Condition 28 in the list of conditions addressed.
3. Revises the Koala Management Plan to:
  - a) replace references to sections and tables of other management plans with the relevant content being referred to in order to minimise potential errors resulting from subsequent management plan revisions or amendments;
  - b) include mapping of koala habitat, koala records and potential koala movement corridors (i.e. habitat links) within and adjacent to the subject land and along the haul road between the quarry site and the Pottsville Road intersection;
  - c) acknowledge the possibility of infrequent koala movements during hours of quarry operation;
  - d) identify the most likely areas of interaction between koalas and quarry vehicles (e.g. koala habitat links);
  - e) include a proposed amendment to the quarry induction process to include an explanation of the legal consequences of unauthorised clearing of native vegetation on the quarry site;
  - f) include provision of compensatory koala food tree plantings as a contingency measure in the event of unauthorised clearing taking place;
  - g) ensure the proposed monitoring methodology focuses on identifying areas of koala activity susceptible to road strike rather than attempting to identify temporal changes in koala densities.
  - h) reduce the proposed koala road-strike threshold for management action from three koalas for the year to any koala at any time
4. Revise the Aboriginal Cultural Heritage Assessment Report to:
  - a) include a statement confirming the report was prepared in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*;
  - b) remove references to a requirement for an Aboriginal Heritage Impact Permit; and
  - c) ensure the recommendations are consistent with the requirement for a Care Agreement to remove Aboriginal objects from the approved project boundary for long-term management if required.
5. Revise the Aboriginal Cultural Heritage Management Plan to replace references to the Office of Environment and Heritage (OEH) with the Biodiversity and Conservation Division (BCD).

If you have any further questions about this issue, Mr Don Owner, Senior Conservation Planning Officer, Biodiversity and Conservation, can be contacted on 6659 8233 or at [don.owner@environment.nsw.gov.au](mailto:don.owner@environment.nsw.gov.au).

Yours sincerely



Dimitri Young 4 September 2019

**DIMITRI YOUNG**  
**Senior Team Leader Planning, North East Branch**  
**Biodiversity and Conservation**

Contact officer: DON OWNER  
6659 8233

Enclosure: Attachment 1: Detailed BCD Comments – Dunloe Quarry MOD 2 – Landscape and ACH Management Plans



## **Attachment 1: Detailed Biodiversity and Conservation Comments – Dunloe Quarry MOD 2 – Landscape and Aboriginal Cultural Heritage Management Plans**

### **Landscape Management Plan**

#### Author Qualifications

Project Approval 27(a) requires the plan to be prepared by suitably qualified consultants, including specialist hydrologist, coastal engineer, wetlands ecologist and landscape architect. The Landscape Management Plan (LMP) does not contain the qualifications of the contributing authors, which is necessary to demonstrate this condition has been met.

#### *BCD Recommendation:*

1. Revise the LMP to include the relevant qualifications and experience of the contributors to demonstrate compliance with Project Approval 27(a).

#### Project Approval Condition 28

The Rehabilitation and Revegetation Management Plan (RRMP) contained in Appendix A of the LMP claims to address the requirements of Conditions 26, 27a and 29 of the Project Approval. However, Project Approval Condition 28, which specifies what must be included in the RRMP, has not been referred to in the RRMP.

#### *BCD Recommendation:*

2. Revise the RRMP to include Project Condition 28 in the list of conditions addressed.

#### Koala Management Plan

Table 2.1 of the LMP indicates Project Approval Condition 28 clauses (h) and (i), which relate to koala management, are addressed in the RRMP provided in Appendix A. However, these conditions have not been addressed in the RRMP. Instead, they have been addressed in the Koala Management Plan (KMP) contained in Appendix C of the LMP.

#### *BCD Recommendation:*

3. Revise Table 2.1 of the LMP to indicate Project Approval Condition 28 clauses (h) and (i) are addressed in Appendix C.

Section 1.3 of the KMP refers to Section 5.4.1 of the LMP for details of the KMP reporting provisions. However, the LMP does not contain a Section 5.4.1. It is also indicated in this section that the presence of koalas will be noted during the monitoring program set out in Table 5.1 of the LMP. However, Table 5.1 provides a very brief summary of the monitoring program for the rehabilitation area, which would not include monitoring of the haul road.

#### *BCD Recommendation:*

4. Revise the KMP to replace references to sections and tables of other management plans with the relevant content being referred to in order to minimise potential errors resulting from subsequent management plan revisions or amendments.

The KMP does not provide any supporting information to inform or provide context to the proposed koala management or monitoring provisions.

*BCD Recommendation:*

5. Revise the KMP to include mapping of koala habitat, koala records and potential koala movement corridors (i.e. habitat links) within and adjacent to the subject land and along the haul road between the quarry site and the Pottsville Road intersection.

Section 1.2.1 of the KMP indicates the risk of koala mortalities due to quarry-related vehicle strike will be low due to the quarry operating hours not coinciding with the main periods of koala movement. This assumption is generally accurate. However, although infrequent, some koala movements may still occur during the quarry operating hours (e.g. movements resulting from territorial disputes or during dispersal of young from natal areas).

*BCD Recommendations:*

6. Revise the KMP to acknowledge the possibility of infrequent koala movements during hours of quarry operation.
7. Revise the KMP to identify the most likely areas of interaction between koalas and quarry vehicles (e.g. koala habitat links).

Section 1.2.2 of the KMP briefly discusses the potential impacts of unauthorised clearing of koala habitat. However, no preventative or contingency measures other than clearly demarcating the limit of authorised clearing have been proposed.

*BCD Recommendation:*

8. Revise the KMP to include a proposed amendment to the quarry induction process to include an explanation of the legal consequences of unauthorised clearing of native vegetation on the quarry site.
9. Revise the KMP to include provision of compensatory koala food tree plantings as a contingency measure in the event of unauthorised clearing taking place.

Proposed monitoring of the frequency of koala sightings would be based on incidental records rather than application of a systematic repeatable sampling method. The resulting dataset will not provide a reliable measure for determining temporal changes in koala occupancy levels or local population size, as intended in the KMP.

Nevertheless, such information may have some use in identifying areas of important koala occupancy, which could then be used to identify potential road strike '*black-spots*' and to formulate mitigation measures (e.g. speed limits, warning signage, traffic calming devices etc.).

*BCD Recommendation:*

10. Revise the KMP to ensure the proposed monitoring methodology focuses on identifying areas of koala activity susceptible to road strike rather than attempting to identify temporal changes in koala densities.

Table 1 of the KMP lists one of the proposed management triggers as being '*quarry-related vehicle koala strikes reach or exceed three for the year*'. This trigger threshold is too high given that three koalas are likely to represent a significant proportion of the koala population utilising the subject land and adjoining areas in any given year.



*BCD Recommendation:*

11. Revise the KMP to reduce the proposed koala road-strike threshold for management action from three koalas for the year to any koala at any time.

**Aboriginal Cultural Heritage Management**

RPS prepared an Aboriginal cultural heritage assessment report (ACHAR) to investigate the potential for harm to Aboriginal cultural heritage resulting from proposed expansion of the extraction boundaries into currently fenced off sand ridge areas. However, the ACHAR was not undertaken under the defence of being in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*.

References in the ACHAR to the need for an Aboriginal Heritage Impact Permit (AHIP) are incorrect given any proposed harm to Aboriginal objects from the approved project would be regulated by a management plan approved by the Secretary of the Department rather than an AHIP.

However, any Aboriginal objects identified whilst undertaking the approved project works could be lawfully removed from within the approved project boundary if the removal is consistent with the will of the Registered Aboriginal Parties and undertaken in accordance with a Care Agreement issued by the Department of Planning, Industry and Environment under section 85A(1)(c) of the *National Parks and Wildlife Act 1974*.

We note that one of the three recommendations provided in the ACHAR for inclusion in the updated Aboriginal Cultural Heritage Management Plan (ACHMP) appears inconsistent with the requirement for a Care Agreement to remove Aboriginal objects from the approved project boundary for long term management if required.

The relevant state government point of contact provided in the ACHMP for various aspects of Aboriginal cultural heritage recording and reporting (i.e. OEH) has recently changed and this should be amended to the Biodiversity and Conservation Division (BCD).

*BCD Recommendations:*

12. Revise the ACHAR to:
  - a) include a statement confirming the ACHAR was prepared in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*;
  - b) remove references to a requirement for an AHIP.
  - c) ensure the recommendations are consistent with the requirement for a Care Agreement to remove Aboriginal objects from the approved project boundary for long term management if required.
13. Revise the ACHMP to replace references to the Office of Environment and Heritage (OEH) with the Biodiversity and Conservation Division (BCD).





OUR REF: C19/467

13 September 2019

Mr Ben Luffman  
Technical Director – Environment  
GHD  
230 Harbour Drive  
COFFS HARBOUR NSW 2450

Dear Mr Luffman

**Re: C19/467 Dunloe Sand Quarry (MP 06\_0031) Landscape Management Plan consultation**

I refer to your email dated 8 August 2019 requesting consultation with DPI Fisheries for the purpose of preparing a Landscape Management Plan for the Dunloe Sand Quarry Project (MP 06\_0031). It is noted that consultation with DPI Fisheries for the development of the Landscape Management Plan is a specific requirement within Condition 27 of the Minister's Conditions of Approval (CoA).

DPI Fisheries is responsible for ensuring that fish stocks are conserved and that there is "no net loss" of key fish habitats upon which they depend. To achieve this, the Coastal Systems Unit assesses activities under Part 4 and Part 5 of the *Environmental Planning and Assessment Act 1979* in accordance with the objectives of the FM Act, the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the FM Act, and the associated *Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update)* (DPI Fisheries P&G). This document is available online at:

<https://www.dpi.nsw.gov.au/fishing/habitat/protecting-habitats/toolkit>. In addition, DPI Fisheries is responsible for ensuring the sustainable management of viable commercial fishing and aquaculture; quality recreational fishing; and to promote the continuation of Aboriginal cultural fishing within NSW.

It is noted that the submitted draft Landscape Management Plan, titled *Holcim Australia Dunloe Sand Quarry Landscape Management Plan* and dated August 2019, contains the relevant requirements as stipulated by Condition 27 of the CoA and, if implemented in full, would contribute to the protection of adjacent key fish habitats from potential impacts of the sand quarry. In summary, DPI Fisheries has no objection to the draft Landscape Management Plan.



## Department of Primary Industries

If you have any queries, please contact me on 02 6626 1375 or [jonathan.yantsch@dpi.nsw.gov.au](mailto:jonathan.yantsch@dpi.nsw.gov.au).

Yours sincerely

A handwritten signature in black ink, appearing to read 'Jonathan Yantsch', written over a horizontal line.

Jonathan Yantsch  
**Senior Fisheries Manager, Coastal Systems (North Coast)**  
Authorised delegate of the Minister for Primary Industries

## Ben Luffman

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**From:** Ben Luffman  
**Sent:** Thursday, 8 August 2019 12:50 PM  
**To:** 'landuse.enquiries@dpi.nsw.gov.au'  
**Cc:** 'Victoria Musgrove'  
**Subject:** Dunloe Quarry Management Plan consultation

**CompleteRepository:** 2220056  
**Description:** Dunloe EMP  
**JobNo:** 20056  
**OperatingCentre:** 22  
**RepoEmail:** 2220056@ghd.com  
**RepoType:** Job

Hi,

We have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06\_0030 require a number of the plans to be prepared in consultation with the DoI. We have therefore provided a link below to the relevant plans for review.

<https://ghd.sendthisfile.com/M3RFj9HigPcjj1ATu8LUMpEj>

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

### **Ben Luffman | A GHD Associate**

B.App.Sc. (Hons) | Grad.Dip. Urban and Regional Planning | Environmental Auditor  
**Technical Director - Environment**

### **GHD**

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## Ben Luffman

---

**From:** cassandra.mcnamara@dpi.nsw.gov.au on behalf of DPI Cabinet  
<dpi.cabinet@dpi.nsw.gov.au>  
**Sent:** Friday, 23 August 2019 10:34 AM  
**To:** Ben Luffman  
**Cc:** Brendan Stone  
**Subject:** DPI Advice - Local Project - Dunloe Quarry Management Plan Consultation

**CompleteRepository:** 2220056  
**Description:** Dunloe EMP  
**JobNo:** 20056  
**OperatingCentre:** 22  
**RepoEmail:** 2220056@ghd.com  
**RepoType:** Job

Hi Ben

### **Subject: Request for input Dunloe Quarry Management Plan Consultation**

I refer to your email of 8 August 2019 to the Department of Planning, Industry and Environment (DPIE) - Department of Primary Industries (DPI) regarding the above matter.

The Department of Primary Industries has reviewed the various management plans and has no objection or comment.

Any further referrals to DPIE - DPI can be sent by email to [dpi.cabinet@dpi.nsw.gov.au](mailto:dpi.cabinet@dpi.nsw.gov.au)

Kind regards,  
Cass

**DPI Coordination Team:**

Cass McNamara, Manager - 0404 087 481  
Jane Bak, A/Manager - 0438 458 914 (27 Aug - 20 Sept)  
Sophia Stanley, Policy & Project Officer - 0427 326 931

eCabinet: <https://ecab.nsw.gov.au/ecabinet-prod/login?0>

NSW Department of Primary Industries  
Lvl 49 MLC Centre | 19 Martin Place | Sydney NSW 2000  
E: [dpi.cabinet@dpi.nsw.gov.au](mailto:dpi.cabinet@dpi.nsw.gov.au)





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----- Forwarded message -----

From: **Ben Luffman** <[Ben.Luffman@ghd.com](mailto:Ben.Luffman@ghd.com)>

Date: Thu, 8 Aug 2019 at 12:50

Subject: Dunloe Quarry Management Plan consultation

To: [landuse.enquiries@dpi.nsw.gov.au](mailto:landuse.enquiries@dpi.nsw.gov.au) <[landuse.enquiries@dpi.nsw.gov.au](mailto:landuse.enquiries@dpi.nsw.gov.au)>

Cc: Victoria Musgrove <[victoria.musgrove@lafargeholcim.com](mailto:victoria.musgrove@lafargeholcim.com)>

Hi,

We have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06\_0030 require a number of the plans to be prepared in consultation with the DoI. We have therefore provided a link below to the relevant plans for review.

<https://ghd.sendthisfile.com/M3RFj9HigPcjj1ATu8LUMpEj>

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

**Ben Luffman | A GHD Associate**

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## Ben Luffman

---

**From:** Colleen Forbes <CForbes@tweed.nsw.gov.au>  
**Sent:** Wednesday, 21 August 2019 4:08 PM  
**To:** Ben Luffman  
**Cc:** Victoria Musgrove; Scott Hetherington; Vince Connell (InTouch); Tracey Stinson  
**Subject:** RE: Dunloe Quarry - Landscape Management Plan consultation

**CompleteRepository:** 2220056  
**Description:** Dunloe EMP  
**JobNo:** 20056  
**OperatingCentre:** 22  
**RepoEmail:** 2220056@ghd.com  
**RepoType:** Job

Dear Ben,

As requested and as part of your consultation process, Council has reviewed the *Dunloe Sand Quarry Landscape Management Plan* August 2019, primarily in relation to **Appendix E - Koala Management Plan** which Council was concerned about in Mod 2.

General comment:

- The bulk of the overall management plan comprises material from between 2006 and 2016 and it is difficult to interpret which previous study or work the published content refer to.

The Koala Management Plan is not supported in its current form due to the following:

- Hours of operation are proposed as the key threat mitigating factor in relation to koalas and vehicle strike. This does not satisfactorily account for winter, when the acknowledged high risk times of dawn and dusk occur during these hours of operation.
- The plan should note that koalas can be on the ground at any time of day or night.
- The plan should also identify the times of the year when risk is higher due to seasonal movements of young males, presence of females with back young and the concurrence of haulage times with dawn and dusk during winter as per above.
- All actions in relation to koala sightings and quarry related vehicle strike are assigned responsibility to the 'Planning and Environment Manager – NSW'. The document needs specify what organisation this relates to.
- No specific actions are proposed in response to quarry related vehicle koala strikes.
- There is no obligation or accountability for quarry staff to record koala sightings.
- 3 koala strikes per year is too many for the endangered population to sustain.
- 'Increased presence of koalas on haulage routes' is intimated as the likely cause for vehicle strikes. This is considered to be a premature and unfounded assumption.

Please contact me if you require any clarification on the matters raised above.

Regards,  
Colleen

## Colleen Forbes

Team Leader Development Assessment



p (02) 6670 2596

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**From:** Ben Luffman [mailto:Ben.Luffman@ghd.com]  
**Sent:** Thursday, 8 August 2019 12:52 PM  
**To:** Colleen Forbes  
**Cc:** Victoria Musgrove  
**Subject:** Dunloe Quarry Management Plan consultation

Hi Colleen,

As discussed, we have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06\_0030 require the Landscape Management Plan to be prepared in consultation with Council. We have therefore attached the relevant plan for review.

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

### **Ben Luffman | A GHD Associate**

B.App.Sc. (Hons) | Grad.Dip. Urban and Regional Planning | Environmental Auditor  
**Technical Director - Environment**

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# **Appendix C** – Long Term Management Strategy



# Long Term Management Strategy

## 1.1 Introduction

The progressive rehabilitation of the wider site throughout the operational life of the Dunloe Sand Quarry is a commitment made by Holcim with the aim of providing for a well-established and long term environmentally sound landscape at the completion of operational works of the quarry. The following outlines the performance criteria to which Holcim or any future owners of the quarry will be required to meet, with an indication as to possible end uses of the land area.

End of operations management and monitoring commitments, to ensure adherence to the performance criteria are also described.

## 1.2 Background - Staged Rehabilitation

The Rehabilitation and Revegetation Management Plan (RRMP) presented in Appendix A, outlines a program of staged rehabilitation of various areas of the site. These rehabilitation areas were previously approved under Development Consent 06\_0030. The RRMP, as amended from time to time, shows a detailed commitment to revegetating previously disturbed areas to create and enhance wildlife corridors, protect riparian areas and ensure the stability of ground and surface water quality within the catchment of Mooball Creek.

The detail outlined in the RRMP has been and continues to be implemented. These works will ensure that by the completion of sand extraction, the required rehabilitated areas will be well established with vegetation to a point of consolidation of continued growth. Upon completion of extraction operations, site conditions will be such that plantings can also be pursued to enhance the end of life appearance and function of the land.

The remainder of this document will outline the procedures for management and monitoring to achieve the objectives beyond the life of the quarry operations.

## 1.3 Objectives

- To ensure that rehabilitation works undertaken during the life of the quarry continue to thrive following the completion of operational works of the quarry.
- To implement management and monitoring procedures following the completion of quarry operations to provide for a permanent, healthy, local ecosystem that successfully functions within the natural parameters of the existing, localised, vegetative communities.
- To allow for and facilitate agricultural use around the perimeter of the extraction areas.
- Upon closure of the quarry operations the rehabilitated and revegetated areas are considered well established and capable of thriving without the need for continuing works and management.

## 1.4 Performance Criteria (Quarry Closure and Post-Extraction)

The following details the end of quarry operational life performance criteria:

- Healthy, thriving vegetation shall be well established upon closure of the quarry and be in a state considered to be capable of thriving into the future with minimal requirements for ongoing management.
- No visible weed infestations in those areas that have been rehabilitated or revegetated or the riparian zones associated with Mooball Creek within the site of the quarry.

- No visible erosion or sediment accumulation within rehabilitated areas and all erosion and sediment control preventative measures are in place prior to closure of the quarry.
- In regard to groundwater quality, target criteria to be used throughout the life of the quarry shall be required to be met upon closure of the quarry (refer to the Soil and Water Management Plan).
- In regard to surface water quality, target criteria to be used throughout the life of the quarry shall be required to be met upon closure of the quarry (refer to the Soil and Water Management Plan).
- Blue-green algae water quality targets presented in the following table and prescribed by Condition 9 of Schedule 3 of the Development Consent shall be met upon closure of the quarry:

Algae and Blue-green algae	No. cells/mL ( <i>M.aeruginosa</i> )	<50,000
	mm <sup>3</sup> /L (total biovolume)	<4

## 1.5 Implementation

1. Surface water monitoring will continue to be undertaken in accordance with the approved schedule at nominated monitoring locations (including monitoring for blue-green algae within the lakes) (refer to the Soil and Water Management Plan) for a period of 12 months after completion of extractive operations or as long as is necessary to indicate that the extraction area will have no impact upon the environment.
2. Groundwater monitoring will be undertaken in accordance with an approved schedule at nominated environmental monitoring locations (refer to the Soil and Water Management Plan) for a period of no greater than 12 months after completion of extractive operations should the monitoring continue to show compliance with set requirements of the Development Consent.
3. All bunding and catch drain lines shall have been removed around each on-site excavation area to allow natural surface water flow to the remaining lakes.
4. Inspection of all rehabilitated areas in accordance with an approved schedule to ensure plantings have been successful and to ensure no weed infestation is present at any of these localities (covered by bond) (refer to the RRMP).

## 1.6 Monitoring

Quarterly surface water monitoring in accordance with the approved schedule (refer to the Soil and Water Management Plan) will continue following the cessation of extraction. This would continue for a period of 12 months only, if water quality objectives can be demonstrated.

If there is visual evidence of an algal bloom, samples will be collected immediately for algal cell count/identification analysis.

Quarterly groundwater monitoring in accordance with the approved schedule (refer to the Soil and Water Management Plan) will continue following the cessation of extraction. This would continue for 12 months only, if groundwater quality objectives can be demonstrated.

As the revegetated areas will essentially be stable forests upon cessation of quarry operations, monitoring of these areas will continue to be undertaken 12 months from the cessation of operations to ensure quality of the vegetation is maintained. The monitoring is to include weeds, erosion and plant health, density and diversity.

After 12 months, monitoring of the rehabilitation areas will cease should all areas be considered stable and effectively free of weeds and approved for no further management by the DPI&E or until such time that it can be demonstrated that no adverse impacts associated with the quarry exist.

## **1.7 Auditing**

Groundwater, surface water, blue-green algae and revegetation area monitoring results will be reviewed quarterly for the first year following cessation of operations by the respective contracted environmental consultant/s. Results shall be compared with those found within previous AEMR documents to ensure compliance with criteria.

## **1.8 Corrective Action**

Should final monitoring of revegetated areas show the presence of significant areas of weed infestation at cessation of the operations, a program will be implemented to remedy this situation to the satisfaction of the DPI&E.

In regard to groundwater, surface water and blue-green algae, the recommended corrective actions presented within the Soil and Water Management Plan will be implemented.

## **1.9 Potential Future Uses**

Potential future uses of the site following a project with a lengthy operational life such as this are difficult to accurately predict. Many variables could occur that may dictate end uses such as State, Regional and Local Government, strategies, policies and legislation changes and directions over time. The certainty is that the mitigation and remedial measures implemented during the operations and at the cessation of operations, as presented throughout the EMP, will ensure that the site will be remediated to the satisfaction of the company, the relevant Government agencies and the community, ensuring environmental quality in the locality.

The proposed rehabilitation and revegetation of the site will allow future agricultural activities to occur within the surrounds of the lakes

Much of the existing areas of the site that are presently under environmental protection through zoning within the Tweed Shire Council LEP may remain under various legislated forms of environmental protection. Those areas of rehabilitated land (particularly those linking and expanding wildlife corridors) not within these protected zones may overtime be included.

Similarly, agriculturally zoned lands within the site that will not be impacted by the sand quarry operations may remain under such zonings into the future.

The environmental measures presented throughout the EMP allow the site following cessation of operations to be suitable and capable of the potential end land uses.

# **Appendix D** – Koala Management Plan

# Koala Management Plan

## 1.1 Introduction

Koala habitat has been identified in areas surrounding the Dunloe Sand Quarry and access road, as well as the Pottsville Mooball Road which is used to access the quarry.

Schedule 3, Condition 28 (h) and (i) require the Dunloe Sand Quarry Rehabilitation and Revegetation Management Plan (RRMP) to include:

- A monitoring and reporting program of the project's impacts on Koalas, including road strike, to the satisfaction of the Secretary.
- Adaptive management options for managing impacts on Koalas, including specific impact triggers, developed in consultation with Council.

This Koala Management Plan (KMP) forms part of and should be read in conjunction with the RRMP, Landscape Management Plan and Environmental Management Strategy for the Dunloe Sand Quarry.

Koalas are mostly nocturnal animals and they are most active during the night and at dawn and dusk. However, it is noted that koalas can be on the ground at any time of day or night. Koalas are more active during the spring and summer breeding period. The birth of young Koalas generally takes place between November and February, with the young remaining in the pouch for six months. The joey will then ride on the mother's back for between six and 12 months.

## 1.2 Potential Impacts

### 1.2.1 Quarry-related vehicle strike

The quarry access road runs parallel with the northern Brushbox Forest (Community 3), which provides koala habitat.

Potential impacts from the project on koalas in the area may arise from vehicle strike where haulage/access routes are located close to koala habitat or areas used by koalas. Under the Development Consent 06\_0030, haulage vehicle movements associated with delivery and distribution of quarry materials are restricted to the following operational hours:

- 7:00 am to 5:00 pm Monday to Friday; and
- 7:00 am to 12 pm Saturday.

The risk of vehicle strike is likely to be higher during the winter months when dawn and dusk fall within the approved operational hours for the quarry. Similarly, the risk would be higher during the spring and summer breeding period.



## 1.2.2 Unauthorised clearing of koala habitat

Clearing of koala habitat will not be undertaken as part of the ongoing quarry operations, however unauthorised clearing in these habitat areas would have the potential to impact koalas.

As outlined in the Landscape Management Plan, approved disturbance areas will be demarcated and access restricted to areas outside these areas, except for monitoring and management purposes.

## 1.3 Monitoring

In order to monitor these potential impacts, Holcim will record any unauthorised clearing, koala sightings or vehicle strikes involving quarry-related vehicles in its online incident reporting system. This will allow such occurrences to be tracked and areas of koala activity and potential road strike identified. Reporting provisions are detailed in Section 5.4 of the Landscape Management Plan and the EMS.

The presence of koalas and any unauthorised clearing of koala habitat will also be noted during the monitoring program set out in Table 5-1 of the Landscape Management Plan.

## 1.4 Reporting

Records of any unauthorised habitat clearing, koala sightings and vehicle strikes involving quarry-related vehicles and koalas will be reported in the Annual Report, along with a discussion of any identified cause, trends such as specific area, time of day, time of year, climatic conditions, etc. associated with the occurrences.

## 1.5 Adaptive Management

Impacts to koalas as a result of quarry activities, specifically haulage, or unauthorised habitat clearing, will be reviewed annually as part of the review of monitoring results, which forms part of the Annual Report, to assess any adverse impacts to koalas. The monitoring results will also be used to identify any trends in occurrences of koala sightings or vehicle strikes.

Responses to the results of this monitoring will be required where certain triggers are met or exceeded. Details of the triggers, actions and responses for koala management are provided in Table 1.

It should be noted that there have been no koala vehicle strikes as a result of quarry vehicles during the site's operation.

**Table 1 Koala management triggers**

Trigger	Action	Responsibility
Approval of KMP (2021)	Incorporate koala impact management materials into site induction, identifying risk areas (i.e. haulage route particularly in proximity to the northern Brushbox Forest (Community 3)), seasonal considerations (i.e. breeding season November to April, potential presence of young / joeys throughout the year) and the requirement to report all koala sightings, near misses and vehicle strikes.	Quarry Manager
Approval of KMP (2021)	Install koala warning signage along internal haul route	Quarry Manager
Unauthorised clearing of koala habitat	Investigate cause of unauthorised clearing	Quarry Manager

Trigger	Action	Responsibility
	Implement measures to prevent recurrence of unauthorised clearing (will depend on cause identified)	Quarry Manager
	Compensatory planting at a ratio of 10 to 1.	Quarry Manager
Koala sightings along haul routes increases year on year	Investigate if any trends are determinable from these occurrences, including whether increased sightings correlates with increased quarry-related vehicle strikes	Planning and Environment Manager – NSW
	Continue to monitor koala sightings in subsequent years to determine if occurrences continue to increase	Planning and Environment Manager – NSW
Quarry-related vehicle koala strike is reported	Review all occurrences and investigate if any trends are determinable from these occurrences	Planning and Environment Manager – NSW
Quarry-related vehicle koala strike recorded for any two (2) years in a rolling five (5) year period	Investigate if any trends are determinable from these occurrences	Planning and Environment Manager – NSW
	Consult with local koala experts and Tweed Shire Council to understand potential causes for increased presence of koalas on or nearby haulage routes and/or incidence of koala vehicle strikes associated with quarry operations and to identify potential measures to be implemented to minimise impacts to koalas as a result of quarry-related vehicle strike.	Planning and Environment Manager – NSW

Potential management measures that could be implemented where impacts to koalas as a result of vehicle strike are identified are provided in Section 1.6. Any measures to be implemented will be selected in response to the findings of the investigation into the incident (e.g. location, contributing factors such as non-compliance with site rules, etc.) and in consultation with local koala experts and Tweed Shire Council.

## 1.6 Potential Management Measures

Measures that may be implemented to manage the risk of koala vehicle strike include:

- Fauna exclusion fencing
- Traffic calming measures
- Lighting
- Road verge maintenance
- Speed reduction signage.

The success of such measures will be monitored in line with Section 2 above and any specific monitoring program recommended by the appointed ecologist, reported in line with Section 3 above and further adaptive management measures progressed where impacts to koalas as a result of quarry-related vehicle strike continues to occur.

# **Appendix E** – Monitoring forms

**ROUTINE FAUNA BOX MONITORING FORM**

Location/Number of Fauna Box			
Description of Fauna Box			
Inspected by		Name:	Signature:
Inspection date		/ /	
Element	N/Y?	Comments/description	Action Required
Empty Box			
Native Fauna Present			
Eggs Present			
Number of eggs			
Colour/description of eggs			
Nest present			
Partial nest present			
Hatchlings/fledglings present			
Box empty but scats/trace present			
Box occupied by pest species (i.e. bees, myna, black rat etc)			
Roof, hinges and/or supports broken or in need of repair/replacement			
Evidence of warping			
Evidence of vandalism			
Other comments/maintenance performed?:			

**FORM A: ROUTINE QUARTERLY REHABILITATION MONITORING SHEET**

<p><b>General Management</b></p> <p>Has there been a fire within the last quarter? _____</p> <p>Do the bushfire trails or adjacent pasture areas require slashing or maintenance to reduce fire risk? _____</p> <hr/> <p>Is there evidence of rubbish dumping within the rehabilitation zones? _____</p> <hr/> <p>Is there evidence of plant theft within the rehabilitation zone? _____</p> <hr/> <p>Does it appear that the rehabilitation zone has been utilized for stockpiling, vehicle parking, building waste dumping, cattle grazing or person traffic? _____</p> <hr/> <p>If yes, acknowledge below what works were undertaken to rectify/restore and the date _____</p> <hr/>	<p><b>Weeds</b></p> <p>Have any areas of weeds re-established within the rehabilitation zones during the last quarter? _____</p> <hr/> <p>What species? _____</p> <hr/> <p>What management was undertaken to eradicate these weeds? _____</p> <hr/> <p>If management was undertaken acknowledge that such was performed in accordance with the approved rehabilitation management plan. _____</p> <hr/>	<p><b>Vegetation regeneration</b></p> <p>Natural regeneration is occurring in (record height range estimate):</p> <ul style="list-style-type: none"> <li>- Tree species _____</li> <li>- Shrub species _____</li> <li>- ground covers _____</li> </ul> <p>What are the dominant species within each layer?</p> <ul style="list-style-type: none"> <li>- Tree _____</li> <li>- Shrub _____</li> <li>- ground covers _____</li> </ul> <hr/> <p>Have you noticed any new native plant species since the last monthly inspection? _____</p> <p>If yes name the species or take a photograph _____</p> <p>Acknowledge that the required routine photographs have been taken within the rehabilitation zones</p> <hr/>
<p><b>Biodiversity</b></p> <p>Have you spotted native fauna within the rehabilitation zone during inspection?</p> <p>If yes, what types?</p> <p>Koala _____</p> <p>Kangaroo/wallaby _____</p> <p>Possums/gliders _____</p> <p>Small mammal (i.e. bandicoot, echidna) _____</p> <p>Reptiles (i.e. snakes/lizards) _____</p> <p>Birds of prey _____</p> <p>Large nectar feeding birds (i.e. lorikeets, parrots, cockatoos) _____</p> <p>Small tree and ground birds (i.e. finches, fairy wrens, treecreepers) _____</p> <p>Glossy Black Cockatoos _____</p> <p>Other _____</p>	<p><b>Modifications</b></p> <p>Have there been any structural additions (eg. new tracks, buildings) to the rehabilitation zones since the last visit?</p> <hr/> <p>What actions were undertaken to remove any illegal modifications?</p> <hr/> <p><b>Condition of fences</b> _____</p> <ul style="list-style-type: none"> <li>- Good _____</li> <li>- Need minor repair _____</li> <li>- Poor (need replacement) _____</li> </ul>	<p>Are any of the following performance criteria exceeded (refer Section 4.5 below)?</p> <p>Declared Weeds? _____</p> <p>Extent of other Weeds? _____</p> <p>Survival Rate of Plants? _____</p> <p>Condition of Plants? _____</p> <p>Canopy Coverage? _____</p> <p>Tree, Small Tree &amp; Shrub Diversity? _____</p> <p>Groundcover Coverage? _____</p> <p>General Coverage/Success? _____</p> <p>If yes, what corrective action was performed (i.e. plant showed drought stress and so watering was undertaken, plant was dead so a replacement plant was pocket planted, canopy plant coverage was not achieved so relevant pioneer plants were pocket planted).</p>



**FORM B - ASSESSING SITE CONDITION**

**PROJECT DESCRIPTION** Note: where options are given, put an 'X' next to the appropriate term(s):

Project name:		Project ID:
Site name:		Site ID:
Type of on-grounds: Assisted Natural Regeneration	Years since site commenced:	When was this site last assessed?
Current assessment conducted by:	Date of current assessment:	
Overall comments on site condition:		
Has the condition of the site changed since last assessment? YES ..... or NO ..... If Yes, briefly describe changes in this box, and provide details in table below.		

**DETAILED DESCRIPTION OF SITE CONDITION** Complete table quarterly, or if conditions have changed since last assessment. Also draw map.

Rating/ zone	Area (ha)	% of site	Location and factors affecting outcomes	Canopy cover (%)	Ground cover	Problem weeds	Tree survival or Recruitment	Other comments	Suggested maintenance
A = OK on track towards target									(should be routine: describe if necessary)
B = Uncertain significant problems									(describe)
C = Poor major problems, likely to fail									(describe)
Overall Condition Score (ranges from 0-100%) Multiply percentage of site occupied by each zone (A, B or C), by the condition rating for each zone (A = 1; B = 0.5; C = 0), and add the products: e.g. (70% x 1) + (20% x 0.5) + (10% x 0) = 80%									..... %

---

MAP OF SITE CONDITION Note: also describe the condition of the site (previous page).

Draw a map of the site, showing variation in outcomes as zones (Zone A = OK, Zone B = Uncertain, Zone C = Poor).

Include an approximate scale (e.g. 0-100 m) and North arrow.



---

## PROFORMA FOR MONITORING FOREST STRUCTURE

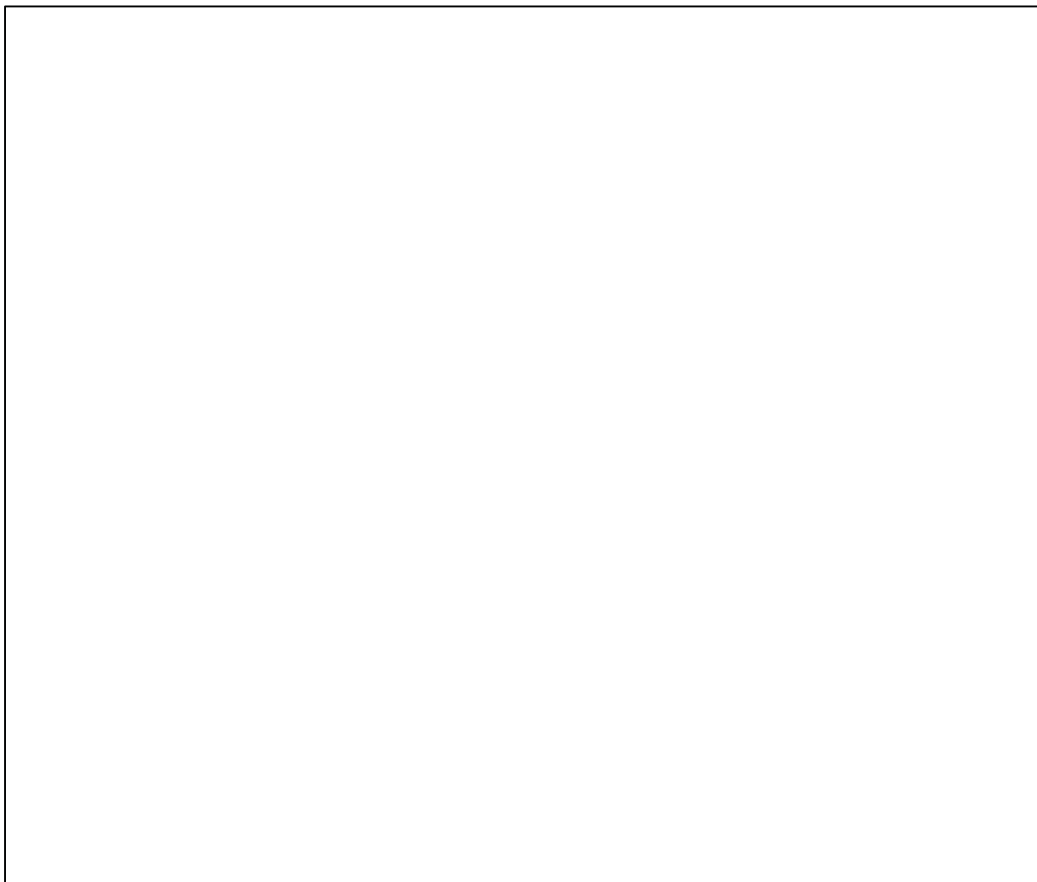
Project name:	Project ID:
Site name:	Site ID:
Assessed by:	Date:

### LOCATION OF MONITORING PLOTS

Provide details and also mark on the map of the site	Plot
Location at 0 m point of plot (grid / GPS coordinates):	
Datum:	
Compass bearing / direction of transect (from 0 m point)	
Landform (e.g. plateau, crest, upper slope, mid-slope, lower slope, stream bank, floodplain)	
Slope (: e.g. flat/steep)	
Aspect (compass bearing / direction of fall of slope)	

### MAP OF MONITORING PLOTS

In the box, insert a map of the site showing the location of monitoring plots (mark 0 m point) in relation to notable features of the site (e.g. property boundaries, roads, waterways). Also show notable features of the monitoring plots (e.g. non-standard layout, presence of remnant trees) and location of any landscape photopoints. Include a scale bar (e.g. 0-100 m) and North arrow.



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Site name:	Date:
<b>GROUND COVER, CANOPY COVER and CANOPY HEIGHT</b> For each survey plot, lay out a 50 m transect. Then survey quadrats centred on the 5 m, 25 m and 45 m points	



Ground cover = proportion of ground covered by (a) vegetation within 1 m of ground (categorised by life form), (b) leaf litter and fine woody debris, (c) coarse woody debris, d) rock, (e) soil, or (f) other. At the 5 m, 25 m and 45 m points, define a 1 m x 1 m quadrat, using four 1 m sticks. Looking down at the quadrat from 1 m, estimate the % of ground covered by each type (as would be seen on a photo: total must add to 100%).

Ground Cover	Plot		
Location of quadrat:	5 m	25 m	45 m

a)  
Vegetation within 1 m of the ground

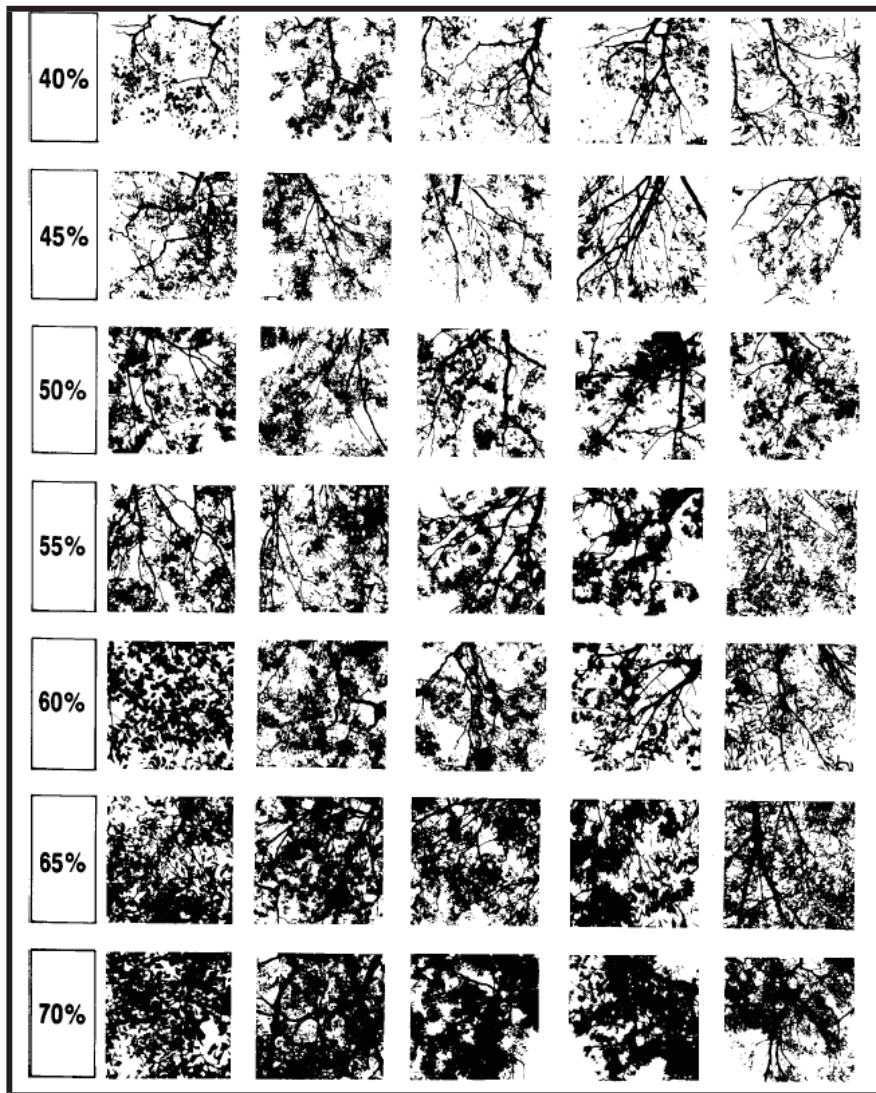
Grass (and sedges)	%	%	%
Herbs (soft-stemmed plants)	%	%	%
Ferns	%	%	%
Vines and scramblers	%	%	%
Tree seedlings and shrubs	%	%	%
Moss (and liverworts and lichens)	%	%	%
b) Leaf litter and fine woody debris <10 cm diameter	%	%	%
c) Coarse woody debris >10 cm diameter	%	%	%
d) Bare rock	%	%	%
e) Bare soil	%	%	%
f) Other (including tree trunks, roots, etc.)	%	%	%
<b>TOTAL (must add up to 100%)</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Canopy (foliage) cover = projective cover of ecologically dominant layer above ground level (shade cast by foliage and stems, if the sun was overhead, assessed (approximately) above the entire 10 m x 10 m quadrat around each point. It can be estimated by eye (although this can be very subjective) or from a photo. 1. Estimate foliage cover visually, e.g. by comparison with reference photos. 2. Take a wide-angled digital photo looking up from the

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centre of each 10 x 10 m quadrat, and use to calculate foliage cover). Record the number of each photo for later reference.

Canopy (foliage) cover	Plot		
	5 m	25 m	45 m
Location of quadrat:			
Visual estimate of canopy (foliage) cover	%	%	%
Canopy (foliage) cover calculated from photo	%	%	%
Record number of canopy photo for reference			



CANOPY COVER PHOTOGRAPHS PER WALKER AND HOPKINS (1990)

Canopy height The height of the tallest tree in the canopy of each 10 m x 10 m quadrat (the canopy is the layer of foliage forming the 'roof' of the forest: it may be broken by gaps or incomplete). In some sites, it may be necessary to distinguish canopy trees from emergents: i.e. trees projecting well above the canopy with crowns exposed on all sides Note: Estimating height is difficult. Use a clinometer & tape measure, or range finder, or other measure. Alternatively, place a 2.5 m pole against a tree, & standing at a distance, estimate height in multiples of 2.5 m.



Canopy height	Plot		
Location of quadrat:	5 m	25 m	45 m
Canopy height (tallest trees in canopy)			
Height of emergent trees (if present)			

Site name:	Date:
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SPECIAL LIFE FORMS: Record presence of life forms in each 10 m x 10 m quadrat centred on the 5 m, 25 m and 45 m points. If life forms are present on site, but not in quadrats, record in last column. Do not count no. of individuals.

Special Life Forms	Plot			On site?
Location of quadrat:	5 m	25 m	45 m	
Strangler figs Figs with network of roots around stem of host tree, rooted in ground				
Hemi-epiphytes Climbing plants adhering to tree trunks, rooted in ground, e.g. Pothos, climbing pandanus				
Vines Climbing woody-stemmed plants dependent on trees for support, and rooted in the ground	Slender (stem <5 cm diam.)			
	Robust (stem >5 cm diam.)			
Vine towers Dense columns of vines growing over and smothering tree crowns and stems				
Vine tangles Dense masses of interwoven vine stems in understory or midstorey				
Thorny scramblers Thicket-forming vines or shrubs, often spiny, e.g. Calamus, lantana, cocksbur, raspberry, other vines (e.g. Eleagnus, Maesa)	Individual plants present			
	Thickets present			
Palm trees Palms with stems >2 m high				
Understorey palms with stems <2 m high, e.g. walking stick palms (also includes juvenile palm trees)				
Tree ferns Ferns with stems usually >0.5 m high				
Ground ferns Ferns or fern-like plants without stems, growing on the ground				
Clumping epiphytic ferns e.g. staghorns, basket ferns				
Other epiphytes Growing on trees, e.g. trailing ferns, orchids, not rooted on ground				
Cordylines 'Palm-lilies': shrubs to 5 m high, occasionally branched, with long leaves				
Herbs with long wide leaves e.g. gingers, cunjevoi, bananas				
Herbs with long strap-like leaves e.g. lilies, mat-rush				
Cycads Plants with leathery palm-like foliage borne on stout stems or growing on ground (subterranean stems)	Stout stems, e.g. Lepidozamia			
	Ground cycads, e.g. Bowenia			
Pandanus Shrub / small tree with serrated strap-like leaves				
Other life forms: describe...				



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FORM D: PROFORMA FOR MONITORING FLORISTIC COMPOSITION

Project name:	Project ID:
Site name:	Site ID:
Assessed by:	Date:

LOCATION OF MONITORING PLOTS

Provide details and also mark on the map of the site	Plot
Location at 0 m point of plot (grid / GPS coordinates):	
Datum:	
Compass bearing / direction of transect (from 0 m point)	
Landform (e.g. plateau, crest, upper slope, mid-slope, lower slope, stream bank, floodplain)	
Slope (: e.g. flat/steep)	
Aspect (compass bearing / direction of fall of slope)	

MAP OF MONITORING PLOTS

In the box, insert a map of the site showing the location of monitoring plots (mark 0 m point) in relation to notable features of the site (e.g. property boundaries, roads, waterways). Also show notable features of the monitoring plots (e.g. non-standard layout, presence of remnant trees) and location of any landscape photopoints. Include a scale bar (e.g. 0-100 m) and North arrow.



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Site name:	Date:
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GENERAL COMMENTS on the composition of vegetation at the site (e.g. dominant or notable species, variation across the site): record by strata as follows:

Canopy/ Ecologically Dominant Layer:

Midstorey:

Understorey/ Ground cover:

RECRUITMENT: What species are common recruits to the site? Any other comments about recruitment?

Does this site have any WEED or MAINTENANCE ISSUES that need attention?

Any other comments on the site? Mark an 'X' here \_\_\_\_\_and add extra page(s) as required.

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9/[https://projects.ghd.com/oc/Newcastle3/holcimdunloesandquar/Delivery/Documents/2220056\\_RPT\\_Dunloe\\_Landscape\\_Management\\_Plan.docx](https://projects.ghd.com/oc/Newcastle3/holcimdunloesandquar/Delivery/Documents/2220056_RPT_Dunloe_Landscape_Management_Plan.docx)

#### Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	Planit					January 2009
1	Planit					February 2009
2	Holcim					October 2016
3	Holcim					July 2018
4	B Luffman	S Lawer		S Lawer		23/09/2019
5	B Luffman	S Lawer		S Lawer		04/06/2021
6	V Musgrove	V Musgrove		V Musgrove		17/06/2021
7	V Musgrove	V Musgrove		V Musgrove		28/10/2021
8	V Musgrove	V Musgrove		V Musgrove		14/04/2022



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