SITE REHABILITATION PLAN

MARTINS CREEK QUARRY
STATION STREET
MARTINS CREEK

AUGUST 2016
REF: 4127/R

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TABLE OF CONTENTS

SECTION 1
INTRODUCTION

SECTION 2
REHABILITATION PROGRAM

SECTION 3
ONGOING MANAGEMENT OF REHABILTIATION AREAS

APPENDICES

SECTION 1

INTRODUCTION

1.1 BACKGROUND

This Site Rehabilitation Plan (SRP) has been prepared for the existing and future quarry areas at Martins Creek Quarry to address long term rehabilitation of quarried and disturbed areas.

This SRP relates to the areas used for the quarry activities including the extraction pit and faces, internal roads, loading areas, stockpile areas and the noise attenuation bund. Other areas of the site required to be revegetated and managed with a natural vegetation cover are to be incorporated into a Vegetation Management Plan. These areas include the vegetation along drainage lines, landscaping areas and any areas of retained natural vegetation within the subject site.

At this stage it is expected that rock resource material will continue to be extracted on a staged basis with the rehabilitation works to continue on an ongoing basis in previously quarried areas to complete the earthworks required for future site rehabilitation covered in this Plan.

This Site Rehabilitation Plan has been prepared to a preliminary stage to demonstrate the application of the site rehabilitation principles for the existing and proposed quarry areas as part of the Environmental Assessment process.

1.2 PRINCIPLES FOR SITE REHABILITATION PLANNING

The following principles have been utilised for the site rehabilitation planning: a combination of rehabilitated offsets and agricultural .activities.

1. Identify the post quarry land use.

The final land use (at present) is expected to be permissible within the zoning of the land. Final land use eg. stock grazing, horticulture (eg multi-span greenhouses) or intensive agriculture (eg poultry production) of the rehabilitated quarry floor area will be dependent on the final contours of the rehabilitated pit.

The ongoing land-use of the site following the closure of has not yet been determined by the land owners. The subject site is leased for the operation of the quarry and the lease holders are not the same as the landowners.

The final landforms within the quarried areas will include the vertical batter face slopes, horizontal benches, flat quarry floor area and ponded water areas retained as sediment control and hydrological balance purposes. These landforms would favour a variety of future land-uses such as:

- Stock grazing of fenced pasture paddock on flat areas;
- Horticultural production in multi-span hydroponic facilities (greenhouses);
- Poultry production in tunnel ventilated sheds;
- Outdoor adventure park incorporating activities such as abseiling, rock-face climbing, archery, quad bike riding, water activities, bush survival;
- Renewable electricity generation using solar collectors; and

- Native plant production nursery.

At this stage the most likely final land-use will be an agricultural activity of sustainable stock grazing once the flatter areas have revegetated to a condition to allow controlled stock grazing.

At this stage bushland rehabilitation is proposed for quarry slopes, batters and rehabilitated access tracks within bushland areas. Agricultural activities might be undertaken on the flatter quarry floor areas or alternatively these areas may be naturally rehabilitated for offset areas.

2. Implement Progressive Site Rehabilitation

Rehabilitation of the quarry extraction area will be undertaken progressively as suitable backfill material and topsoil material for revegetation becomes available. The Rehabilitation Program is detailed in to Sections 2.1, 2.2, 2.3, 2.4 and 2.5 of this SRP.

Rehabilitation will be undertaken as areas containing the rock resource have finished extraction and the final extraction depth of the specific area of extraction is achieved.

3. Identify a final stable and permanent landform.

The final landform for the excavated quarry pit area is likely to be a low slope area and which incorporates a depression with sloped batters (gradients to be determined) leading to a pond at the base of the rehabilitated quarry pit. Refer to Section 2 of this SRP for details on the Rehabilitation Program.

Following rehabilitation the site will comprise three different rehabilitation areas including the rehabilitated quarry pit area, pit slopes and rehabilitated infrastructure areas (roads, noise bunds, stock pile areas, loading areas etc). The rehabilitated quarry pit and pit slopes areas will require specific ongoing management and maintenance to ensure that the vegetative cover is maintained to a standard for the identified end land use. The other rehabilitated areas of the site are expected to be rehabilitated to a condition which can be managed utilizing specific agricultural, environmental, or ecological land management practices.

4. Revegetate disturbed land surfaces to achieve a sustainable vegetation cover.

The final land surfaces will be reshaped to stable landforms and certified safe by geotechnical engineers. Revegetation will be undertaken using appropriate seed and fertilizer mixes to achieve a suitable and sustainable grass/pasture cover on the revegetated land surface (quarry floor area) following soil tests of the reused soil material to be revegetated as detailed in Section 2 of this SRP.

A range of surface finishing techniques will be utilized for areas to be rehabilitated back to a bushland condition. These techniques will include:
- Spreading of rocks and overburden material
- Placement of tree sections, (hollows, branches etc.)
- Spreading of any retained/reused topsoil/mulch from staged clearing areas
- Replanting of suitable local tree and shrub species.

5. Incorporate appropriate erosion and sediment control and water management measures during site rehabilitation.

An Erosion and Sediment Control Plan is to be provided for ongoing stages. This plan will require amendments when the revised SRP is to be prepared after 3 years of operation of the expanded quarry operations.

A Stormwater Management Plan is to be finalised for the final landform. This plan will require amendments when the revised SRP is to be prepared.

6. *Implement appropriate site maintenance procedures.*

A range of site maintenance procedures will be implemented and will be dependent on the area being maintained and the matter being addressed. Site maintenance will cover the following matters:

- Soil erosion control
- Control of noxious and environmental weeds
- Fencing repairs for access control
- Feral pest control
- Bushfire hazard management

7. *Develop a monitoring and reporting program.*

The details for the environmental monitoring and reporting of the quarry are provided in the Preliminary Monitoring Program detailed in Section 3.

1.3 SITE REHABILITATION OBJECTIVES

This SRP outlines the measures, procedures and timing of works which will be undertaken to rehabilitate the quarried and associated disturbed areas. The principal objectives of site rehabilitation are to:

i) Remove unconsolidated fill material (soil, rock, roadbase) from around the site and use this material (or other suitable fill material) to recontour the void created by material extraction;

ii) Recontour the excavated batters within the quarry face and extraction pit to achieve regularly shaped slopes which are structurally stable;

iii) Import suitable material (eg certified VENM or ENM) if required into the site for use in erosion and sediment control measures, drainage works, subgrade backfill and topsoiling for surface revegetation;

iv) Rehabilitate/Reshape the disturbed land surfaces in a manner compatible with the final determined land use, in stages of approximately 15 hectares in each stage.

v) Revegetate disturbed land surfaces which have been shaped and topsoiled to create a grassed, stable soil surface or other vegetation on batter slopes to prevent soil erosion and to provide a long term pasture cover suitable for future agricultural land use, or for native vegetation re-establishment.

1.4 STATUS OF THIS SITE REHABILITATION PLAN

This SRP should be considered a concept plan for site rehabilitation as the rehabilitation works will be completed on an ongoing basis as suitable material becomes available and areas where quarrying has been completed becomes available for revegetation. The extent of works required for adequate site rehabilitation will be identified in the Annual Site Rehabilitation Report for the quarry. The Annual Site Rehabilitation Report will provide and ongoing revision required for this SRP which will be based on the extent of the excavation pit and detailed volumetric analysis of the material available for reshaping the batters of the excavation pit and extracted quarry face.

SECTION 2

REHABILITATION PROGRAM

2.1 AREAS TO BE REHABILITATED

The areas to be rehabilitated include all areas disturbed for the purposes of material extraction operation, material processing, storage, transport and for management of the quarry. These areas and works include:

- Filling and site regrading to obtain desired site levels;
- Filling the batters of the excavation pit and extraction faces;
- Removal of the haul roads;
- Removal or upgrading of the culverts over drainage lines;
- Removal of storage and loading areas;
- Removal of the noise attenuation mound;
- Revegetation of all disturbed areas, except the principal access/management tracks.

Some details on the methods for Rehabilitation of Offset Areas within the quarry area are provided in Appendix 4.

The extent of the areas to be rehabilitated (or those areas rehabilitated in the previous years) will be identified in the Annual Site Rehabilitation Report. This plan will be based on the contour plans of the excavation pit which will identify the depth, extent and batter gradients of the excavation pit.

For site management and rehabilitation purposes the site and quarry area should be separated into rehabilitation stages incorporating the existing and proposed quarry areas and other land located outside of the quarry area being retained as a visual buffer to adjoining areas.

The timing of rehabilitation works will be dependent on the rate of resource extraction for each staged rehabilitation area and the final levels of the base of the quarry (quarry floor). These finished floor levels will be dependent on the resource extraction depth and site water management.

2.2 RESHAPING OF EXCAVATION PIT BATTERS

The vertical batters of the excavation pit will be reshaped to batters with an appropriate gradient subject to geotechnical recommendations based on the type of material available.

The material for batter reshaping will be obtained from the material obtained from removal of the haul road, loading area, any stockpiles available, any residual overburden and any other material imported to the site to meet the rehabilitation requirements. The final surface of the reshaped batters will be shaped with the subsoil and topsoil material contained within the stockpiles supplemented with suitable imported material. This will ensure that the suitable draining gravel material from onsite or from suitable material imported into the site is placed at the base of the reshaped batters.

2.3 TOPSOIL TREATMENT

Topsoil material for revegetation is to be sourced from soil stored on-site which has been stockpiled as part of the initial clearing and soil removal process or from suitable material imported (Certified VENM or ENM) into the site for restoration and revegetation purposes. Prior to reuse samples of topsoil material are to be analysed at a NATA registered laboratory to determine the requirements for any soil amelioration such as lime, dolermite, fertilizer, trace elements etc which will assist with providing a suitable medium for revegetation purposes. Soil tests are also to be taken from areas disturbed for roads, bunds and stockpiles to determine any soil constraints and soil amelioration requirements.

2.4 REVEGETATION

All disturbed quarried areas will be revegetated to achieve a grass or shrub/tree cover to provide a stable soil surface and to prevent soil erosion.

At this stage revegetation using native tree, shrub or groundcover species is not proposed for the quarry floor areas. These species are more suited to the batter slopes or riparian zones identified for revegetation in the Vegetation Management Plan to be prepared for the finished quarry areas.

The mix for the revegetation process will include permanent pasture species (Kikuyu, Rye Grass, Clover) with a temporary cover crop (Oats, Japanese Millet) and a surface mulch.

The steeper slopes within the reshaped quarry areas which may require a grass cover require seeding by the hydro seeding technique where the revegetation mix is sprayed onto the soil surface by a hydroseeder and covering with a protective surface mulch.

Alternatively these areas may be subjected to direct placement of topsoil and overburden, large rocks and logs/branches from trees removed from other stages of the quarry. The placement of these materials over the regraded surfaces will provide habitat enhancement opportunities for vegetation regeneration and fauna occupation on site conditions develop to a suitable level for birds, reptiles and amphibians at the early stages of site rehabilitation.

2.5 SURFACE MULCHING

All areas of revegetation on slopes will be covered by a protective surface mulch of straw, relocated trees or eucalypt mulch. This will provide surface protection against rainfall impact and protection for germinating seeds. The organic matter from the breakdown of the mulch material will also benefit the soil structure for revegetation.

2.6 HABITAT ENHANCEMENT

Habitat enhancement incorporates the placement of rocks, soil, tree branches, tree logs etc within the rehabilitated area to provide areas for suitable utilization by fauna. This will be completed on a staged basis as suitable habitat resources become available from the areas of future quarry expansion.

SECTION 3

ONGOING MANAGEMENT OF REHABILITATION AREAS

3.1 REGULAR INSPECTIONS AND MAINTENANCE

Regular quarterly inspections (for a 5 year period) are to be undertaken to monitor the progression of rehabilitation works in the growth of revegetation and presence of any weeds or pests within the revegetated areas. Management works are to be undertaken on a quarterly basis to address any matters required to ensure the continued growth and vigour of the revegetated areas.

3.2 WEED MANAGEMENT

Any environmental or noxious weeds growing in the revegetated areas are to be removed during each quarterly management program.

3.3 PEST MANAGEMENT

Any pests affecting the revegetated areas are to be controlled by implementing appropriate pest control techniques applicable at the time of rehabilitation and revegetation.

3.4 VEGETATION MANAGEMENT

Regrowth vegetation within the revegetated areas may require controlled mowing/slashing to control growth and to encourage a robust vegetative cover. The mowing regime to be used will be dependent on the growth of the vegetative cover.

3.5 MAINTENANCE FERTILIZER

Application of fertilizers to promote plant growth on rehabilitated areas (for agricultural area) is to be undertaken six months after seeding. The type and application rate of the fertilizer is to be determined following the results of soil tests for the site.

3.6 MONITORING PROGRAM

Quarterly monitoring inspections are to be undertaken of rehabilitated areas with the results compiled into an annual monitoring report for the site. Aspects to be monitored and methods to be applied are to include:

- Photographs at standard monitoring locations to show growth and condition of vegetation;
- Details of weeds present and weed control actions implemented;
- Details of any maintenance works required for rehabilitated areas;
- Weather records for current or monitoring period.

The Annual Monitoring Report is to be integrated into the overall Annual Environmental Management Report for the site.

3.7 REPORTING

A report is to be prepared for each quarterly management program based on the results of the quarterly monitoring inspections. An annual report is to be prepared for the rehabilitation areas which is to be incorporated into the Annual Site Rehabilitation Report for the quarry.

APPENDICES

APPENDIX 1
SUPPLEMENTARY PLANTING DETAILS

1. DETAILS OF VEGETATION TYPE TO BE REINTRODUCED

The following natural vegetation types are present within the site and/or dominant within the adjoining areas:

- White Gum/Spotted Gum Open Forest
- Spotted Gum/Ironbark Open Forest
- Slatey Red Gum Grassy Woodland

2. IDENTIFICATION OF REQUIREMENT FOR SUPPLEMENTARY PLANTINGS

The requirement for supplementary plantings is to be determined by the results of vegetation regrowth monitoring. Where regrowth monitoring indicates that natural regeneration is not occurring after capping is undertaken, planting is to be undertaken to supplement natural regrowth to ensure the desired cover for the target vegetation type is achieved. The methods and planting densities are to be determined by the project ecologist.

3. DETAILS OF SUITABLE SPECIES FOR SUPPLEMENTARY PLANTINGS

Suitable species for supplementary plantings, desired vegetation cover and minimum planting sizes are provided in Table A1.1 for each vegetation type to be replanted.

TABLE A1.1
FLORA SPECIES PLANTING LIST

Target Community Stratum Scientific Name	Common Name	Desired Projected Foliage Cover	Minimum Planting Size
Trees		5-30%	Tube or pot
Allocasuarina torulosa	Forest She-oak		
Corymbia glaucina	Slatey Red Gum		
Eucalyptus crebra	Narrow leafed Ironbark		
Shrubs		10-90%	Tube or seed
Acacia implexa	Hickory Wattle		
Melaleuca styphelioides	Prickly-leaved Tea Tree		
Leucopogon juniperinus	Prickly Beard-heath		
Bossiaea obcordata	Spiny Bossiaea		
Groundcovers		30-90%	Tube or seed
Themeda triandra	Kangeroo Grass		
Lomandra longifolia	Spiny-headed Mat-rush		

4. DETAILS OF SUPPLEMENTARY PLANTING METHODS

4.1 SITE PREPARATION

Capping of revegetation areas may be undertaken with crushed sandstone material in accordance with the methodology described by Buchanan (2009). Site preparation activities for all planting sites will include preliminary weed control. Bare soil areas may be sown with a native grass mix or cover crop to provide temporary soil stabilisation. Soil erosion control measures are to be implemented where necessary.

4.2 PLANT MATERIAL

Plant material used for revegetation within the project area shall be sourced from local stock. All plants are to be provided in a healthy condition.

4.3 PLANTING GUIDELINES

Planting Densities and Niche species
The Project Ecologist shall be responsible for determining planting densities and seed application rates necessary to achieve the desired cover for each stratum. The Project Ecologist shall be responsible for ensuring planting densities are achieved and appropriate niche species are utilised.

Niche preferences shall be considered in planting, with plants being placed in the correct position with regard to soil type, moisture, aspect and slope.

Planting Methods
Planting holes shall be excavated to a depth of two times the pot size. Slow release native plant fertiliser (low phosphorous formulated native plant fertilizer tablet/granules) shall be placed into the planting hole. In poorly structured soils, native plant soil mix is to be placed and incorporated into the planting hole with fertiliser and water storing granules. Plants must be placed into moistened soil preferably by soaking water into each hole. After planting the soil shall be replaced and carefully firmed, leaving a slight depression around each plant to allow for water collection. Soil is to be replaced in the hole so that the base of the stem is level with the soil surface, not set below the soil, or sitting above.

All plants are to be thoroughly watered before planting and again on a weekly basis for one month after planting. If the weather is hot, additional watering may be required.

Plant Protection
If needed tree guards and stakes are to be used around each plant and maintained throughout the maintenance period. The use of Jute mats (mulch mats) is recommended where annual or grass regrowth is expected.

Mulching
After planting, the exposed ground should be thickly mulched with low-nutrient mulch such as chipped eucalyptus. No exotic plant material is to be used. Pine bark is not considered to be a suitable mulch material. The provenance of all mulch material must be known and approved by the Project Ecologist. Mulch is not to be used in sand dunes ecosystems or bushfire inner protection areas. Care should be taken to keep mulch material away from the stems of the newly planted tubestock. Alternately, a light sowing of a suitable nurse crop (Rye Corn or Japanese Millet) can be made between plantings to provide a protective microclimate. Sowing rates to be used are those recommended by the supplier and agreed with the Project Ecologist.

Maintenance and Weed Control
Plantings must be suitably maintained (watering and weeding). During the maintenance phase any plant losses in excess of 20% of the total number planted must be replaced.

Site maintenance shall consist of the following tasks:

- Weeding throughout the planting area;
- Watering tubestock;
- Replacing lost plants (as required); and
- Removing wind-blown or other rubbish from the planting area.

The Project Ecologist shall provide a preliminary maintenance schedule which incorporates a timetable of works for each of the activities listed above.

APPENDIX 2
WEED MANAGEMENT TECHNIQUES

1. BACKGROUND INFORMATION

Weed management is to be undertaken to promote a moderate to good condition naïve vegetation cover of the targeted communities identified in Appendix 1.

The Bradley method of weed removal should be undertaken as the main method for achieving revegetation of natural bushland. Small tools such as spades, mattocks, garden forks and saws are to be used to reduce soil disturbance and minimise damage to nearby plants. In addition to hand removal of weeds in some situations where weeds are abundant, such as for many of the grass species and when native plants will not be affected by spray drift, the use of Glyphosate herbicide may be suitable in accordance with the manufacturers specifications.

Herbicides should not be applied prior to rain occurring as this reduces the effectiveness and increases the potential for herbicides to enter creeks and drainage lines in runoff.

Additionally initial capping of highly disturbed offset areas currently dominated by exotic vegetation may be undertaken with crushed sandstone material to enable weed suppression in accordance with the methodology described by Buchanan (2009).

2. WEED REMOVAL TECHNIQUES

Weeds are to be removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

2.1 Weed removal techniques for woody plants

Cut and Paint (Woody weeds to 10 cm basal diameter)
- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:
- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants resprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem Injection
- At the base of the tree drill holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Frilling or Chipping
- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:

- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

2.2 Weed removal techniques for small hand-pullable plants

Hand Removal

- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil e.g. hang in a tree, remove from site or leave on a rock.

2.3 Weed removal techniques for vines and scramblers

Hand Removal

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

2.4 Weed removal techniques for plants with underground reproductive structures

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;

- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of exotic plant species should be removed and disposed of appropriately.

3. USE OF HERBICIDES

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systematic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used biodegradable herbicides are those containing glyphosate (ZERO ®, Glyphosate 340 ® and Roundup ®).

An advantage of herbicide use is the relatively reduced amount of time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. Another advantage is that the dead weeds may provide some measure of soil stabilisation for a short period of time.

Herbicides should not be applied prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creeklines and waterways.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

Buchanan (2009), recommends that the use of herbicides should be considered when:

- There are small areas of dense weeds with few or no native plants to protect;
- There are large areas of weeds;
- The weeds are growing too rapidly for physical removal; and
- The weeds are located in areas with a high potential for erosion if vegetation is removed.

The spraying of weeds must only be undertaken by experienced and qualified persons. The success of each treatment must be evaluated by the operator after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid excess use due to the sensitivity of the wetlands and waterways into which runoff will eventually flow.

APPENDIX 3
FAUNA NEST BOX GUIDELINES

1.1 Nest Box Construction Standards

Nest boxes are to be constructed of durable timber materials such as hardwood. Nest boxes are to be appropriately sized to compensate for the types of tree hollows to be removed from adjoining areas of development. Where hollows removed from quarry areas are of suitable and practical size they may be reconstructed as nest boxes.

1.2 Protocol for the Installation of Nest Boxes

The following protocol will be utilised for the installation of nest boxes within the subject site.

i. All nest boxes are to be secured to trees at a minimum height of four metres above ground level. They are to be installed on the trunk or branch of recipient trees with shade or under a tree canopy cover.

ii. Nest boxes are to be attached to the trees using suitably durable fixing such as marine grade stainless steel bolts, or lashed to the host trees using a wire lash covered in plastic hose with suitable springs to allow for movement affixed to the nest box;

iii. Nest boxes are to be installed within the identified Biodiversity Offset Area prior to clearing works within the adjoining quarry site.

iv. Nest boxes are to be erected by an ecologist or an arborist under the supervision of the consulting ecologist;

v. Nest boxes are to be clearly numbered and their locations plotted by a GPS. A map showing these locations and numbers is to be provided in the ongoing monitoring report.

1.3 Nest Box Monitoring Requirements

Nest boxes are to be monitored by the Ecologist to determine their usage and to carry out repairs or replacement (as required) every twelve (12) months for a minimum period of five (5) years following erection. Monitoring is to be undertaken with the use of a pole mounted video camera or similar device to determine nest box occupation.

Monitoring reports are to be prepared by the ecologist after each monitoring event. Each monitoring report is to include details on the following:

- Number of nest boxes;
- A description of the condition of each nest box;
- Details on the presence of any native fauna species observed within nest boxes;
- Details of the presence of any introduced fauna species within nest boxes; and
- Suggested management actions to ensure the good condition and ongoing use of nest boxes by native fauna species.

APPENDIX 4
REHABILITATION OFFSET AREA MANAGEMENT PLAN

1. BACKGROUND

The Biodiversity Offset Strategy has identified on-site biodiversity offset area covering fifteen hectares of rehabilitated quarry area.

The establishment of the biodiversity off-set area within the site and the relevant vegetation enhancement and habitat management requirements are incorporated into this Rehabilitation Offset Area. The Rehabilitation Offset Areas are to be located on-site and incorporate previously quarried areas.

2. PLAN OBJECTIVES

The overall aim of the Rehabilitation Offset Area (ROA) is to improve the biodiversity values of the identified offset areas. The objectives of this Plan are to identify:

i. The location of the biodiversity offset areas.

ii. Actions and mechanisms to be implemented to establish at least 15ha of vegetation for biodiversity.

iii. Actions for establishing and enhancing habitat for threatened fauna species.

iv. Methods for the construction and installation of 20 fauna nest boxes.

v. A program to be implemented over a 10 year period for the ROA.

vi. Ongoing monitoring and reporting of the actions undertaken within the biodiversity offset area.

vii. Any adaptive measures or actions which could be undertaken to rectify any problems arising from the implementation of the ROA.

viii. Any other relevant matters required to be covered which may be referenced in the Approval Conditions, Environmental Assessment Report or the Statement of Commitments, (to be included as required).

ix. Any key threatening processes which can be addressed and reduced through the actions implemented in the ROA.

3. IMPLEMENTATION OF BIODIVERSITY OFFSET STRATEGY

The overall Biodiversity Offset Strategy would be implemented over a 10 year period through the actions, measures and requirements identified in the Biodiversity Offset Strategy Report.

The 10 year implementation program is directly linked to the operational (extensions) stages of the quarry works area. The expansion of the quarry area will provide physical habitat resources (eg tree hollows rocks, topsoil, overburden capping, rubble etc) from future expansion areas which will be used for habitat enhancement and as a planting substrate. Additionally, funding for implementing the ROA will become available through quarry product sales, over the 10 year implementation period.

It is expected that the works undertaken within the biodiversity offset areas during the 10 year period of the rehabilitation work will be provided with some ongoing maintenance funding or other resources until the closure of the quarry.
The works required for the biodiversity offset area, will be the responsibility of the quarry owners/operators. Where required specialist consultants or contractors will be engaged.to undertake identified works.

Drainage from the quarry area will pass through the drainage lines of the ROA after passing through the site water management structures. In this regards the runoff water flow is integrated between the quarry rehabilitation area and Rehabilitation Offset Area.

The inspections, monitoring and reporting of the progress of the ROA will be undertaken by a qualified and experienced Project Ecologist or Site Rehabilitation Environmental Consultant in association with the quarry operator.

4. ACTIONS TO BE IMPLEMENTED

The actions to be implemented within the biodiversity offset area to meet the objective of this Plan and the possible approval conditions are itemised in Table A4.1. The timing of these actions has been identified so that implementation can be undertaken progressively as the quarry area extends and both funding and salvaged resources becomes available.

The first year of the implementation of the ROA will concentrate on identifying, recording and mapping the site specific micro-features of the biodiversity offset area. This will include identifying areas of:

- Remnant native vegetation and regrowth
- Weed dominance
- Hollow tree resources
- Rock outcrops
- Drainage lines/soaks/water flows
- Fallen trees

This habitat and physical features micro-mapping will be used as a basis for determining the location and extent of a range of biodiversity management actions including:

- Suitable fence location
- Implementation of weed control strategies
- Areas for native seed/propagules collection
- Habitat/vegetation condition monitoring points
- Areas requiring erosion/sediment control
- Areas for habitat enhancement

Supplementary planting details are provided in Appendix 1 and Weed Management details are provided in Appendix 2.

Guidelines for fauna nest boxes are provided in Appendix 3.

The timing of the implementation of the actions for the management of the biodiversity offset area are provided in Table A4.1. These are separated into:

- Short term (year 1 and years 2, 3, 4).
- Medium term (years 5, 6, 7).
- Longer term (years 8, 9, 10).

TABLE A4.1 ACTIONS TO BE IMPLEMENTED (REHABILITATION OFFSET AREA)						
ACTIONS			SHORT TERM		MEDIUM TERM	LONG TERM
			YEAR 1	YEARS 2, 3, 4.	YEARS 5, 6, 7.	YEARS 8, 9, 10.
SITE RESOURCE MAPPING	A1	Complete micro habitat/site features mapping	X		X	
	A2	Identify and analyse soil erosion/sediment problems	X	X	X	X
	A3	Identify surface drainage features	X		X	
	A4	Identify habitat enhancement needs	X	X		
VEGETATION AND WEED MANAGEMENT	B1	Collect soil samples for nutrient testing	X		X	
	B2	Map main weed occurrences	X		X	
	B3	Develop weed management strategy	X			
	B4	Prepare revegetation strategy	X	X		
	B5	Collect suitable seeds for revegetation		X		
	B6	Implement revegetation strategy		X	X	X
FENCING	C1	Identify feral pest exclusion fencing requirements	X		X	
	C2	Construct exclusion Fencing		X		
	C3	Maintain exclusion fencing		X	X	X
HABITAT ENHANCEMENT	D1	Implement habitat Enhancement	X	X	X	X
	D2	Install 20 nestboxes, record locations	X			
	D3	Salvage environmental/habitat resources	X	X	X	
	D4	Undertake pre-clearance surveys		X	X	

TABLE A4.1 ACTIONS TO BE IMPLEMENTED (REHABILITATION OFFSET AREA)						
ACTIONS			SHORT TERM		MEDIUM TERM	LONG TERM
			YEAR 1	YEARS 2, 3, 4.	YEARS 5, 6, 7.	YEARS 8, 9, 10.
REPORTING/MONITORING	E1	Re-assess risks to implementation of action	X	X	X	
	E2	Implement adaptive response strategies	X	X		
	E3	Implement monitoring and reporting strategy to cover:	X	X		
		– Nestboxes	X	X		
		– Weed control	X	X		
REPORTING/MONITORING		– Vegetation growth/condition		X		
		– Revegetation areas		X		
		– Habitat enhancement measures		X		
		– Fencing condition	X			
		– Ongoing actions	X	X	X	X
		– Remedial actions	X	X	X	X

Actions to address Key Threatening Processes

The overall management of the ROA is to be undertaken with an objective of minimising and rectifying, as far as practical, any key threatening processes occurring within the biodiversity offset area. Some of the key threatening processes from historical land management which may have affected threatened biodiversity within the biodiversity offset area are:

- Loss of hollow bearing trees
- Removal of dead wood and dead trees
- Herbivory and environmental degradation caused by feral deer
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Bushrock removal
- Clearing of native vegetation
- Competition and grazing by the feral rabbit

Description of Actions to be implemented in Rehabilitation Offset Area.

A1 Micro-habitat mapping

Micro-habitat is the habitat substrate which a fauna species might utilize. Rock outcrops, drainage lines, ground hollows, tree hollows are micro-habitats within a larger landscape area.

A2 Identify and analyse soil erosion/sediment problems

Soil erosion is the removal of soil by the action of running water, often over un-vegetated areas.

Sedimentation is the accumulation of soil eroded from the land surface.

A3 Identify surface drainage features

Habitat enhancement is the provision of additional fauna or flora microhabitat features such as hollow logs, rocks, soil, mulch. This action may incorporate habitat management measures such as noxious weed control.

B1 Soil samples for nutrient testing

The nutrient levels in the soil within the offset areas particularly nitrogen and phosphorus, will provide some data on the nutrient states of the soils in comparison to natural nutrient levels. These soil samples will be laboratory tested to provide information on how the soil nutrient levels can be managed during site rehabilitation and revegetation.

B2 Map Noxious Weed Management

The extent of noxious weeds within the biodiversity offset areas is required to be determined so that weed control and management activities can be directed to the area where weeds are present. A map of the weed occurrences for the biodiversity offset areas will be prepared at a scale of 1:500 or 1:1000.

B3 Develop weed management strategy

Weed management is the control of spread or removal of an identified weed source. Weed management techniques are described in Appendix 1.

B4 Revegetation Strategy

Revegetation is the introduction of plant species into an identified area to achieve a particular purpose such as; soil stability, native species enrichment, fauna habitat/feeding resources or for vegetation community structure purposes. Assisted regeneration of the native species is part of the revegetation strategy. Further details on site revegetation are provided in Appendix 1.

B5 Collect suitable seeds for revegetation

Native species within the site suitable for revegetation include:

- *Allocasuarina littoralis*
- *Callistemon citrinus*
- *Doryanthes excels*
- *Kunzea ambigua*
- *Leptospermum spp.*
- *Themeda triandra*

Seeds from these species will be obtained for revegetation purposes through direct seed collection when suitable seeds are available or by cutting seed baring branches. These branches will be placed over a suitably prepared seedbed within the revegetation areas. Additional native grass seeds may be required if insufficient seed resources are available from within the site.

B6 Implement Revegetation Strategy

Revegetation within the three identified native plant revegetation areas in the offset areas. The revegetation details are identified in Appendix 1.

C1 Identify protective fencing requirements
Parts of the offset area are already fenced however the location, type and condition of this fencing does not exclude feral deer from grazing within the site. The existing fence is to be inspected and the location of more appropriate pest exclusion fencing is to be determined.

C2 Construct pest exclusion fencing
Protective fencing is to be constructed around the revegetation areas as determined following action C1 above.
Fenced areas will be provided with 3 metre wire vehicle access gates.

C3 Maintain deer exclusion fencing
Fencing is to be maintained in an operational condition at all times. The condition of the fencing is to be reported on during the regular monitoring inspections.

D1 Implement habitat enhancement measures
The various habitat enhancement measures (as per action A4 above) are to be implemented as habitat resource material becomes available and at the locations determined from action A3.

D2 Install 20 nestboxes
The details of the nest boxes (size, location, utilization etc) are to be provided with the initial annual Monitoring Report.

D3 Salvage environmental/habitat resources
Any useful materials such as tree hollows, rocks, mulch, topsoil, capping rubble from areas of quarry expansion will be relocated to the biodiversity offset area for revegetation or habitat enhancement purposes.

D4 Undertake pre-clearance Surveys
All hollow bearing trees are to be checked prior to clearing by a nocturnal spotlight survey by the Ecologist. Any trees which contain fauna are to be sectionally dismantled or otherwise selectively and carefully cleared by controlled felling and machinery assisted lowering to minimise impact to any occupying fauna. Records of these pre-clearance surveys are to be maintained by the Ecologist and provided in the annual report.

E1 Re-assess risks to implementation of action
Each action is to be reviewed on an annual basis to determine if the action/risk/implementation has been successfully undertaken. Additionally an analysis to determine if the changing site conditions require modifications to the actions will be undertaken on an annual basis.

E2 Undertake adaptive response Strategies
Any strategies/actions required to be undertaken as a response to non-compliance, or poor performance of the actions are to be identified as part of the regular reporting program.

E3 Implement monitoring and reporting strategy
Apart from any reporting or inspections undertaken to implement any actions identified for the biodiversity offset area a monitoring progress inspection is to be undertaken every 3-4 months with an annual monitoring report covering all of the actions in Table 2.1 to be completed.

5. MONITORING OF PERFORMANCE AND COMPLETION CRITERIA

Each action identified in Table A4.1 will be monitored, seasonally as required or on an annual basis (for 10 years) to determine if the action has been implemented and whether the action is successfully working towards the objectives of the ROA. Once the actions have been evaluated at the end of the first year of the management plan the relevant performance/completion criteria can then be further refined for each criteria. A record of actions implemented including dates, locations and action details is to be kept for monitoring purposes. This reporting of actions is to be undertaken by the landowner. Monitoring of biodiversity offsets is to be undertaken on an annual basis under the approval. Monitoring is required to assess the establishment and maintenance of at least 15 ha of Woodland vegetation and report on any nest box maintenance or replacement necessary over the initial 10 years. Implementation and monitoring details are provided in Table A4.2.

Vegetation Quadrat Monitoring

Biodiversity offset areas are to be monitored annually with fifteen fixed 100m^2 monitoring quadrats. The following is to be assessed for each of the monitoring quadrats:

- Floristics;
- Native plant cover;
- Exotic plant cover;
- Plant regeneration (including percentage survival for plantings);
- Signs of surface erosion and sedimentation;
- Presence of feral animals;
- Natural Disturbance;

Results of the monitoring surveys are to be provided in annual monitoring reports, provided to the Department of Planning and Environment.

A frame work for assessing the identified actions against performance criteria will be incorporated into any subsequent plan when the first year actions have been reported.

Nest Box Monitoring

The condition and use of the nest boxes will be monitored annually during the September – December season breeding period.

Photo Point Monitoring

A photopoint monitoring station will be positioned in each of the vegetation monitoring quadrats.

TABLE A4.2 IMPLEMENTATION AND MONITORING DETAILS FOR PROPOSED ACTIONS			
Action		**Performance / Completion Criteria**	**Monitoring**
RESOURCE MAPPING	Complete micro habitat/site features mapping	Provide appraisal map of existing habitats Provide map of all created habitat features. Maps to cover 100% of offset site	Complete visual inspection and provide photo monitoring and appraisal map with 1st year monitoring report Monitor habitat supplementation progress annually and provide final map of habitat features on completion with 10th year monitoring report.
	Identify and analyse soil erosion/sediment problems	Provide map of any erosion and sedimentation identified Provide photographic evidence of rectification of 100% of problem areas in following annual reports.	Complete visual inspection and provide photo monitoring, map and report on details for each annual monitoring inspection
	Identify surface drainage features	Provide appraisal map of existing surface drainage features. Maps to cover 100% of offset site.	Complete visual inspection and provide photo monitoring and appraisal map with 1st year monitoring report
	Identify habitat enhancement needs	Provide map of locations of proposed habitat enhancement works in baseline monitoring report. Map to cover all enhancements proposed for short term works (first 4 years) and medium term works (4-7 years) At minimum map to include locations for nest boxes, ground logs, rock armouring of drainage lines and rock pile/habitat works	Complete and provide photos and map of proposed habitat enhancement locations and details. Provide timeline for works. Include with 1st year monitoring report
VEGETATION AND WEED MANAGEMENT	Collect soil samples for nutrient testing	Collect and analyse at least 4 soil samples	Complete and provide soil lab results with 1st year monitoring report
	Map main weed occurrences	Map occurrences of noxious weeds for 100% of offset areas	Complete visual inspection and provide photo monitoring and appraisal map with 1st year monitoring report

TABLE A4.2 IMPLEMENTATION AND MONITORING DETAILS FOR PROPOSED ACTIONS			
Action		**Performance / Completion Criteria**	**Monitoring**
			Repeat every 2 years for duration of works
	Develop weed management strategy	Provide locations, works methods, target species and target reductions for all noxious weed occurrences mapped with baseline monitoring report.	Adapt weed management strategy as dictated by monitoring success levels to achieve suppression of targeted infestation areas
	Implement revegetation strategy	Revegetate areas where dense weed infestations have been removed, areas subject to capping and any remediated drainage lines. Revegetation must achieve moderate to good condition cover based on benchmark of target community within 5-10 years	Complete visual inspection and provide photo monitoring and appraisal map every 12 months
FENCING	Identify protective fencing requirements	Provide map of proposed deer exclusion fencing locations	Provide details with 1st year monitoring report
	Construct protective fencing	All protective fencing to be erected in coordination with revegetation works and to be completed within 4 years of program commencement	Complete visual inspection and provide photo monitoring annually until all proposed fences are erected.
	Maintain protective fencing	Protective fencing to be checked monthly Any fence damage to be repaired as soon as possible	Complete visual inspection and provide photo monitoring of any fence damage every 12 months
HABITAT ENHANCEMENTS	Implement habitat enhancement	All habitat enhancements proposed in baseline monitoring report to be implemented progressively over 10 years	Complete visual inspection and provide photo monitoring every 12 months. Report on compliance with proposed timeline of works
	Install nest boxes, record locations	All nest boxes to be installed and map to be provided within baseline monitoring report. Nest boxes to be maintained in good condition for at least 10 years	Complete visual inspection and provide photo monitoring of all nest boxes every 2 years
	Salvage environmental/habitat resources	All identified habitat resources within proposed quarry areas to be	Complete visual inspection and provide photo monitoring of all

TABLE A4.2 IMPLEMENTATION AND MONITORING DETAILS FOR PROPOSED ACTIONS			
Action		**Performance / Completion Criteria**	**Monitoring**
		progressively relocated to offset areas in unison with quarry staging	salvaged resources installed in offset area. Provide with annual monitoring reports as necessary.
	Undertake pre-clearance surveys	Complete for all hollow bearing trees and provide certification letter for each stage on completion of clearing works	No monitoring required.

6. POTENTIAL RISK AND CONTINGENCIES

Each action listed in Table A4.3 will be re-assessed each year for both the risk of the action failing or for not being successfully implemented. The contingency to be identified will be a further action, response or adaptive measure to be implemented to address the shortcomings of the action within the reporting period. The reporting process for risks to actions failing or not successfully being implemented will be incorporated into any revised plan when the success or otherwise of the actions have been reported.

TABLE A4.3 POTENTIAL RISKS AND CONTINGENCIES FOR PROPOSED ACTIONS			
Action		**Risk**	**Contingency**
RESOURCE MAPPING	Complete micro habitat/site features mapping	Mapping and identification is not completed on time or to a satisfactory level	Extend works period to reflect any delay in commencement.
	Identify and analyse soil erosion/sediment problems	Mapping and identification is not completed on time or to a satisfactory level	Extend works period to reflect any delay in commencement.
	Identify surface drainage features	Mapping and identification is not completed on time or to a satisfactory level	Extend works period to reflect any delay in commencement.
	Identify habitat enhancement needs	Mapping and identification is not completed on time or to a satisfactory level	Extend works period to reflect any delay in commencement.
VEGETATION AND WEED MANAGEMENT	Collect soil samples for nutrient testing	Work is not completed on time or to a satisfactory level	Extend works period to reflect any delay in commencement.
	Map main weed occurrences	Weed management strategy fails to supress target weed infestations	Modify control methods to achieve targets
	Develop weed management strategy	Weed management strategy fails to supress target weed infestations	Modify control methods to achieve targets
	Implement revegetation	Revegetate areas where	Replace excessive

TABLE A4.3 POTENTIAL RISKS AND CONTINGENCIES FOR PROPOSED ACTIONS			
Action		**Risk**	**Contingency**
	strategy	dense weed infestations have been removed, areas subject to capping and any remediated drainage lines. Revegetation must achieve moderate to good condition cover based on benchmark of target community within 5-10 years	planting losses and adjust species composition to exclude unsuccessful species Ensure initial soil preparation, watering, herbivore exclusion and weed suppression is adequate
FENCING	Identify protective fencing requirements	Plantings are excessively damaged by animals or natural disturbances	Provide additional fencing
	Construct protective fencing	Fences are excessively damaged by animals or natural disturbances	Change style of fencing and/or repair damaged sections
	Maintain protective fencing	Fences are excessively damaged by animals or natural disturbances	Change style of fencing and/or repair damaged sections
HABITAT ENHANCEMENTS	Implement habitat enhancement	Habitat enhancements are not installed within timeframe required	Extend works period as necessary until completion is achieved
	Install 36 nest boxes, record locations	Nest boxes become damaged or decay	Provide replacement nest boxes
	Salvage environmental/habitat resources	Habitat enhancements are not installed within timeframe required	Extend works period as necessary until completion is achieved
	Undertake pre-clearance surveys	Works are not undertaken	Document during annual monitoring report