Rehabilitation and Landscape Management Plan

Hanson
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Calga Sand Quarry

Rehabilitation and Landscape Management Plan

Compiled by:

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CONTENTS

Page

APPENDICES

CONTENTS

Page

FIGURES

TABLES

1. INTRODUCTION

Development consent for Stage 3 of the Calga Sand Quarry ("the Quarry") was granted by the Minister for Planning on 28 October 2005 (DA 94-4-2004) on the condition that a Rehabilitation and Landscape Management Plan be prepared for the Quarry. Hanson Construction Materials Pty Ltd (Hanson) now own and operate Calga Sand Quarry. *Condition 3(22)* of DA 94-4-2004 is as follows.

Rehabilitation and Landscape Management Plan

22. Within 6 months of the date of this consent, the Applicant shall prepare and subsequently implement a Rehabilitation and Landscape Management Plan for the development in consultation with Council and DEC, and to the satisfaction of the Director-General: This plan must:

a) identify the areas likely to be disturbed by the development;

b) describe in general the short, medium, and long-term measures that will be implemented to rehabilitate the site;

c) describe in detail the measures that will be implemented over the next 5 years to rehabilitate the site;

d) describe how the performance of these measures will be monitored over time;

e) set completion criteria for the rehabilitation of the site;

f) include a Vegetation Clearing Protocol, a Pest and Weed Management Plan, and a Landscape Plan; and

g) include a program to monitor the development's effects on vegetation, including threatened species and groundwater dependent ecosystems."

This document is the first revision of the initial Rehabilitation and Landscape Management Plan dated August 2006 and has been prepared to address the requirements of *Condition 3(22)* and to reflect the experience Calga Sand Quarry has gained since 2006 during its operation of the Quarry. This document is presented as five sections as follows.

Section 1: introduces the requirements of and format of the Plan.

Section 2: identifies those areas to be disturbed over the life of the Quarry and since 2006.

Section 3: presents a rehabilitation plan for the Quarry including a description of rehabilitation objectives and procedures, detailed information on rehabilitation during the next 5 years of Quarry operations (to August 2016). A more conceptual description of medium and long term Quarry rehabilitation is also provided.

Section 4: presents completion criteria for rehabilitation of the site and outlines the monitoring and reporting to be undertaken to measure the performance of Quarry rehabilitation and landscaping against these criteria.

Section 5: describes the more targeted monitoring to be undertaken to measure the impact of the Quarry (if any) on native vegetation and in particular, threatened species and groundwater dependent ecosystems.

The Plan also includes a set of four appendices as follows.

Appendix 1: presents a tabulated list of the consent conditions relevant to the preparation and management of the Plan along with where each conditional requirement is addressed within the Plan.

Appendix 2: presents a Vegetation Clearing Protocol for the quarry.

Appendix 3: presents a Pest and Weed Management Plan for the quarry.

Appendix 4: presents a plan for Acoustic Bund wall Rehabilitation.

2. THE CALGA SAND QUARRY

Figure 2.1 presents the layout for the Calga Sand Quarry as at 13 November 2016 and **Figure 2.2** presents the Quarry design. The Quarry Site, including both the original (Stage 1 and 2) and extended Quarry (Stage 3), covers an area of 32.5ha and is wholly contained within Lot 2, DP 229889 owned by Hanson. Of this 32.5ha area, Stage 1 and 2 of the Quarry make up 13.5ha, Stage 3 is 11.8ha, the acoustic bund wall covers an area of 2ha with the remaining 5.2ha to be maintained as a vegetated drainage area retained for landscaping purposes as a buffer zone to the Quarry.

The land to be disturbed has been highly modified from its original form by historic land uses including small scale agriculture. The majority of this area is characterised by exotic grasses and weeds with some scattered native trees and shrubs. **Figure 2.1** presents an aerial photograph of the Quarry Site which illustrates the cleared nature of the majority of the area to be disturbed by the Quarry.

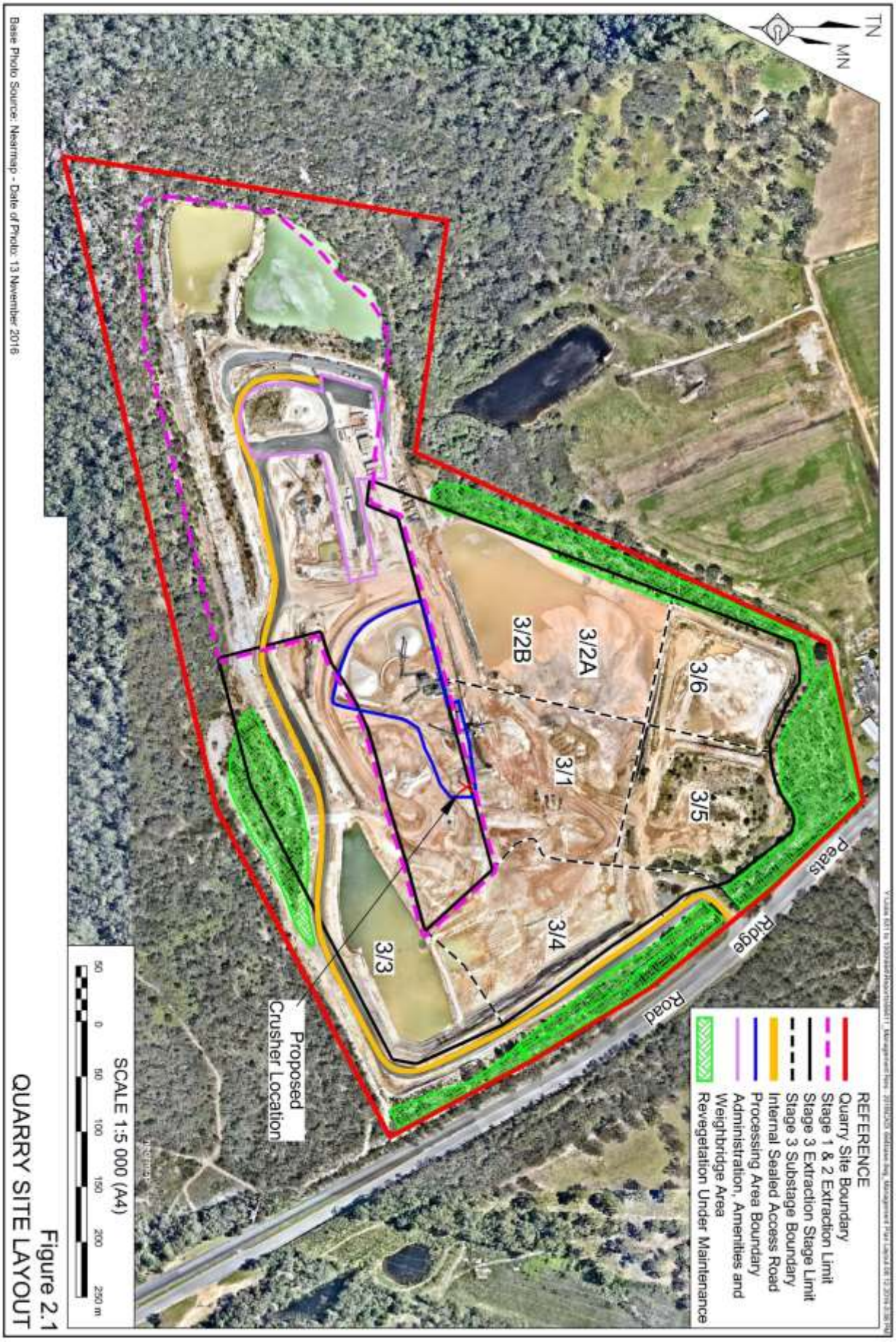

Figure 2.1
QUARRY SITE LAYOUT

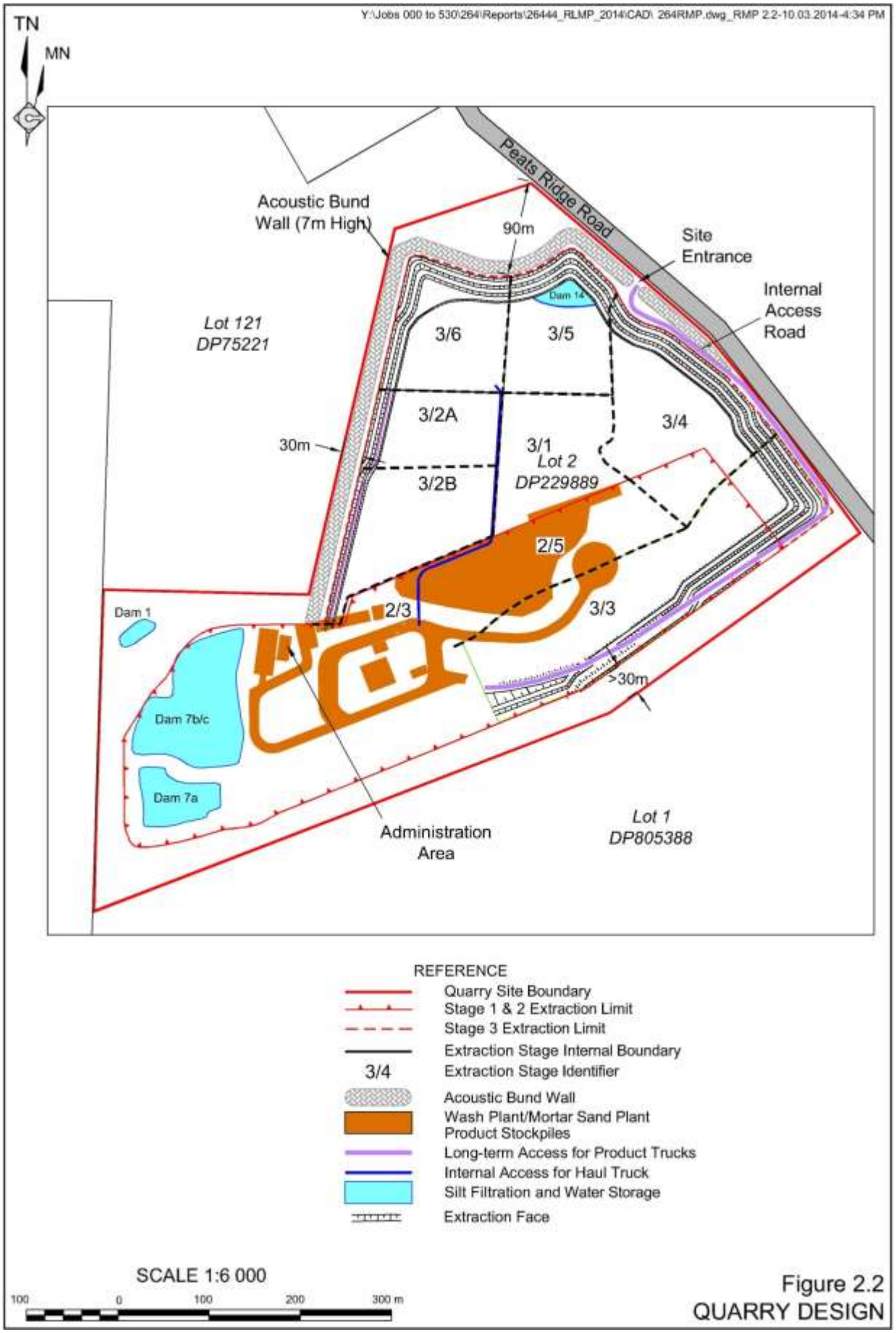

Figure 2.2
QUARRY DESIGN

3. REHABILITATION PLAN

3.1 INTRODUCTION

Figure 3.1 presents the sequence of extraction and rehabilitation for the Quarry which is based on the indicative extraction and rehabilitation sequence presented in a report titled "Amendment to a Proposal Submitted as Development Application (DA 94-4-2004) for an Extension to the Calga Sand Quarry" (R.W. Corkery & Co. Pty. Limited, 2005).

The following subsections present the objectives of rehabilitation management at the Quarry (Section 3.2), provide a detailed description of the rehabilitation proposed for the five year period of quarry development August 2016 (Section 3.3), outline the conceptual development of the rehabilitated landform in the medium and long term (Section 3.4) and describe the rehabilitation procedures to be implemented (Section 3.5).

Information on Landscape Management, whilst a complimentary activity to the rehabilitation of the Quarry is provided as a separate Landscape Management Plan as **Appendix 4** to this document.

3.2 REHABILITATION OBJECTIVES

In the short term, the objectives of rehabilitation will continue to stabilise all earthworks, drainage lines and disturbed areas no longer required for quarry-related activities in order to minimise erosion and sedimentation, and to reduce the visibility of the activities from adjacent properties and the local road network. Erosion control will be achieved by the early establishment of a ground cover.

The rehabilitation objectives are as follows.

- To produce a stable final landform able to support a range of alternative final land uses.
- To provide a number of water storages to facilitate the subsequent use of the land for agricultural or horticultural purposes.
- To minimise the environmental impact of all site earthworks associated with environmental controls and rehabilitation activities.
- To optimise the use of available overburden and soil as a substrate for vegetation.
- To achieve a stable and functional drainage system at the site under extreme rainfall events.

To achieve these short and long term objectives, a range of short, medium and long term rehabilitation procedures will be employed, and presented with reference to particular areas of disturbance on the Quarry Site. These procedures (presented in Section 3.5) have intentionally been presented as a broad outline to the approach to be taken to the rehabilitation of each of these areas. Section 3.3 presents a detailed rehabilitation plan for the period to February 2019. Any refinements to the proposed rehabilitation of the Quarry as proposed within Sections 3.3 and 3.4 will be documented in each Annual Environmental Management Report (AEMR) for the Quarry.

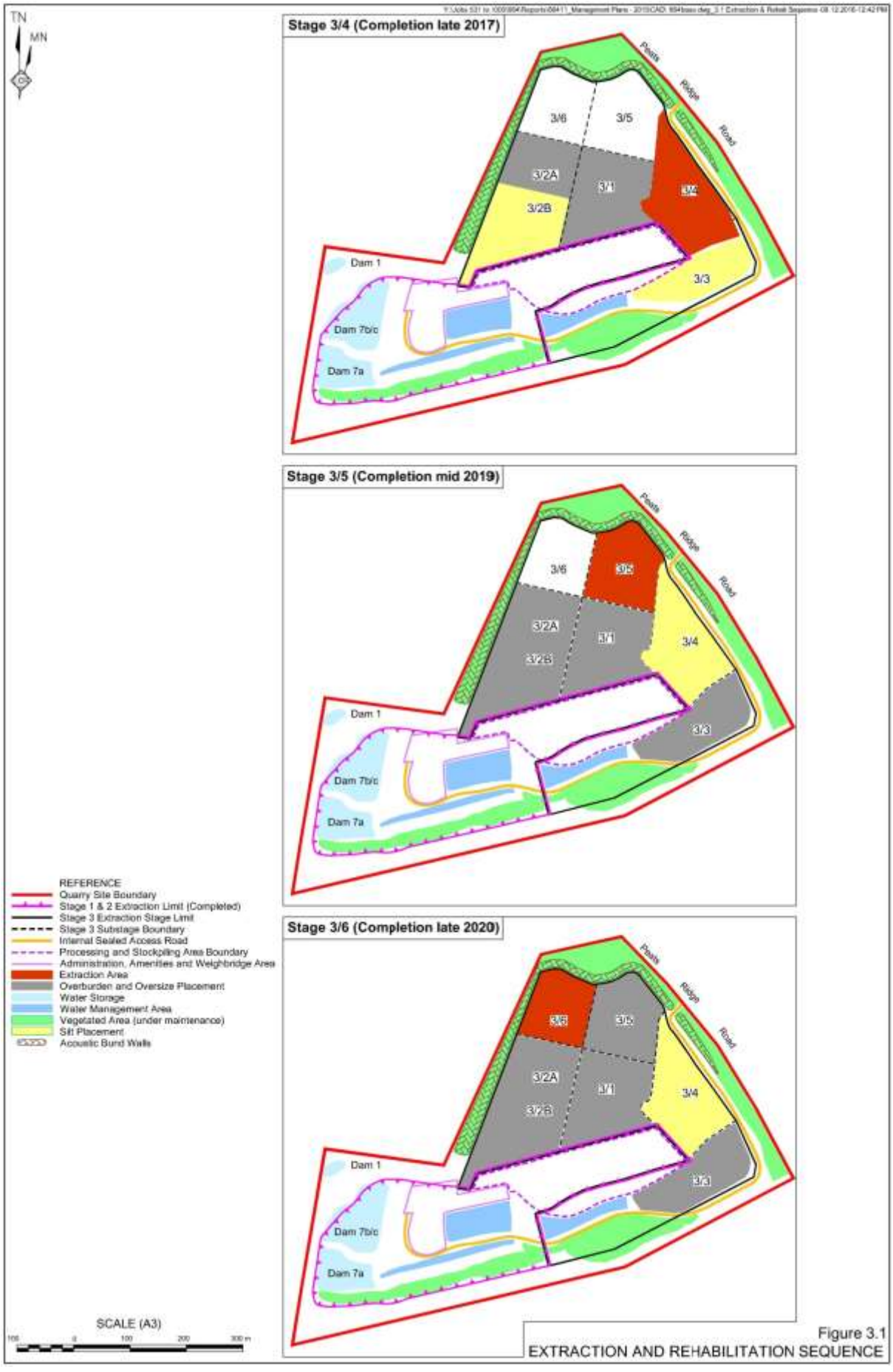

Figure 3.1
EXTRACTION AND REHABILITATION SEQUENCE

3.3 REHABILITATION PLAN

3.3.1 Introduction

Figure 3.1 presents the proposed areas of rehabilitation at the Quarry throughout Stage 3 of the quarrying operations. The proposed rehabilitation presented reflects the indicative extraction and rehabilitation sequence. The Project will maintain the rehabilitation objectives proposed in this plan in conjunction with DA 94-4-2004.

3.3.2 Proposed Rehabilitation Activities

The following rehabilitation activities will be undertaken progressively at the Quarry .

- Rehabilitation activities at the Quarry would continue to focus on monitoring and maintenance of the acoustic bund wall as required throughout this rehabilitation period. Particular attention will be paid to the maintenance of native tree and shrub species on the slopes and top of the earth mound and management of noxious weed species. Once the noxious weeds that are established on each of the bunds are reduced to an acceptable level, particular attention will be paid to the establishment of native tree and shrub species on the slopes and along the top of the bunds (see **Appendix 4** for detail).
- Rehabilitation works within the Stage 1 and 2 quarry areas will continue to be monitored and maintained with weed spraying undertaken on both the rehabilitated and undisturbed areas of the Quarry Site.
- Completed Silt Cells in Stages 3/1, 3/2, 3/3 and 3/4 will be capped with overburden and oversize material and compacted once they reach capacity and the silt retained in each cell is allowed to consolidate.

3.3.3 Proposed Operational Activities

- Extraction will continue within Stage 3/4 to 3/6.
- The silt produced by the washing of the raw sand will be transported to a Silt Cell within Stage 3/3.

3.4 MEDIUM AND LONG TERM REHABILITATION OF THE QUARRY

Figure 3.1 presents the stage by stage extraction and rehabilitation sequence of the Quarry, demonstrating the anticipated progress of medium and long-term rehabilitation. In the medium term, rehabilitation will be primarily focused on the completion, capping and stabilisation of silt cells. It will only be in the long-term that the final landform, designed as free draining and gently sloping to the southwest, approximately 15m to 25m below the pre-extraction elevation, will be fully formed and stabilised. **Figure 3.2** presents this final landform.

Drainage will be designed to provide runoff to the southwest controlled along two separate channels, namely:

i) maintenance of the existing southern channel flowing approximately east to west along the southern perimeter of the Quarry; and

ii) a broad, southwest / northeast-oriented central channel through Stages 3/1, 3/3, which will, in turn drain to two dams (Dams 7a and 7b/c) adjacent to the western margin of the 2005 amended Quarry Site.

A drain is to be constructed around the outside of the acoustic band wall to aid in water retention and flow to neighbouring properties.

It is envisaged that the vegetation progressively established on the silt cells will provide for open grassland areas that will be suitable for ongoing agricultural/horticultural use.

The vegetated acoustic bund wall will be retained to minimise any impact on the established vegetation, although a decision might be made to remove the 2m high fence atop the earth mound. The Quarry perimeter will be revegetated with native tree and shrub species.

3.5 REHABILITATION PROCEDURES

3.5.1 Silt Cells

The silt generated from the Wash Plant will be stored on the Quarry floor in a series of silt cells. These cells will be constructed within the confines of sound undisturbed rock walls.

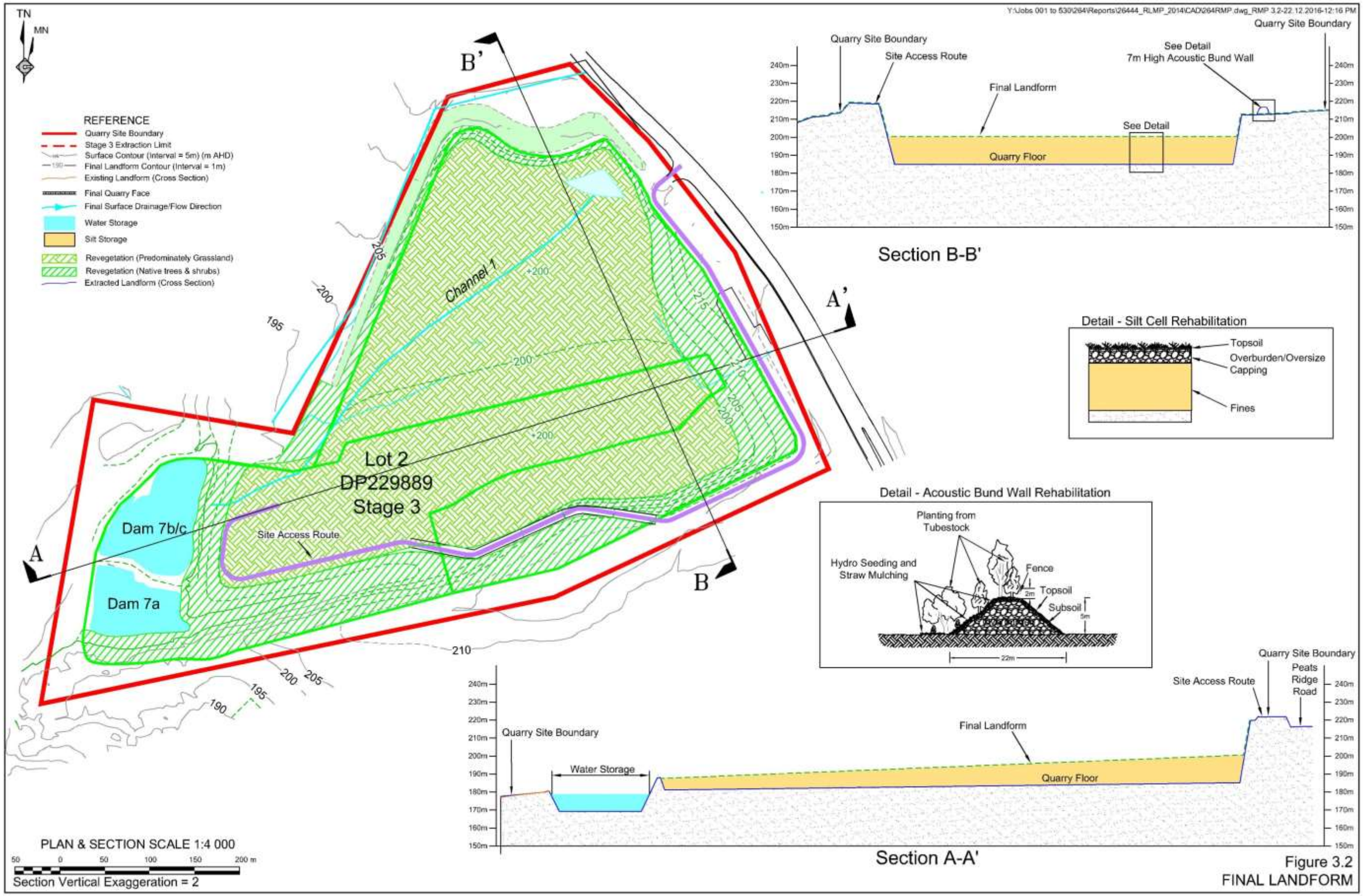

Figure 3.2
FINAL LANDFORM

On completion of each cell, the fines will be allowed time to consolidate after which they will be capped with overburden and oversize material to stabilise the surface of each cell. After the silt cells are capped, and providing they are not required for any other land use, the capped surface will be covered with a layer of topsoil to a depth of approximately 0.15m. Whenever possible, this topsoil will be directly transferred from an active stripping area elsewhere within the Quarry. This area will then be either sown using native seed and tubestock with species listed in **Table 3.1** or sterile Japanese Millet and a range of pasture species. An indicative cross-section of a rehabilitated silt cell is provided in the detail of **Figure 3.2**.

Table 3.1
Revegetation Species

Acacia linifolia	*Davesia acicularis*	*Mirbelia rubiifolia*
Acacia myrtifolia	*Dodonaea triquetra*	*Mirbelia speciosa*
Acacia oxycedrus	*Eucalyptus eugenioides*	*Ozothamnus diosmifolium*
Acacia suaveolens	*Eucalyptus haemastoma*	*Patersonia mixed species*
Acacia ulicifolia	*Eucalyptus puntata*	*Pultenaea ferruginea var deanei*
Acacia terminalis	*Eucalyptus racemosa*	
Acacia prominens	*Glycine clandestina*	**Grasses**
Banksia ericifolia	*Hardenbergia violacea*	*Anisopogon avenaceus*
Banksia obtusifolia	*Hakea dactyloides*	*Austrodanthonia tenuior*
Banksia serrate	*Hakea gibbosa Hakea sericea*	*Cymbopogon refractus*
Boronia ledifolia	*Isopogon anemonifolius*	*Dichelachne crinita*
Bossiaea stephensonii	*Isopogon anethifolius*	*Dichelachne micrantha*
Bossiaea hetraphylla	*Juncus continuus*	*Dichelachne rara*
Allocasuarina littoralis	*Kunzea ambigua*	*Echinopogon caespitosus*
Allocasuarina torulosa	*Kunzea capitata*	*Echinopogon ovatus*
Conospermum longifolium	*Leptospermum polygalifolium*	*Entolasia stricta*
Conospermum taxifolium	*Leptospermum species to be identified*	*Eragrostis brownie*
Callitris rhomboidea	*Lomandra longifolia*	*Eragrostis leptostachya*

3.5.2 Quarry Floor

Much of the Quarry floor will be covered by silt cells and as a result rehabilitation will be undertaken as described in Section 3.5.1. In those areas where silt cells are not present, overburden and/or oversize rock material will be used to produce the desired gently sloping land profile, and a topsoil cover of approximately 0.15m placed over the profiled ground. The majority of the Quarry floor will be sown using native seed and tubestock with species listed in **Table 3.1** or sterile Japanese Millet and a range of pasture species.

3.5.3 Quarry Perimeter

The Quarry perimeter is effectively the area between the edge of the extraction area and the acoustic bund wall. Areas disturbed within this zone, e.g. access roads, stockpiles, will be ripped and profiled to provide the preferred landform. Where necessary, overburden from the quarrying operations will be utilised to aid in the creation of the final landform.

Where disturbance has resulted in the removal of a soil layer, topsoil previously stockpiled on-site will be placed to a depth of approximately 0.15m, and covered with any broken tree trunks and branches cleared as part of pre-stripping activities. Progressive rehabilitation of the

acoustic bund and perimeter areas is ongoing, with targeted weed maintenance and revegetation using native seed or tubestock (in accordance with **Table 3.1**) already undertaken with success.

Species to be used for revegetation are set out in **Table 3.1** with planting and sowing generally taking place in autumn to maximise the survival rates.

3.5.4 Infrastructure

After the completion of the extraction and processing operations, all infrastructure will be removed from the Quarry Site. Areas on the Quarry perimeter will be rehabilitated in accordance with the procedures set out in Section 3.5.3, while those areas on the Quarry floor, such as the internal access roads, stockpiles and processing plant sites, revegetated in a similar fashion to that set out in Section 3.5.1 and 3.5.2. Where necessary, the internal roads completed on solid sandstone will be cross-ripped to assist with plant growth.

3.5.5 Management of Weeds and Ongoing Rehabilitation

Hanson will maintain its current weed management strategy, which involves selective weed spraying programs throughout the year. Hanson will continue to use the services of an ecological or rehabilitation consultant to monitor the revegetation of completed areas of the Quarry and the spread of noxious weeds. Hanson will continue to document completed and planned rehabilitation work in each AEMR.

4. COMPLETION CRITERIA, MONITORING AND REPORTING

4.1 COMPLETION CRITERIA

Completion criteria for rehabilitation of the Quarry Site reflect the intended final land use for agriculture. The following criteria are considered appropriate in the consideration of the rehabilitation status of the Quarry Site.

Water Resources

- The quarry site will be free-draining to the southwest without any pooling of water.
- Water quality on and discharged from the Quarry Site will consistently meet the standards set in the Site Water Management Plan.

Water Storage Structrures

- Dam 7a and Dam 7b/c will remain in the final landform and drain freely into Cabbage Tree Creek, consistent with current discharge from the dams (during periods of heavy rainfall).
- Dam walls would be assessed for structural stability. The dams would be free draining and all Quarry Site infrastructure such as pumps removed.
- The condition of Dam 7a and Dam 7b/c would be reported in a closure report.

Erosion and Sediment Control

- All drainage lines will be stabilised. Discharge from the Quarry Site will remain consistent with the suspended solids criteria established in the Site Water Management Plan.
- Dust deposition monitoring results will meet the criteria nominated in DA 94-4-2004.

Vegetation Cover

- The majority of the Quarry Site will be revegetated to grassland suitable for grazing activities. Approximately 70% of areas designated for agricultural use will have vegetation cover. The remainder of the site,with the exception of the retained Quarry walls, will have a vegetative cover of native trees and shrubs. Based on existing revegetation activities and management of these areas it is anticipated that approximately
  65-70% of areas designated for native shrubs and trees will have vegetation cover at closure. The lower percentage cover in these areas allows for spacing of plants to encourage natural development of vegetation to a point where it is self-sustaining (see **Figure 3.2**).

Species Diversity

- Of the species included in the revegetation program (**Table 3.1**), approximately 75% will be represented in the final landform.

Threatened Species

- Monitoring of the threatened plants *Darwinia glaucuphylla* and *Hibbertia procumbens* is reported in the AEMR. Monitoring in 2013, 2014 and 2015 was unable to identify *Hibbertia procumbens* in the original locations with Cumberland Ecology concluding that the species is either not present in the not present within the Quarry Site or not able to be located and noting the possibility that this species was incorrectly identified in original surveys.
- Cumberland Ecology has also noted natural variation in the *Darwinia glaucuphylla* population within the Quarry Site with originally located plants dying back in some locations and new plants evident in new locations. This is consistent with a self-sustaining population and indicates no impact from Quarry activities.
- It is not considered appropriate to set specific completion criteria for the populations of the threatened flora species, *Darwinia glaucuphylla* and *Hibbertia procumbens,* identified on and adjacent to the Quarry Site. A closure report will summarise final plant locations and condition consistent with the annual reporting requirements. It is assumed that management of these populations will continue through monitoring and reporting in the AEMR until site closure. ,

Noxious Weeds

- The noxious weeds identified within the Quarry Site, namely, Crofton Weed, *Ageratina adenophora*, and Blackberry, *Rubus fruticosus*, will be removed and their distribution restricted, as much as practically possible. Progress with weed management is reported in each AEMR and a target of no more than 5% total weed cover is used as a goal for adaptive management. Weed distribution will be reported in a closure report with Crofton Weed, Ageratina adenophora, and Blackberry, Rubus fruticosus completely eradicated and remaining weeds limited to no more than 5% of vegetation distribution. A target of 5% of weed cover is based on evidence from existing successfully revegetated areas within the Quarry where areas that are considered complete continue to have 5% weed cover even with annual weed control programs.

4.2 MONITORING

Monitoring the progress of rehabilitation will be undertaken by an ecological or rehabilitation consultant.

As has previously been undertaken at the Calga Sand Quarry, rehabilitation areas will be defined and the works undertaken within each area during the previous 12 months identified. A

summary of rehabilitation activities will be included in the AEMR. Areas where rehabilitation has commenced will be inspected annually and the relative progress against the relevant completion criteria noted in Section 4.1 will be documented. In addition, the number and distribution of the two threatened flora species identified on or adjacent to the Quarry Site and the condition of groundwater dependent ecosystems identified to the south of the Quarry will be documented.

Other monitoring relevant to the rehabilitation of the Quarry Site is likely to include:

- surface water quality monitoring at the discharge points from the Quarry Site and representative upstream sites;
- groundwater levels in quarry piezometers and domestic bores of surrounding land owners; and
- dust deposition at six locations external to the Quarry Site.

Hanson will commission an environmental consultant to undertake this monitoring in accordance with Site Water Management Plan and Air Quality Monitoring Program .

4.3 REPORTING

Monitoring of surface water, groundwater and dust deposition will be reported to Hanson. These results, and the results of annual rehabilitation progress monitoring, will be reported in each AEMR for the Quarry.

5. OFF-SITE MONITORING

As described in Section 4.1, monitoring the number and distribution of the threatened species, *Darwinia glaucuphylla* and *Hibbertia procumbens* and the condition of groundwater dependent ecosystems will be undertaken on an annual basis. Each of the individual or sub-population locations previously identified on the Quarry Site and adjoining land will be inspected and the condition of the individual or sub-population documented. Reference to salient recent meteorological conditions will be made and commentary on the general status of surrounding vegetation provided. Opportunistic searches of the Quarry Site and adjoining land will be conducted during targeted surveys to determine whether any additional individuals or sub-populations of the targeted threatened flora species are present.

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Appendices

(Total No. of pages including blank pages = 20)

Appendix 1	Relevant Consent Conditions for the Preparation of a Rehabilitation and Landscape Management Plan for Stage 3 of the Calga Sand Quarry
Appendix 2	Vegetation Clearing Protocol for Stage 3 of the Calga Sand Quarry
Appendix 3	Pest and Weed Management Plan for Stage 3 of the Calga Sand Quarry
Appendix 4	Acoustic Bund Wall Rehabilitation for Stage 3 of the Calga Sand Quarry

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Appendix 1

Relevant Consent Conditions for the Preparation of a Rehabilitation and Landscape Management Plan for Stage 3 of the Calga Sand Quarry

(Total No. of pages including blank pages = 4)

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Table A1
Relevant Development Consent Conditions

DA 94-4-2004 Reference	Condition	Section / Reference in Plan
22 (Sch.3)	Within 6 months of the date of this consent, the Applicant shall prepare and subsequently implement a Rehabilitation and Landscape Management Plan for the development in consultation with Council and DEC, and to the satisfaction of the Director-General: This plan must:	
	a) identify the areas likely to be disturbed by the development;	2.0
	b) describe in general the short, medium, and long-term measures that would be implemented to rehabilitate the site;	3.2
	c) describe in detail the measures that would be implemented over the next 5 years to rehabilitate the site;	3.3
	d) describe how the performance of these measures would be monitored over time;	4.2
	e) set completion criteria for the rehabilitation of the site;	4.1
	f) include a Vegetation Clearing Protocol, a Pest and Weed Management Plan, and a Landscape Plan; and	Appendices 2, 3 & 4
	g) include a program to monitor the development's effects on vegetation, including threatened species and groundwater dependent ecosystems.	5.0
23 (Sch.3)	Within 4 years of providing the Rehabilitation and Landscape Management Plan to the Director-General, and every 5 years thereafter, the Applicant shall review and update the plan to the satisfaction of the Director-General.	3.2
10 (Sch. 5)	Within 1 month of the approval of any management plan/strategy or monitoring program required under this consent (or any subsequent revision of these management plans/strategies or monitoring programs), the completion of the independent audits required under this consent, or the completion of the AEMR, the Applicant shall: a) provide a copy of the relevant document/s to the Council, relevant agencies and the CCC; b) ensure that a copy of the relevant documents is made publicly available at the Quarry; and c) put a copy of the relevant document/s on the Applicant's website; to the satisfaction of the Director-General.	4.3
11 (Sch. 5)	During the life of the development, the Applicant shall: a) make a summary of the results of all monitoring required under this consent publicly available both at the Quarry and on the Applicant's website; and b) update these results on a regular basis (at least every 3 months), c) to the satisfaction of the Director-General. Note: The Applicant's environmental management plans/protocols should specify the reporting provisions for each environmental aspect.	4.3

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Appendix 2

Vegetation Clearing Protocol for Stage 3 of the Calga Sand Quarry

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A2.1 VEGETATION CLEARANCE PROCEDURES

A2.1.1 Introduction

There is limited need for any further tree clearing for the remainder of the approved extraction activities in Stage 3.

A2.1.2 Method

Clearing activities within the area to be disturbed will be undertaken in the following manner.

i) Clearing of tree and shrub vegetation will be carried out in campaigns.

ii) The area cleared in each campaign will generally be no greater than that required to accommodate the Quarry's development requirements for the following 12 months. This will ensure that excessive areas of vegetation is not cleared at any single time. This will also reduce the risk of erosion and sedimentation posed by large exposed areas.

iii) The limits of each planned clearing campaign will be clearly delineated on the ground to avoid excessive clearing.

iv) On areas devoid of tree and large shrub vegetation, the vegetation will be collected with the topsoil and either transferred directly to an area that has been prepared for topsoil application or, alternatively will be stockpiled for later use in rehabilitation. Direct transferral is the preferred alternative.

v) Any trees felled will be either transferred to areas of the final landform designated for establishment of native vegetation, or stockpiled for later use in this fashion.

vi) To ensure post-extraction rehabilitation is carried out with stock from local trees and is consistent with the composition of the original local vegetation community, this protocol includes procedures for the collection and propagation of seed from vegetation of the Quarry Site (see Section A2.2).

A2.1.3 Pre-Requisite Works

No clearing or vegetation removal will be undertaken prior to the installation of erosion and sediment controls.

A2.2 SEED COLLECTION, HANDLING AND STORAGE

Suitable horticulturists continue to be contracted to collect native species and propagate for rehabilitation.

A2.2.1 Plant Propagation

Seedling propagation activities continue to be undertaken by a nursery or horticulturalist commissioned by Hanson and this person(s) will be experienced in the propagation of native species.

Hanson advises the nursery / propagation contractor of its rehabilitation requirements (in terms of area) sufficiently in advance of the programmed planting time to enable seedling propagation progressively as rehabilitation areas become available. Planting will preferentially be undertaken in the Autumn period followed by mulching around each seedling where appropriate pending the horticulturalist's recommendations.

Appendix 3

Pest and Weed Management Plan for Stage 3 of the Calga Sand Quarry

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A3.1 Weed and Feral Pest Control

A3.1.1 Weed Control

The groundcover over much of the Quarry Site is dominated by exotic grass and weed species. Of these, two species are declared noxious weeds for the Gosford City LGA.

These species are:

- Crofton Weed (*Ageratina adenophora*)[1]; and
- Blackberry (*Rubus fruticosus*)[1].

These noxious weed species are targeted in regular campaigns to ensure their control and, where possible, eradication.

In general, weed species tend to be prolific colonizers of disturbed ground. As a consequence, effective general weed control on rehabilitated areas has been undertaken since 2006 following the sowing of improved pastures to initially stabilise the outer surface of the acoustic bund. Similarly, weed control on areas where tree seedlings are planted or direct seeding is used is the single most important factor in maximising tree and shrub establishment.

Inspection of all revegetated areas for noxious and other weed species will be undertaken by a suitably qualified person and reported in the AEMR.

Herbicides with the capacity to move through the soil will continue to be used. The key herbicide used on site is Glysophate (commonly referred to as Roundup). Weed removal techniques are determined by the horticulturalist based on the identified weed, location and other relevant condition and may include spraying, manual or mechanical removal and where required collection and destruction of destroyed seeds.

A3.1.2 Feral Animal Control

Quarry rehabilitation areas, except for wetlands and riparian corridors, often carry the highest permanent, non-commercial biomass in the landscape and will attract native wildlife and vertebrate pests from the surrounding areas.

The following vertebrate pests have been identified on the Quarry Site and are consequently potentially relevant to feral animal control at the Calga Sand Quarry.

- European Rabbits.
- European Red Foxes.
- Feral Cats.
- House Mice.

[1] The Noxious Weed species occurring at the Calga Sand Quarry site are **Class 3** noxious weeds. These are plants that must be prevented from spreading and their numbers and distribution reduced.

With the exception of the House Mouse, these exotic species are listed as Key Threatening Processes in the *Threatened Species Conservation Act 1995* (TSC Act). The European Rabbit is also declared noxious species under the *Rural Lands Protection Act 1998*. The European Red Fox is listed as Key Threatening Processes in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The main controls to be adopted during the period to December 2016 include the following.

- Sampling for all the nominated vertebrate pests will be conducted in conjunction with the quarry rehabilitation monitoring program.
- Hanson will participate with local landholders in any vertebrate pest control programs.
- A program of feral cat and house mouse control using appropriate poison bait (when necessary).

Appendix 4

Acoustic Bund Wall Rehabilitation for Stage 3 of the Calga Sand Quarry

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A4.1 INTRODUCTION

A4.1.1 Weed Control

Calga Sand Quarry has been granted approval under DA 94-4-2004, on the condition that a Landscape Plan be prepared for the quarry site. Landscaping of the Quarry Site involves three primary elements:

- the construction and vegetation of an acoustic bund wall around the northern, western and part of the southern Quarry perimeter;
- general housekeeping activities and operational procedures; and
- final land form.

The Landscape Plan concentrates on these elements of site landscape management.

A4.2 ACOUSTIC BUND WALL

A4.2.1 Introduction

In order to reduce the impact of noise generated by the Quarry extension, Calga Quarry has constructed an acoustic bund wall around the sections of the northern, western and eastern Quarry perimeter. The bund wall incorporates a combined earthen bund and colour bond fence, which has been placed on top of the earthen bund. While the constructed bund wall reduces noise impacts significantly and visually screens activities within the Quarry Site, it has been designed to complement the visual amenity of Peats Ridge Road and surrounding residences (see **Figure A4.1**), particularly:

- Residence 5 – owned by B Kashouli,
- Residence 4 – owned by RD King;
- Residence 2 – owned by F & G Rozmanec;
- Residence 6 – owned by AM & RA Townsend; and
- Residence 3– owned by Power Pastoral Pty Limited.

The following subsections outline the objectives, procedures and maintenance of landscaping to, as far as practicable, reduce the impact on visual amenity.

A4.2.2 Objectives

Landscape management of the acoustic bund wall has been designed to meet the following objectives.

1. To provide a stable landform with minimal erosion risk.
2. To not compromise the function of the acoustic bund wall in its primary function of noise attenuation.
3. To provide an aesthetically pleasing cover of native vegetation over the earthen bund.

4. To ensure continued maintenance of the acoustic bund wall.

5. To ensure the long-term viability of the acoustic bund wall and vegetation of the earthen bund beyond the life of the Stage 3 Quarry.

A4.2.3 Landscaping Design

Figure A4.1 presents the location of the acoustic bund wall, a cross-section of the bund wall and the view that will ultimately be afforded from vantage points simulated as Residences 2 and 5. The major features of the landscape design are as follows.

i) A flat surface has been retained on the top of the earthen bund.

ii) Larger vegetation will be established on the external side of the earthen bund to aid visual amenity.

iii) The 2m colour bond fence has been erected on the Quarry side edge on top of the earthen bund to create additional space for the establishment of larger vegetation.

iv) The 2m colour bond fence is of a neutral colour to blend with the establishing vegetation.

v) The native vegetation establishment program will extend to the north of the earthen bund within the boundary of the Quarry Site.

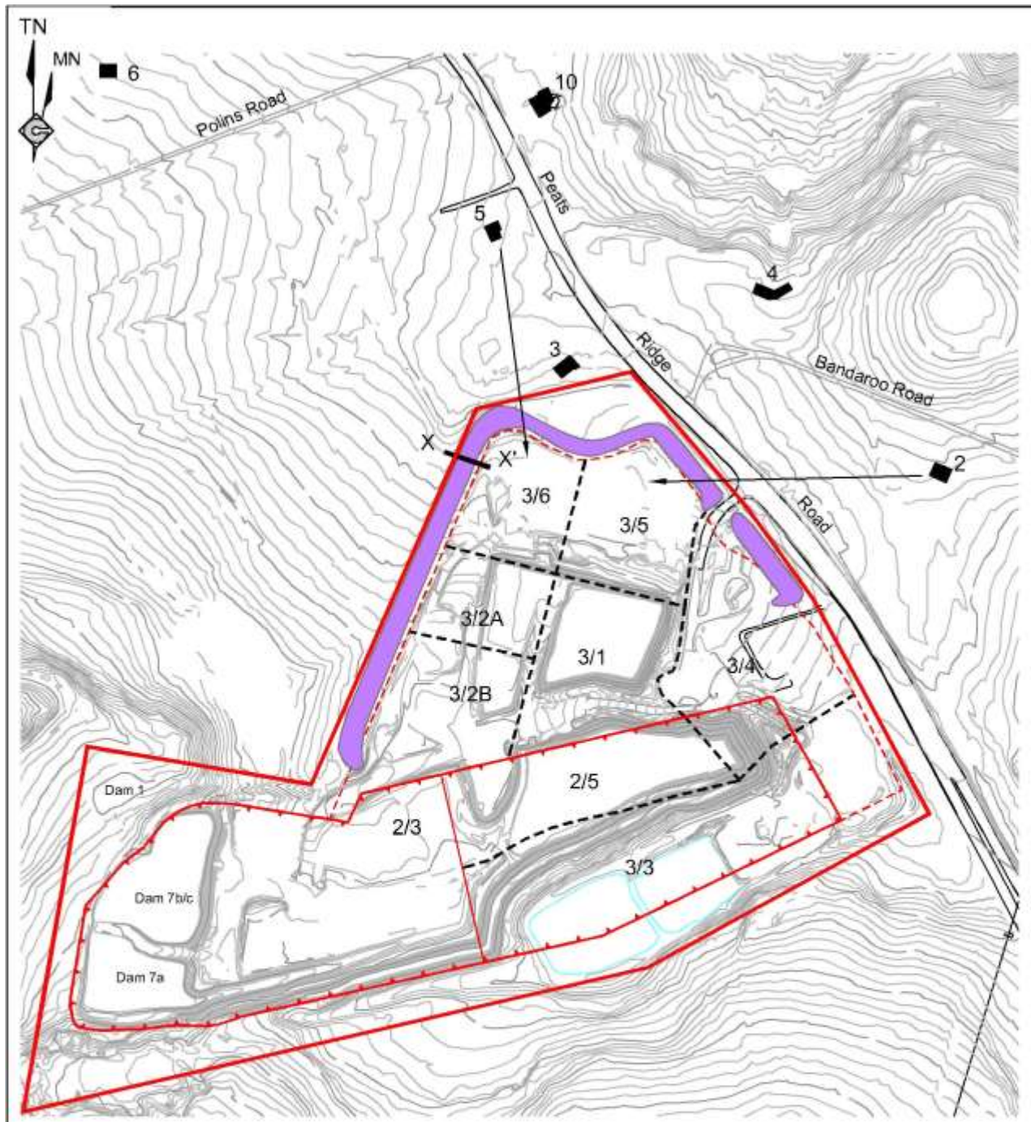
vi) Drainage control features were established prior to construction activities and sown with a vegetative cover.

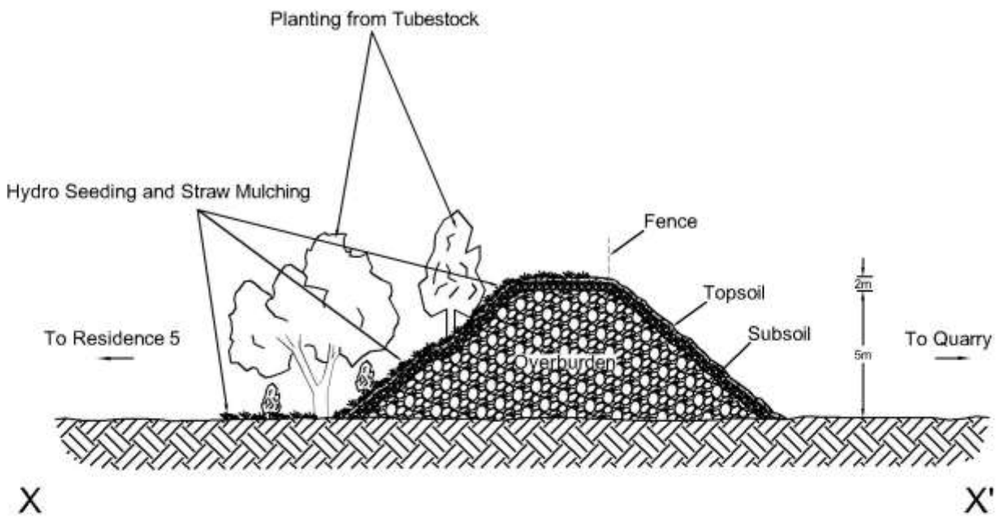
A4.2.4 Vegetation Establishment

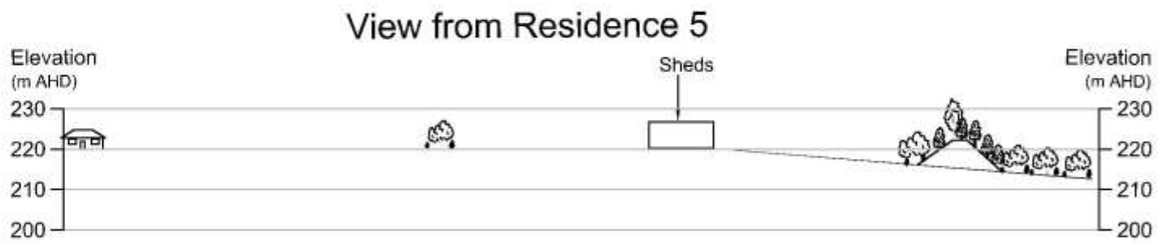
The procedure for establishing vegetation on the earthen bund has been based on established rehabilitation/revegetation techniques of the Quarry, originally compiled by T.R.E.E.S. Pty Ltd, specialist rehabilitation consultants.

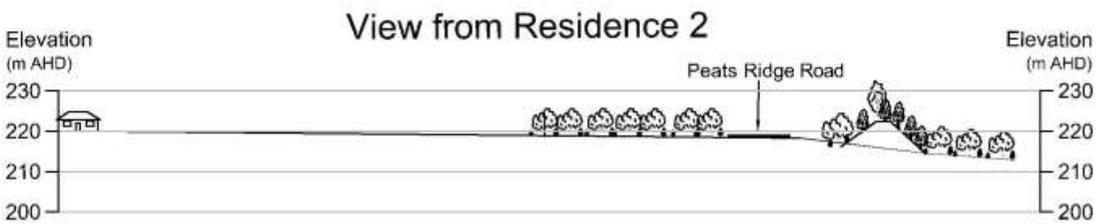
a) The external side surface of the earthen bund has been hydroseeded and straw mulched with the same seed mix. This provides a better microclimate for seed germination and surface protection from raindrop impact, thereby reducing the potential for erosion. The following seed mix was originally used.

Species	Application rate
Japanese Millet	15kg/ha
Hardenbergia violaceae	0.75kg/ha
Kennedia rubicunda	0.75kg/ha
Acacia suaveolens	1kg/ha
Acacia terminalis	1kg/ha
Acacia ulicifolia	1kg/ha
Banksia serrata	0.5kg/ha
Banksia ericifolia	0.5kg/ha
Kunzea parvifolia	0.75kg/ha
Xanthorrea australis	0.75kg/ha
Themeda australis	3kg/ha
Lomandra longifolia	1kg/ha









REFERENCE
- Quarry Site Boundary
- Stage 1 & 2 Extraction Limit
- Stage 3 Extraction Limit
- Stage 3 Acoustic Bund Wall
- 4 Non-Project Related Residence
- Simulated View

SCALE 1:6 000
100 0 100 200 300 m
Base Map Source: AAM Pty Limited - December 2013

Figure A4.1
PERIMETER BUND WALL

b) The Quarry side surface of the earthen bund has been hydroseeded and straw mulched.

c) Hydroseeding and mulching has been completed, the bund vegetation will be monitored.

d) The top of the earthen bund, berm established on the residence side surface and available areas between the earthen bund and Quarry Site perimeter will be planted with native tubestock. The species may include (but is not limited to):

Hardenbergia violaceae, kennedia rubicunda, Acacia suaveolens, Banksia serrata, Banksia robur, Banksia spinulosa, Angophora costata, Angophora hispida, Eucalyptus eximia, Eucalyptus gummifera, Eucalyptus haemostoma, Kunzea capitata and Kunzea ambigua.

e) Tubestock are to be planted in a 1.5m^2 grid pattern and reviewed for growth annually.

f) Tubestock planting is to be undertaken preferentially in Autumn with a slow release fertiliser tablet placed in each tubestock hole prior to planting.

A4.2.5 Maintenance

Following revegetation activities, the bund wall is to be regularly inspected to assess the success of landscaping. This is to include the following.

i) Inspection of the acoustic bund wall to ensure minimal erosion and sedimentation. In the event this is identified, remediation works will be undertaken.

ii) Plant growth is to be monitored with addition of fertiliser applied during drought conditions or in the event vegetation appears highly stressed.

iii) On establishment of larger eucalypt style vegetation on the top of the earthen bund, the earthen bund is to be inspected for structural stability with action taken should evidence of slope instability be identified.

A4.2.6 Consultation

Hanson would continue to report on relevant landscape management in the AEMR and at the CCC meetings.

A4.3 GENERAL HOUSEKEEPING AND OPERATIONAL PROCEDURES

A4.3.1 Housekeeping

The Quarry Site will be maintained in a clean and tidy state at all times with particular emphasis placed on the following activities.

- Raw sand, product sand, clay and other raw materials will only be stockpiled in designated areas.

- Clearly marked skip bins will placed at appropriate locations on the Quarry Site and personnel educated as to the use of these.
- All maintenance work will be undertaken within the designated maintenance area of the Quarry Site and wastes placed in hydrocarbon storage area.
- Putrescible wastes and general rubbish is removed from site to licenced disposal facilities.

A4.3.2 Operational Procedures

The following operational procedures will assist in the efficient management of Quarry Site materials and storage areas and therefore minimise the requirement for further landscaping.

- Where practicable, any areas of disturbance should be minimised with maximum emphasis placed upon using existing disturbed or prepared areas or facilities. Existing disturbed areas that are unlikely to be required should be rehabilitated.
- Undertake regular inspections of the Quarry Site to identify areas where rehabilitation can be implemented.