



Albion Park Quarry

Vegetation Management Plan

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Revision Register

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1	Oct 2007	Original plan	N/A	Kevin Mills & Associates	DoP 23/6/2008
2	15/1/2018	Revision required prior to quarrying in Stage 5 & 6.	All	Mark Hammond	
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1 INTRODUCTION

1.1 Background

Cleary Bros (Bombo) Pty Ltd (Cleary Bros) operates a hard rock quarry and processing plant at Croom, near Albion Park in the City of Shellharbour. Under the conditional approval (MOD 3 of Application 10639 of 2005), the Development is permitted to produce up to 900,000 tonnes of hard rock products per year, with material extracted from the Quarry Extension located on the southern slope of the Wentworth Hills, which separates the Lake Illawarra catchment from the Minnamurra River catchment (the Development Consent). The area approved for extraction as well as the broader area of the site (encompassing Lot 1 of DP 858245) is shown in Figure 1.

The Development Consent requires Cleary Bros to conserve and revegetate/rehabilitate certain areas to the south of the approved quarry, in accordance with a Vegetation Management Plan (VMP), approved by the Department of Planning and Environment (DPE). Cleary Bros engaged Kevin Mills & Associates, Ecological and Environmental Consultants, to develop this VMP in accordance with the conditions of the Development Consent. The original VMP was prepared in October 2007 and approved by the then Director-General of the DPE. This amended version has been updated in 2017 following the approval of Modification 3 of the Development Consent, with input received from the Office of Environment and Heritage used to advise changes to the VMP.

The proposed area for the quarry is mostly cleared, although some areas of native vegetation, mainly rainforest, are still present on other parts of the adjacent properties. Most of the remnant vegetation occurs on the steep slopes and along gullies, while the gentler slopes and flat land have been almost totally cleared and used for grazing purposes.

Farming and quarrying are the main land uses in the vicinity of the site. There has been a long history of farming at Albion Park, dating from 1817 when the first land grants were made. There are several quarries in the area, and the hard rock quarry operated by Cleary Bros has been operating for about 50 years.

The study area is located on a ridge system composed of the Permian-aged Gerringong Volcanics, a unit of which, the Bombo Latite, is the objective of the proposed quarry. It receives an estimated rainfall of approximately 1,120 mm per year. The altitude of the study area ranges from about 70 metres to 130 metres.



Figure 1 - Location Plan of the area approved for extraction

1.2 Purpose and Scope

The purpose of this VMP is to provide a detailed plan for the protection, management and enhancement of the ecosystems and native flora and fauna adjacent to the Albion Park Quarry Extension. In particular, the VMP aims to address Schedule 4 Conditions 34 to 37 of the Development Consent. The VMP applies to all areas of the site that are approved for extraction activities or included within the Vegetation Management Areas on Lot 1 of DP 858245.

The following terms are referred to throughout the report and are defined here:

Planting Zone: Refers to the areas mapped 'Area to be Planted' in Appendix 2 of the Consent.

Restoration Zone: Refers to the areas mapped 'Weed Control to Promote Natural Vegetation' in Appendix 2 of the Consent.

Revegetation Area(s): Incorporates the Planting Zone and the Restoration Zone.

Remnant Vegetation: Includes those areas mapped as 'Existing Vegetation' in Appendix 2 of the Consent.

Vegetation Management Area(s): Includes both the Revegetation Area(s) and Remnant Vegetation, as described above and mapped in Appendix 2 of the Consent.

The figure described in Appendix 2 of the Consent is reproduced as Figure 2 here. Refer to the Development Consent for a high resolution version of this figure.

The Vegetation Management Plan was originally prepared in 2008 by Dr Kevin Mills, a suitably qualified ecologist. The plan has since been revised in 2018, as a pre-requisite to quarrying in Stages 5 and 6 of the Quarry Extension. This latest plan was revised by Cleary Bros, with input and a peer review undertaken by Kevin Mills & Associates.

1.3 Regulatory Requirements

The Development Consent conditions relating to flora and fauna management are summarised in Table 1, alongside the relevant section of the VMP.

Table 1 – Development Consent conditions

Condition No	Requirement	Relevant Section
Schedule 4 Condition 34	<p>Vegetation Clearing Protocol</p> <p>Prior to the commencement of works, the Applicant must prepare a Vegetation Clearing Protocol for the development in consultation with Council and the OEH, and to the satisfaction of the Secretary. This plan must:</p> <p>(a) Delineate the areas of remnant vegetation to be cleared; and</p> <p>(b) Describe the procedures that would be implemented for:</p> <ul style="list-style-type: none"> • Pre-clearance surveys; • Progressive clearing; • Fauna management; • Conserving and reusing topsoil; • Collecting seed from the site; • Salvaging and reusing material from the site; and • Controlling weeds. 	Section 4
Schedule 4 Condition 35	<p>Southern Remnant Vegetation and Revegetation Area</p> <p>The Applicant must conserve and maintain the southern areas of remnant vegetation marked on the map in Appendix 2.</p>	Section 3.4

Condition No	Requirement	Relevant Section
Schedule 4 Condition 36	<p>Southern Remnant Vegetation and Revegetation Area</p> <p>The Applicant must revegetate/rehabilitate and maintain the areas marked 'Area to be Planted' and 'Weed Control to Promote Natural Vegetation' on the map in Appendix 2. Revegetation must be in accordance with the Vegetation Management Plan described in Condition 37.</p>	Sections 3.2 & 3.3
Schedule 4 Condition 37	<p>Vegetation Management Plan</p> <p>Within 6 months of this consent, the Applicant must prepare a Vegetation Management Plan for the development in consultation with Council and the OEH, and to the satisfaction of the Secretary. The plan must be prepared by a suitably qualified ecologist / bush regenerator, and must address:</p> <ul style="list-style-type: none"> (a) Establishment of baseline data for existing vegetation and habitat in the area; (b) Vegetation management on all areas of the site outside the working area of the quarry; (c) Conservation, maintenance and enhancement of threatened communities, including 'Illawarra Subtropical Rainforest' and 'Illawarra Lowlands Grassy Woodlands'; (d) Conservation, maintenance and enhancement of threatened plant species, including <i>Cynanchum elegans</i> (White Cynanchum), <i>Daphnandra johnsonii</i> (Illawarra Socketwood), and <i>Zieria granulata</i> (Illawarra Zieria); (e) Establishment and maintenance of vegetation/habitat for threatened fauna species, including the Grey-headed Flying fox; (f) Ongoing management of weeds and pests, including the provision of stock-proof fencing and replacement of damaged plantings; (g) A program for how the performance of the measures described in (b) to (f) above would be monitored over time; (h) A program for monitoring the effect of quarrying, including water management, on vegetation communities. <p>Prior to the commencement of quarrying activities in Stages 5 and 6, the Vegetation Management Plan must be revised, in consultation with OEH and to the satisfaction of the Secretary.</p> <p>The Applicant must implement the approved plan as approved from time to time by the Secretary.</p>	<p>This Plan</p> <p>Section 2.1</p> <p>Section 3</p> <p>Section 3.4</p> <p>Section 3.5</p> <p>Section 3.6</p> <p>Sections 3.7, 3.8, & Section 3 generally</p> <p>Section 5.1</p> <p>Section 5.1</p>
Schedule 4 Condition 38	<p>Reporting</p> <p>The Applicant must include a progress report on the implementation of the Vegetation Management Plan in the Annual Review.</p>	Section 5.2

1.4 Consultation with the Office of Environment and Heritage (OEH)

Cleary Bros provided a copy of the previous (2007) Vegetation Management Plan to the regional office of the NSW Office of Environmental Heritage (OEH), inviting feedback on the measures proposed to meet the requirements of the Development Consent. The OEH subsequently provided a range of recommendations that have, where appropriate, been incorporated into this revised plan.

2 BACKGROUND

This section summarises the baseline data for the site, which is described in detail in the *Flora and Fauna Assessment – Proposed Extension to Cleary Bros (Bombo) Albion Park Quarry – City of Shellharbour* (KMA 2003), including within the Environment Impact Statement for the Quarry Extension. It also describes additional monitoring that will be undertaken in FY18 to establish a quantitative baseline, which will form the basis of the assessment of future performance of the Vegetation Management Area.

2.1 Vegetation Communities

The vegetation on the quarry site is largely non-native (introduced) grassland, used for many years for the grazing of stock. The only significant vegetation on the site are small patches of rainforest plants. Evidence of the extensive pre-quarrying clearing can be seen on the 1961 aerial photo (Figure 3), which highlights those small areas left untouched by the 20th century agricultural land practices. Note the area mapped as current vegetation includes various areas, particularly to the south of the site, that were previously cleared.

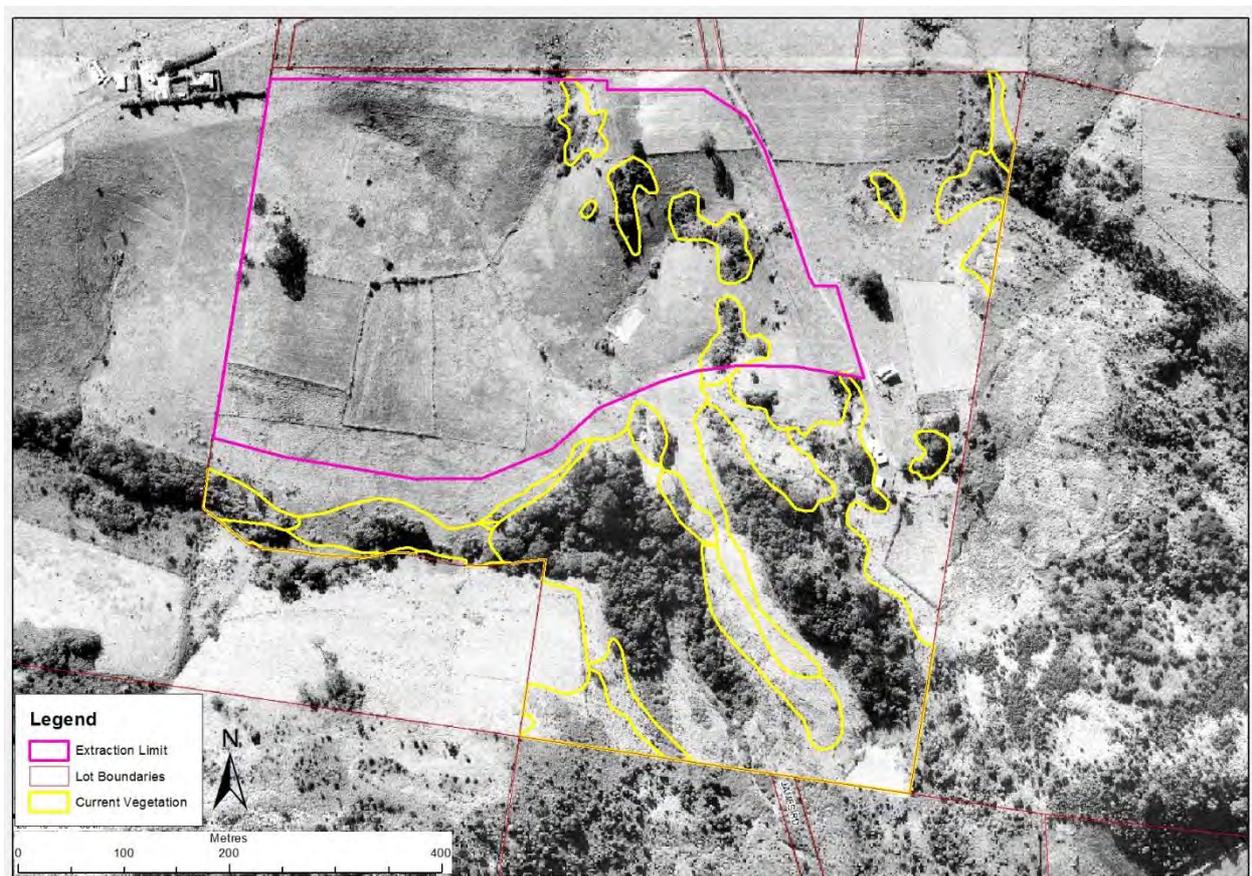


Figure 3 - Extent of pre-quarrying clearing - 1961 aerial photograph.

The Vegetation Management Area is to the south of the approved extraction area, and is comprised of intact rainforest, a dense Lantana fringe and the exotic grassland in the buffer area. The stands of Lantana contain many rainforest species. In the east, near the side gully, there is a small stand of eucalypt woodland. A full description of this vegetation is provided in the Environmental Impact Statement. Table 2 describes the vegetation communities identified on the site, and their pre-quarrying location is shown in Figure 4.

Table 2 – Vegetation Communities of the site

Community	Distribution
Rainforest (Closed Forest)	Mainly within the valleys and gullies surrounding the study area; small regrowth stands occur on the eastern slopes of the quarry footprint.
Open Forest	Remnants of this forest occur at various places in and near the site, but most of the eucalypt forest on the site has been cleared; some areas now support dense stands of Black Wattle.
Lantana Shrubland	Shrubland, dominated by the introduced <i>Lantana camara</i> , occurs in various places, usually along the edges of forest. Largely regrowth of other communities
Sedgeland/Rushland	Small patches of wetland plants occur on the dams on the site.
Cleared Grassland	Most of the site is grassland, dominated by introduced plants.

Two ecological communities on the site are listed as endangered under the *Biodiversity Conservation Act 2016*; these are discussed below.

2.1.1 Subtropical Rainforest

The rainforest stands identified above are listed as an endangered ecological community under the *Biodiversity Conservation Act 2016*. They are described in the Flora and Fauna Report in the EIS (Kevin Mills & Associates 2003), with a summary as follows:

Structure: The height of the trees and shrubs varies from 5 to 35 metres, depending on location. Stands of relatively undisturbed closed forest, with continuous closed canopy and mature trees occur along the main creekline and gully to the south of the study area. Stands on hill-slopes generally consist of a few over-mature individuals, surrounded by regrowth native tree species and, often, an outer band of Lantana. Ground cover is absent to sparse, usually consisting of ferns or small soft-wooded perennials. Lianas are plentiful, especially near edges.

Occurrence: Continuous stands occur along two sections of the main creekline, extending from the adjoining quarry, through a gully described by QEM (1994) as the Cody property. Small patches occur on the eastern slopes of quarry site.

Floristics: Mills and Jakeman (1995) describe Subtropical Rainforest *Ficus – Planchonella – Baloghia – Streblus* as occurring on "...the steep rocky slopes on the latite rock outcrops of the Gerringong Volcanics...". This vegetation type approximates Floyd's (1990) classification of Dry Rainforest Suballiance 23.

Common tree species include Black Plum *Diospyros australis*, Red-fruited Olive Plum *Elaeodendron australe*, Sweet Pittosporum *Pittosporum undulatum*, Whalebone Tree *Streblus brunonianus*, Muttonwood *Myrsine variabilis* on hill slopes and Lilly Pilly *Syzygium smithii*, Murrogun *Cryptocarya microneura*, Bolly Gum *Litsea reticulata* and Brush Cherry *Syzygium australe* in gullies. Common emergent trees are figs *Ficus* spp. in remnant stands and Red Ash *Alphitonia excelsa* in regrowth stands. Common weed species along edges and along drainage lines include Lantana *Lantana camara*, Blackberry *Rubus fruticosus*, Mist Flower *Ageratina riparia*, Moth Vine *Araujia sericiflora* and Madeira Vine *Andredera cordifolia*. Common native species of the edges include Native Hibiscus *Hibiscus heterophyllus*, Whalebone Tree *Streblus brunonianus*, Cockspur Thorn *Maclura cochinchinensis*, Tree Violet *Meliclytus dentatus* and Breynia *Breynia oblongifolia*.

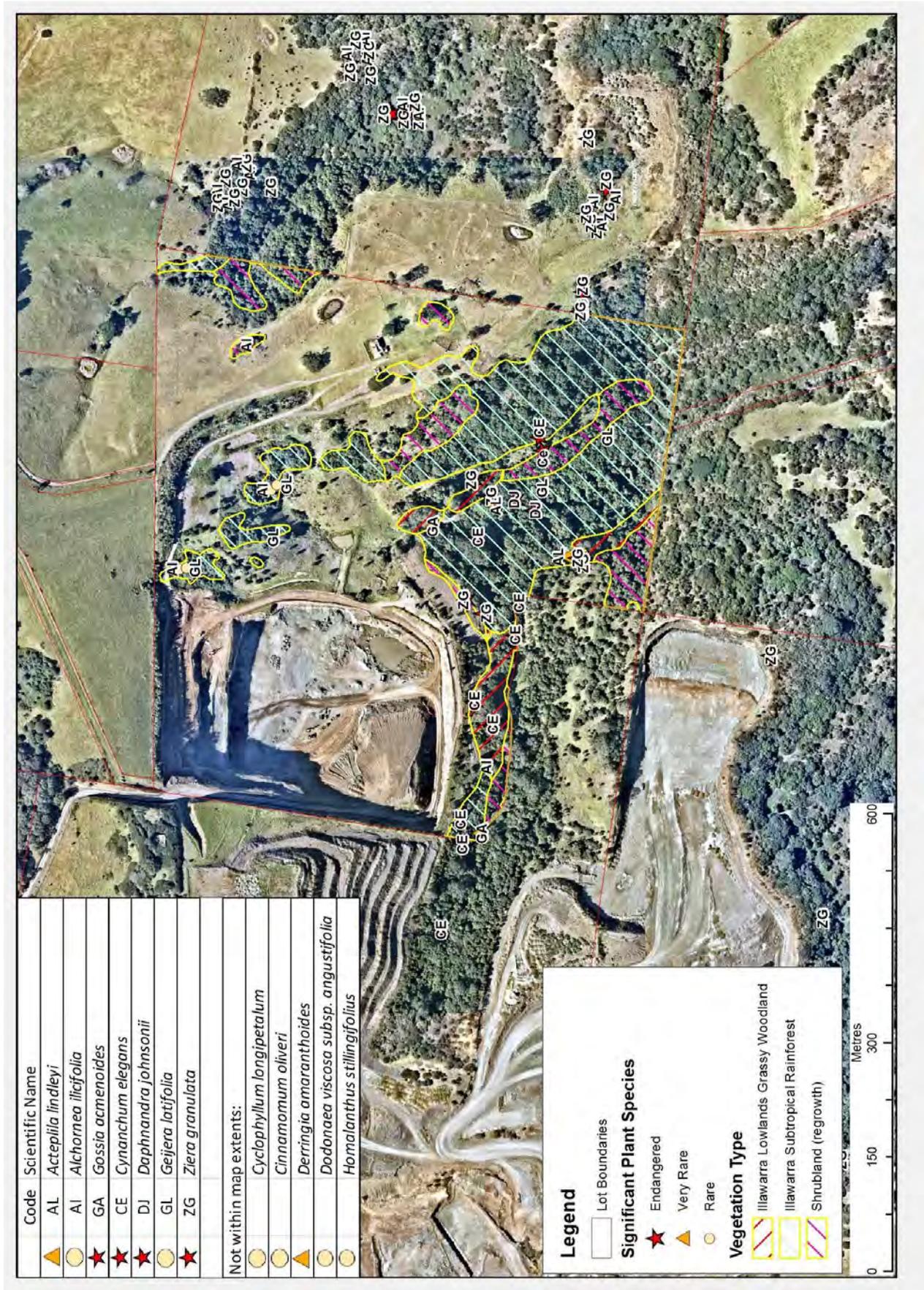


Figure 4 - Vegetation communities and plants of conservation significance.

Ferns occasionally occur in moist sites, including Climbing Fishbone Fern *Arthropteris tenella*, Giant Maidenhair *Adiantum formosum*, Necklace Fern *Asplenium flabellifolium*, Prickly Rasp Fern *Blechnum novaehollanicum* and Rock Felt Fern *Pyrrhosia rupestris*."

2.1.2 Illawarra Lowlands Grassy Woodland

This community has been listed as an endangered ecological community under the *Biodiversity Conservation Act 2016*. The stand of eucalypts in the study area was surveyed to determine its structural and floristic characteristics and to determine if it met the criteria of the Illawarra Lowlands Grassy Woodland community, as documented in the Final Determination.

This stand of eucalypts is dominated by Forest Red Gum *Eucalyptus tereticornis* and Coast White Box *Eucalyptus quadrangulata*. The understorey is a mixture of rainforest species, typical native grassland species and weeds. This type of forest was termed Moist Red Gum Forest by Kevin Mills & Associates (1997), and is at the "moist end" of the complex of communities known as Illawarra Lowlands Grassy Woodland. The rainforest species present include Cockspur Thorn *Maclura cochinchinensis*, Native Olive *Notelaea longifolia*, Black Plum *Diospyros australis*, Whalebone Tree *Streblus brunonianus*, Guioa *Guioa semiglauca*, Native Quince and *Alectryon subcinereus*. The native grassland species present include Bergalia Tussock *Carex longebrachiata*, Kidney-weed *Dichondra repens*, Crane's-bill *Geranium* sp., Twining Glycine *Glycine clandestina*, Australian Basket-grass *Oplismenus hirtellus* and Love-grass *Eragrostis* sp. The weed species are Kikuyu Grass *Cenchrus clandestinus*, Olive *Olea europaea*, Lantana *Lantana camara*, Spear Thistle *Cirsium vulgare*, Ribbed Plantain *Plantago lanceolata*, Fleabane *Conyza* sp. and Fireweed *Senecio madagascariensis*.

2.1.3 Further Assessment of Baseline

Following suggestions by OEH, additional surveys are proposed to be undertaken in FY18 to prepare a quantitative baseline for the vegetation communities in the remnant forests and shrubland. As part of this assessment, fixed 20m x 20m monitoring plots will be established in each of the Rainforest (3 plots), Open Forest (2 plots) and Shrubland (2 plots) communities. The locations of these plots will be determined based on field observations of sites considered to represent the typical structure and assemblage of each community, and will be located outside of the quarry extraction area. Once identified, the coordinates of the centre of each plot will be logged using GPS, and corners marked with survey pegs for later identification. For each plot, the percentage foliage cover and abundance of each plant species will be counted. The presence and abundance of weed species in the plot will also be recorded. The results of these additional baseline surveys will be included in the 2017-2018 Annual Review.

2.2 Threatened and Regionally Significant Plant Species

Several plant species of conservation importance have been identified on site and nearby during various studies of the area. These species are listed in Table 3. Where these species are located on the site they are shown in Figure 4.

Table 3 – Plant Species of Conservation Importance

Scientific Name	Common Name	Form
Endangered Plant Species		
<i>Cynanchum elegans</i>	White Cynanchum	Vine
<i>Daphnandra johnsonii</i>	Illawarra Socketwood	Tree
<i>Gossia acmenoides</i>	Scrub Ironwood	Small tree
<i>Zieria granulata</i>	Illawarra Zieria	Shrub
Regionally Significant Plant Species		
<i>Actephila lindleyi</i>	Actephila	Shrub/small tree
<i>Alchornea ilicifolia</i>	Native Holly	Shrub
<i>Cyclophyllum longipetalum</i>	Coast Canthium	Small tree
<i>Cinnamomum oliveri</i>	Oliver's Sassafras	Tree
<i>Deeringia amaranthoides</i>	Deeringia	Shrub
<i>Dodonaea viscosa subsp. angustifolia</i>	Hopbush	Shrub
<i>Geijera latifolia</i>	Brush Wilga	Tree
<i>Homalanthus stillingifolius</i>	Small Bleeding Heart	Shrub

2.2.1 Endangered Plant Species

Three plant species that occur on the site are classified by Briggs and Leigh (1996) as having national conservation significance; all three are threatened species in New South Wales (*Biodiversity Conservation Act 2016*). These species are all endangered: *Cynanchum elegans*, *Daphnandra johnsonii* and *Zieria granulata*. In addition, the Illawarra population of *Gossia acmenoides* is listed as an endangered population under the Biodiversity Conservation Act 2016.

***Cynanchum elegans* - endangered**

This species is listed as endangered. The species has a relatively small geographic range and occurs only in small populations that are mainly restricted to highly specific and localised habitats. Protected areas where this species occurs include Goulburn River National Park (Matthes & Nash 1993), Woko National Park and Camels Hump Nature Reserve (Briggs & Leigh 1996). Harden (1992) states that the species is rare, recorded from rainforest gullies, scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar. Recent local recordings of this species include creeklines in Farmborough Heights and in the Keira Green Corridor. Individuals have also been recorded in small remnant stands at Cobbitty and Fairfield (NPWS 1997). In all cases only one individual or a very small population has been recorded.

A recovery plan for this species includes the following observations (Matthes & Nash 1993):

"None of the populations recorded in the Illawarra are protected and all are under some degree of immediate threat. If these threats are successful then *C. elegans* may become extinct in the Illawarra

within ten years. At this stage, until we understand more about the population dynamics of *C. elegans* every individual must be considered important for the long term survival of the species.

Fourteen specimens of *Cynanchum elegans* were recorded by QEM (1994) on the Holcim land in the area in and around the site. Of these individuals recorded, two occur within the site. Three specimens were recorded on the "Cody gallery rainforest". Recent inspections undertaken in 2018 have confirmed the presence of these specimens shown in Figure 4 on Cleary Bros property.

***Daphnandra johnsonii* (*Daphnandra* sp. 'C' (Illawarra)) - endangered**

Illawarra Socketwood is the only tree species that is endemic to the Illawarra rainforests (Fuller & Mills 1985), and is listed as endangered. This species is a small tree and is described by Harden (1990) as a very rare small tree, confined to the Illawarra area. Small populations or individuals have been recorded between Scarborough and Berry, generally in closed forest. Distribution appears to be restricted to sites below 200 metres above sea level. Most recorded populations of this species appear to be ramets (clones) from a single individual and in most cases sexual reproduction does not appear to be taking place.

Harden (1990) describes the globose shape of the fruiting receptacle as a distinguishing feature. It is possible that this globose fruiting body is a false fruit, as the globose fruiting bodies do not appear to contain seeds.

Mills and Jakeman (1995) have proposed that this species have a conservation rating of 2VCI, and observe that the only known conservation area in which the species occurs is in Budderoo National Park, in the gorge at Minnamurra Falls. This species occurs in the gorge to the south of the quarry development area, well within the rainforest remnant.

The *Daphnandra johnsonii* present on the site is one of three known locations (of c. 45 sites) to produce viable seed. For this reason the stand of Illawarra Socketwood in the rainforest remnant is highly significant.

***Gossia acmenoides* – endangered population**

A small population of *Gossia acmenoides* was recorded in the closed forest below the adjoining quarry, and an additional specimen was recorded near the northern extent of the "Cody gallery rainforest". This species occurs no further south than Jamberoo (Mills 1988, 1989) and is rare in the Illawarra. Harden (1991) describes the distribution of this species as ... common north of the Hunter Valley, and ... as far south as the Illawarra region". This species was not found in the extraction area of the quarry. The population in the Illawarra is listed as an 'endangered population' (Final Determination, NSW Scientific Committee 2014).

***Zieria granulata* - endangered**

Status: This species is endangered. The code indicates that the species has a geographic range of less than 100 kilometres, is not presently endangered but is at risk from disappearing from the wild over the next 20-50 years and is reserved, but not adequately, in Budderoo National Park and in Killalea State Recreation Area. This species is listed as vulnerable in a national context in Part 2 Schedule 1 of the TSC Act (1995). Mills and Jakeman (1993) describe the distribution of *Zieria granulata* as extending from Broughton Village to Albion Park. The Dunmore area accounts for an estimated 80% of the total known population and the stands occurring in the study area occur near the northern limit of distribution for this species.

The largest populations of this species were recorded along the western and eastern edges of the shrubland on Belmont Ridge. Small populations or scattered individuals were also recorded within the

shrubland, and along the closed forest edge to the south and downslope of the farm buildings on Belmont Ridge. Three large individuals were recorded on the northern edge of the "Cody gallery rainforest" (QEM 1994). Seedlings were recorded in the population occurring near a farm dam on the western edge of the shrubland stand. No seedlings were recorded within the shrubland stand, although it appears that this area is heavily grazed, so it is possible that emergent seedlings are regularly eaten. The larger populations contain from 30 to 200 individuals. The total number of individuals occurring in and along the shrubland stand would exceed 1000.

2.2.2 Regionally Significant Plant Species

Eight plant species listed as regionally rare by Mills (1988) and Mills and Jakeman (1995) were recorded on the site during this and previous studies as listed in Table 3. The status and location of the species of regional conservation significance are discussed below.

Two of these species have been classified "Category 1" by Mills (1988): *Actephila lindleyi*, and *Deeringia amaranthoides*. By the use of the term, "Category 1", Mills (1988) refers to species that are very rare in the Illawarra (<10 known occurrences) and in need of particular conservation and consideration in conservation planning and environmental impact assessment.

Actephila lindleyi is considered to be very rare in southern New South Wales, and usually occurs as a single specimen in subtropical rainforest (Mills 1988). This species was recorded by QEM (1994) in the "Cody gallery rainforest", which is part of the Remnant Vegetation Area. It is not found in the extraction area of the quarry.

Deeringia amaranthoides occurs in subtropical rainforest and is listed as being conserved in Royal National Park, Morton National Park, Budderoo National Park and Devils Glen Nature Reserve. Mills (1988) considers that this species is rare in the region "... and possibly also in the State". This species was recorded near the creekline in the closed forest following the major creekline below the adjoining quarry. This species was not found in the extraction area of the quarry.

Six species recorded during the survey have been classified as "Category 2" by Mills (1988). "Category 2" refers to species that are rare in the region but generally better conserved and/or abundant than Category 1 species.

Alchornea ilicifolia occurs on the margins of rainforest remnants, particularly on volcanic hills between Berkeley and Kiama. The only conservation area where this species is recorded is Killalea State Park (Mills 1988). Specimens of *Alchornea ilicifolia* occur along the edges of the shrubland on Belmont Ridge, as well as along the edges of sections of closed forest, including the vegetation immediately downslope of the adjoining quarry and remnant patches on Belmont Ridge and Kyawana Ridge. A few specimens of *Alchornea ilicifolia* occur within the quarry extraction area.

Cyclophyllum longipetalum occurs throughout the Illawarra in subtropical rainforest but "... is nowhere a common tree ..." (Fuller & Mills 1985). Individuals of this species were recorded in the closed forest in the main creekline and in the gully at the south-eastern end of the site. This species was not found in the extraction area of the quarry.

Cinnamomum oliveri occurs at its southern limit in the Jamberoo area (Fuller & Mills 1985) and prefers high rainfall areas, particularly on the escarpment. This species was recorded at several sites in the closed

forest along the main creekline, as well as in the closed forest band on Belmont Ridge. This species was not found in the extraction area of the quarry.

Geijera latifolia is an occasional occurrence in several small remnant rainforest patches, as well as along rainforest stands occurring on south-facing hill-slopes. This species is conserved in Macquarie Pass and Budderoo National Parks and Mount Brown Reserve. Local occurrences are generally restricted to "... drier areas of rainforest, nearly always on volcanic soils" (Mills 1988). A few specimens of *Geijera latifolia* were found in the proposed quarry extraction area, as well as within the "Cody gallery rainforest".

Dodonaea viscosa subsp. *angustifolia* is a shrub species found in dry ridgetop communities, usually with *Melaleuca armillaris*, in the Dunmore-Jamberoo area, but is otherwise not found in the region. This species occurs in the eastern part of the property, on dry ridges. This species was not found in the extraction area of the quarry.

Homalanthus stillingifolius is a shrub species recorded by QEM (1994) on the margins of the Eastern Ridge (adjoining quarry). This species occurs on rocky sites mainly in coastal areas, but is uncommon in the Illawarra region. No individuals of this species were found on the site.

2.3 Threatened Animals

The *Biodiversity Conservation Act 2016* aims to conserve threatened species, populations and ecological communities of animals and plants in New South Wales. Threatened fauna are listed on the schedules attached to the Act and are classified either as "endangered", "vulnerable" or "extinct" (Schedules 1 - 3).

No threatened fauna species were recorded in the study area but several are known to occur in the locality. Threatened fauna species recorded within a five kilometre radius of the site are listed in Table 4. The table and subsequent discussion do not include threatened fauna species for which there is no suitable habitat in or adjacent to the site. The site is within the general distributional range of many species of threatened fauna; the species discussed are the most likely species to be in the area.

Table 4 – Threatened Fauna in the Dunmore-Albion Park District

Scientific Name	Common Name
Endangered Species	
<i>Litoria aurea</i>	Green and Golden Bell Frog
Vulnerable Species	
<i>Botaurus poiciloptilus</i>	Australasian Bittern
<i>Ninox strenua</i>	Powerful Owl
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox
<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll

Green and Golden Bell Frog

The closest known occurrence of the Green and Golden Bell Frog is Killalea Lagoon, about five kilometres to the east. The only wetlands in and near the site are farm dams, and most of them do not contain habitat suitable for this frog. The only dam in the study area with suitable habitat is Dam No. 8, because of the

presence of Cumbungi *Typha orientalis*. All records of the Green and Golden Bell Frog in the Illawarra have been on the coastal lowlands, rather than hilly country, so it is unlikely that the Green and Golden Bell Frog would occur in the study area.

Australasian Bittern

The Australasian Bittern has been recorded in the Minnamurra River system, at Dunmore and Jamberoo, at Killalea Lagoon and at Albion Park. There are large areas of suitable habitat at all of these locations, unlike the study area where there is only a small area of Cumbungi *Typha orientalis* on Dam No. 8. If the Australasian Bittern occurs in the study area, visits would be rare and fleeting because so little suitable habitat is present.

Powerful Owl

The Powerful Owl was regularly recorded in rainforest at Bass Point, eight kilometres east of the study area, between 1984 and 1991. The owl has also been recorded at various locations along the Illawarra escarpment. The Powerful Owl may roost in the rainforest on the site and may forage there if arboreal mammals are present. It is unlikely that the owl would use the small patches of regrowth in the paddocks.

Rose-crowned Fruit-Dove

The Rose-crowned Fruit-Dove inhabits rainforest and was observed regularly at Bass Point between 1984 and 1989. Immatures seen in 1985 and 1989 may indicate local breeding. The species was last seen in the district in 1995 at Mount Keira. The Rose-crowned Fruit-Dove may occur in the rainforests on the site.

Spotted-tailed Quoll

There are many old records of the Spotted-tailed Quoll in the district (Robinson 1988), but few recent records from the Shellharbour area. Most recent records are from the forests along the escarpment south of Barren Grounds.

Grey-headed Flying-fox

The Grey-headed Flying-fox is relatively common in the Illawarra region during summer, when it makes nightly visits to gardens, orchards and isolated fruit trees to feed on fruiting trees. There is a known daytime roosting camp site at Flying Fox Gully, north of Jamberoo, about four kilometres to the south of the present study area.

Microchiropteran Bats

Several threatened bat species have been recorded in the district, including the Greater Broad-nosed Bat *Scoteanax rueppellii* (Tallawarra 1997), Large-footed Myotis *Myotis macropus* (Tallawarra 1997), Common Bentwing-Bat *Miniopterus schreibersii* (Kiama 1966) and Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*. Apparently no bat surveys have been undertaken in the vicinity of the site. Bats would certainly occur in the general area, because of the presence of ample foraging habitat, large trees with hollows for roosting and other resources for bats; these are mainly in the valley to the south of the quarry site.

2.4 Weeds and Pests

The most significant weeds on the site are listed in Table 5. Note that there are many exotic (introduced) plants on the plant species list for the site, but most are not regarded as being significant weeds. The most important weeds are listed as Weeds of National Significance, and are listed under Schedule 3 of the Biosecurity Regulation 2017, which prohibits their sale or import. Other weeds, termed environmental

weeds, may also become important within the restoration and revegetation areas. All weed species are regulated with a general biosecurity duty under the Biosecurity Act 2015, requiring landowners to prevent, eliminate or minimise any biosecurity risk they may pose.

Table 5– List of Important Weed Species on the Site

Species	Habit	Status/Notes
Noxious (Schedule 3) Weeds		
African Box-thorn <i>Lycium ferocissimum</i>	Shrub	Must not be imported or sold. Rare on the site.
Blackberry <i>Rubus fruticosus</i>	Scrambling shrub	Must not be imported or sold. Scattered small patches.
Lantana <i>Lantana camara</i>	Scrambling shrub	Must not be imported or sold. Rampant invasive species, forms large thickets if left unchecked. Common on the site.
Madeira Vine <i>Anredera cordifolia</i>	Vine	Must not be imported or sold. Occasional to common amongst Lantana.
Prickly Pear <i>Opuntia stricta</i>	Succulent herb	Must not be imported or sold. Rare on the site.
Environmental Weeds		
Castor Oil Plant <i>Ricinus communis</i>	Large herb	Mostly on disturbed ground; can form large colonies if not treated. Occasional on the site.
Crofton Weed <i>Ageratina adenophora</i>	Large herb	Significant weed of moist places.
Large-leaved Privet <i>Ligustrum lucidum</i>	Small tree	Occasional in treed areas.
Mist Flower <i>Ageratina riparia</i>	Shrub	Common in moist areas.
Moth Vine <i>Araujia sericiflora</i>	Vine	Common amongst Lantana.
Noogoora Burr <i>Xanthium occidentale</i>	Large herb	Mainly on disturbed areas.
Small-leaved Privet <i>Ligustrum sinense</i>	Shrub, small tree	Occasional in treed areas.

Site observations to date have identified that feral goats (*Capra hircus*) are the primary pest animal present in the Vegetation Management Areas. While these pests are likely to have a positive impact on certain woody weed species such as Blackberry and Lantana, they may also significantly hamper revegetation efforts on site.

3 MANAGEMENT ACTIVITIES

3.1 Management Approach

The strategies to be implemented across the site will generally be based on the current level of disturbance, and as such can be broken down into the areas as follows. In the Remnant Vegetation Area, minimal management activities will be undertaken, which will primarily be focused on occasional weed and feral animal control as required to maintain and enhance the existing ecological values of the area.

In the Restoration Zone, the aim of management is to enhance the natural processes of rainforest regeneration. This will largely be achieved through weed removal. Natural regeneration is likely to be prolific in these areas with the removal of stock and the main weeds in the area. There may be some minor planting of native species as decided after weed control has been undertaken. Feral animal control may be undertaken if required. Further details on management activities to be undertaken in the Restoration Zone are described in Section 3.2.

The planting zone was previously cleared and grassed, mainly with exotic species, and contained little native regeneration. In this zone, the primary task is to re-plant appropriate local native species and control weed growth. Feral animal control will also be essential to ensure survival of seedlings. Further details on management activities to be undertaken in the Planting Zone are described in Section 3.3.

The Quarry footprint includes those extracted areas undergoing rehabilitation, the area of active extraction from the quarry face, and the areas currently approved for future extraction. Activities in this area will be managed in accordance with the Rehabilitation Management Plan approved by the DPE. Feral animal control may be undertaken in this area as part of the wider control of pest species across the site.

All works as described this section are to be undertaken by or under the direction of an ecologist or suitably qualified bush regeneration personnel. Any personnel engaged in pesticide application will also undertake training in pesticide use as required under the Pesticides Regulation 2017.

Other areas of the site not within the Vegetation Management Areas or within the approved quarry footprint will be managed as an agricultural enterprise, consistent with the historical land use of the site. This will include maintenance of fences, access tracks, cattle grazing, and pest control as required to support agricultural production. Activities in these areas do not form part of the approved development, and as such are not covered by this Vegetation Management Plan. The distribution of the various areas identified above are depicted in Figure 5.

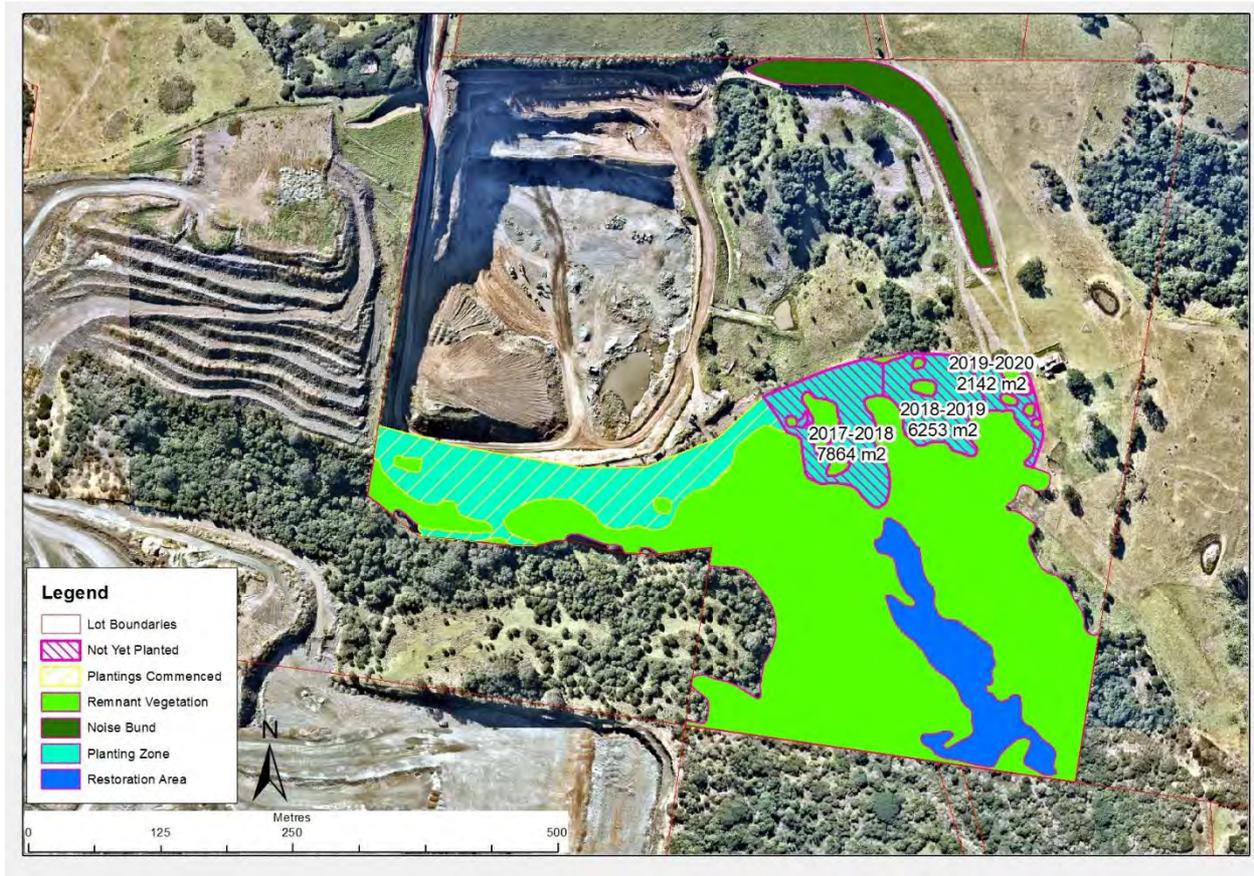


Figure 5 - Vegetation Management Areas and Planting Schedule

3.2 Restoration Zone

As described above, the aim of the restoration zone is to remove and suppress weed growth, thereby allowing the natural re-establishment of the rainforest community from the adjoining rainforest remnants. Table 6 identifies the management activities to be undertaken in the Restoration Zone.

Table 6 – Management Activities in the Restoration Zone

Activity	Description	Frequency
Fencing	Not required, as zone is fully encapsulated within the Remnant Vegetation Area	N/A
Signage	Not required (fully encapsulated)	N/A
Weed Control	Cut and paint application of lantana stumps with appropriate herbicide. Other small scale application of individual weeds as required	Quarterly or as required
Feral Animals	Control feral goats as part of wider site strategy	Assess biannually
Infill Planting	Numerous native trees have emerged in the zone to date. It is not envisaged that infill planting will be required.	Not required
Watering	No watering of plants will occur in this zone	N/A
Fertilising	No application of fertilizer will be undertaken in this zone	N/A

3.3 Planting Zone

As described above, the aim of the Planting Zone is the long term transformation of a cleared, exotic grassland into an ecological community reminiscent of the adjacent remnant rainforest and woodland communities. Table 7 lists the management activities to be undertaken in the Planting Zone. Where appropriate, these strategies are further described in the following subsections.

Table 7 – Management Activities in the Planting Zone

Activity	Description	Frequency
Fencing	Install stock-proof fence prior to initial planting or seed spread	Completed. Monitor integrity biannually
Signage	Signs installed on any gates entering planting area restricting vehicle movements	N/A
Weed Control	Initial spraying of exotic grasses and application of mulch (if available). Cut and paint application of lantana stumps with appropriate herbicide. Other small scale application of individual weeds as required	Prior to planting. Quarterly or as required
Feral Animals	Control feral goats as part of wider site strategy	Assess biannually
Planting	As per Planting Methodology	See Section 3.3.5
Watering	As per Planting Methodology	See Section 3.3.5
Fertilising	As per Planting Methodology	See Section 3.3.5

3.3.1 Collection of Propagating Material

The availability of plant propagation material will be identified during the pre-clearing surveys described in Section 4.1. Propagation material includes:

- Seeds, these can be collected and stored for later use;
- Cuttings, many species can be propagated this way;
- Rootstock, some species can be readily transplanted by using their rootstock;
- Whole plants, useful in some circumstances, such as seedlings of rare species and wetland plants.

The propagation material collected during the pre-clearing inspections will be provided to a specialist nursery for propagating the plants required for the planting programs. If constructed ponds require vegetating, appropriate wetland plants on existing dams will be identified by the ecologist for transplanting.

3.3.2 Reuse of Cleared Material

Material removed from some areas, particularly from within the small rainforest patches, may be useful in the revegetation areas, to assist in revegetation or for creating habitat. This material will be identified during the pre-clearing surveys, and may include topsoil, logs, surface rocks and mulch.

3.3.3 Treatment of Topsoil

The topsoil is a valuable resource for revegetation and restoration of habitats. The soil below native vegetation often contains propagules (seeds, rootstock) useful for revegetation areas.

Topsoil stripped from each stage and identified for use in revegetation will be used as soon as practicable. Preferably, it would be taken and spread immediately after stripping to the end use area, rather than being stored in a stockpile for a long period of time.

3.3.4 Plant Selection

Plant species to be used in the revegetation areas must be locally occurring species and obtained from local stock. These species can be selected from the list of species that occur in the area, with a preferred list provided in Appendix 1. Initial plantings will focus on the selection of tree and shrub species. Except where available as cleared material, ground covers are only to be planted once other species are well established in the event natural colonisation does not occur. The local rainforest groundcovers are almost entirely ferns, which are generally not suitable for planting as the site will be too exposed until tree cover is established. Alternative ground cover plants representative of moist forest species may be utilised until dense tree cover is achieved. Species selection will be based on available stock, with the following seedling rate provided as a guide per 100m² of area to be planted:

- Large Tree species – 6
- Shrub/ Small Tree species – 6
- Groundcovers – 100 (where natural recruitment does not occur)

Maximum use will be made of the existing plants growing in the revegetation area. When weeds are removed, for example, care will be taken to ensure that active species growing amongst the weeds will be kept. This strategy will greatly accelerate the regeneration of the forest in the area and reduce the need for planting in some areas.

3.3.5 Planting Methodology

Between one week and three months prior to any planting programme, weed control will be undertaken to kill any unwanted species present in the plant area. This is likely to be focused on the introduced grasses prevalent in the Planting Zone, but will also focus on other noxious and environmental weeds.

Trees and shrubs will be planted at a spacing of no more than three (3) metre centres. Ground cover plants will be planted (where required) at a density of one plant per square metre.

The staking of individual plants will be avoided, as it requires much effort and may be detrimental to the plant, which should be left to grow naturally. Placing plastic bags or 'Grow Tubes' around each plant can improve the success rate. These plant guards are used to protect the plant from grazing animals, reduce weed competition, reduce wind and frost effects, and lower evaporation rates around the plant. Treating individual plants can be high maintenance, but the results are usually worth the effort.

Tubestock or similar sized plants will be used for all plantings. Advanced plants are not usually successful in this type of project and should not be used.

For aesthetic reasons, the plants should not be planted in rows, lines or grid patterns. The plantings should be at random, with an average density as set out above.

Each plant will be placed in a hole of suitable size. Two slow-release fertiliser tablets will be placed at the bottom of the hole, and a handful of water-holding crystals placed around the plant as the hole is filled in. The use of strong fertilisers is generally avoided in native planting projects. A tree guard (e.g. plastic bag)

will be placed around the planted trees and shrubs, although this may not be necessary for the ground cover plants.

Each plant will be watered immediately after planting. The area around the plant will be mulched as soon as possible after planting, as each section is completed. Follow-up watering will occur at least once per week, depending on rainfall. Watering will cease or be curtailed when the plants are large enough to survive without; this will encourage deeper root growth and better plant health.

All trees and shrubs cleared from the quarry area will be mulched on site, with the mulch to be utilised on site in landscaping or forest restoration works. Mulch containing weed propagation material (e.g. seeds) must be heap composted to ensure this material is rendered unviable.

3.3.6 Planting Schedule

The initial planting of an area will preferably be undertaken during March, encapsulating the period of greatest and most reliable rainfall, however will be delayed in the event of unsuitable ground conditions. Figure 5 depicts the planned planting schedule for the remaining areas to be planted. Infill planting will be undertaken throughout the year as required, subject to suitable ground conditions and seedling availability.

3.3.7 Regular maintenance of Planting Zone

Maintenance of the restoration areas and planted vegetation will be guided by monthly site inspections undertaken by the Quarry Manager. Six-monthly monitoring inspections by the ecologist will also provide information for the successful maintenance of these areas.

Monthly site inspections will involve checking the following:

- Condition of the plantings;
- Condition of the planting bag and stakes (where used);
- The need for weed control;
- The impact of feral animals;
- The need for follow up planting or watering;
- The condition of fences;
- General condition of the restoration and planting areas.

3.4 Management of Threatened Communities

The distribution of threatened ecological communities derived from site surveys have been mapped against the approved quarry extraction area in Figure 4. A stock-proof fence has been constructed along the extraction limit, thereby providing a physical barrier to prevent quarry ingress. Where gates have been constructed along this fenceline, signage has been installed to restrict the movement of any vehicles or machinery, except for those engaged in vegetation management or environmental monitoring purposes.

Following periods of significant rainfall, rainwater will collect in the sump within the quarry excavation. This water will be discharged to the environment as described in the Water Management Plan. The release of water from the quarry sump will be variable; that is, rather than a continuous flow, water release will mirror the local rainfall events as far as practicable. This practice will ensure any captured water is made

available to the threatened ecological communities down-gradient of the quarry, mirroring as far as reasonably practical the pre-existing hydrological regime of the area.

The remnant threatened ecological communities of the area will be enhanced through the exclusion of stock and equipment, supplementary water discharges, the control of weeds and pests on site (see sections 3.7 and 3.8), and the enhancement of communities in the Revegetation Areas, which will form an additional buffer for the existing communities.

3.5 Management of Threatened Plant Species

As described in Section 2.2, four threatened and eight regionally significant plant species have been identified on or adjacent to site through field surveys. As for the remnant threatened ecological communities, these individuals are well separated from the extraction limit of the quarry (excluding those individuals within the approved extraction area). The controls described in Section 3.4 (fencing, signage, water releases, weeds and pest management) will ensure the conservation of those individuals within the remnant areas.

Section 4 of the VMP describes the process to be followed when clearing remnant vegetation from the approved extraction area of the quarry. While no threatened plant species have been observed in these pockets, populations of two regionally significant (rare) plant species have been identified. The measures described in Sections 4.4 to 4.6 may provide these rare species with a boost to assist establishment in the Planting Zone.

It is acknowledged that the conservation significance of the Illawarra Socketwood (*Daphnandra johnsonii*) is of particular importance on the site, as it is one of only three known sites to produce viable seed. Fortunately, the population on site is well within the boundary of the remnant rainforest, as shown in Figure 4. Given the protected distribution of this population and the controls described above, it is not envisaged that any further management practices would be beneficial in conserving the population of this unique species on the site.

3.6 Management of Threatened Fauna Species

The Environmental Impact Study did not positively identify any threatened fauna species on the site, however identified certain species that may be present due to suitable habitat, or known records of identification in the area surrounding the site (Section 2.3). While no threatened species were directly observed during surveys, four species listed as vulnerable (Powerful Owl, Rose-crowned Fruit-Dove, Spotted-tail Quoll and Grey-headed Flying-Fox) are assumed to use the remnant vegetation within the site for habitat or foraging purposes.

Management strategies to conserve these threatened species on site will revolve around the enhancement of suitable habitat, which is the aim of the revegetation programme. While the control of certain weed species such as the Blackberry may reduce food availability for certain arboreal mammals and birds, the enlargement of the rainforest communities are likely to have a net positive effect on the threatened fauna species.

3.7 Weed Control

Weed control will be undertaken primarily within the quarry extraction area, and Planting and Restoration Zones. Weed control will focus on those five weeds identified as noxious in the Illawarra, with control of

other environmental weed species as required to suppress growth and expansion. Weed control will generally be undertaken on a monthly basis if required, and dependent on suitable conditions for control. Any weed control works will be undertaken in accordance with the Pesticides Act 1999 and Regulation 2017. Weed control activities will be reported in the Annual Review for the project. The specific methodologies to control the noxious weeds are described in the following subsections. No mechanical removal or herbicide application will be undertaken within 30 metres of any species identified as endangered in Figure 4. Weed characteristics and control strategies have been developed based on published information provided by the NSW Department of Primary Industries. The effectiveness of weed control strategies will be assessed based on monitoring undertaken as part of the annual surveys described in Section 5.1.3

3.7.1 African Boxthorn (*Lycium ferocissimum*)

African Boxthorn forms an impenetrable spiny thicket that provides a haven for feral animals, and is toxic to humans. Fruit set generally occurs in autumn, but can occur at any time of year depending on conditions. Seeds can germinate at any time of the year if there is adequate moisture and warmth. The plant has an extensive, deep, branched taproot that will sucker and produce new growth if broken.



Control Strategies

Where accessible, and not posing a threat to existing remnant vegetation or threatened species, mechanical removal of mature thickets will be undertaken utilising medium-sized dozers to remove top growth and roots where practical. Removed material will be placed at the base of the quarry excavation prior to backfilling. Follow up mechanical or chemical treatment will be undertaken in the event of any regrowth.

Where accessibility or remnant vegetation restricts mechanical removal, chemical control will be undertaken. This will involve basal bark treatment of smaller plants (up to 5cm diameter) or cut stump treatment of larger plants. Any stems that are cut as part of the treatment will be buried in the quarry excavation as described above. Follow up treatment will be undertaken to control any regrowth. A glyphosate based herbicide (*Roundup*) will generally be used for chemical control of African Boxthorn.

3.7.2 Blackberry (*Rubus fruticosus*)

Blackberries are semi-deciduous, scrambling shrubs with prickly stems. Recognised as one of the worst weeds in Australia, blackberries are a Weed of National Significance. Blackberry fruit set during summer, with each berry containing 20 to 30 seeds, with seed number and seedling survival lower in shaded areas compared to areas with full sun. Blackberry will reproduce vegetatively where the new growing tips contact the ground, and can also reproduce from suckers, root fragments, and other plant parts.



Control Strategies

As there are no large infestations of Blackberry on site, and due to its ability to easily regrow vegetatively, chemical control of Blackberry thickets will be prioritised over other control strategies. The preferred chemical control method will involve the application of triclopyr & picloram (*Vigilant II*) with diesel using the cut and paint method. Suckering is likely following this treatment, and will be managed through follow up applications. This is the method recommended by the NSW DPI for sensitive areas. For larger areas within the quarry footprint, foliar application of this herbicide may be used, including a 2 metre area around the bush. Foliar application will not be undertaken within the Vegetation Management Areas unless other strategies have been unsuccessful. Chemical control of Blackberry will be undertaken from early summer through to mid-autumn.

3.7.3 Lantana (*Lantana camara*)

Lantana is a serious invader of disturbed ecosystems, which can form a dense understorey competing with native flora and limiting natural regeneration. Lantana can flower and fruit year round when soil moisture is available, with seedlings also germinating year round, but generally peaking after summer rain. Lantana doesn't sucker from damaged roots, but can regrow vigorously from the base of stems.



Control Strategies

Where accessible, and not posing a threat to existing remnant vegetation or threatened species, mechanical removal of mature lantana thickets will be undertaken utilising medium-sized dozers to remove top growth and roots where practical. Follow up chemical control of seedlings will be undertaken in the event on any regrowth.

Where accessibility or remnant vegetation prohibits mechanical removal, chemical control will be undertaken. This will involve basal bark treatment of smaller plants (up to 5cm diameter) or cut stump

treatment of larger plants. Follow up treatment will be undertaken to control any regrowth. A triclopyr or picloram based herbicide (separately or combined; *Garlon 600*, *Access*, *Vigilant II*) or glyphosate (*Roundup*) will generally be used for chemical control of Lantana.

3.7.4 Madeira Vine (*Anredera cordifolia*)

Madeira Vine is an invasive climber that has been used as an ornamental plant in gardens in Australia, however as become an invasive weed, blanketing and smothering trees and bushes. It is common in coastal areas of NSW, including the margins of rainforest. Madeira vine flowers in summer, and reproduces through the production of thousands of underground tubers and aerial bulbils. The small light-brown or green potato-like bulbils fall to the ground as vines age. The tubers and the bulbils can remain viable for many years.



Control Strategies

Physical removal may be undertaken on small or immature infestations, with all plant material (including tubers) placed at the base of the quarry excavation prior to backfilling. For larger infestations, chemical control of Madeira Vine will be prioritised over other methods, due to its growth habit and its ability to vigorously regrow when disturbed. This will involve either scrape and paint or foliar application of herbicide, depending on the nature of the infestation and stage of the control process. A glyphosate based herbicide (*Roundup*) will generally be used for chemical control of Madeira Vine, however other options, including Picloram and Triclopyr based herbicides (such as *Grazon DS*, *Vigilant II*) may also be suitable. Chemical control of Madeira Vine will be prioritised for the spring and summer months.

3.7.5 Prickly Pear (*Opuntia stricta*)

The Prickly Pear is a cactus with swollen fleshy stems, spines, and no leaves, usually under a metre high with thick blue-green flat pads. Birds and other animals can spread the seed, however it will also reproduce vegetatively by pads or broken segments taking root if left in contact with the ground.



Control Strategies

Due to the relative scarcity of Prickly Pear on site, manual removal of any isolated plants will generally be undertaken using hand tools, if detected during other management activities. All plant material including roots and fleshy stems will be placed at the base of the quarry excavation prior to backfilling.

3.8 Feral Animal Control

Site observations to date have identified that feral goats are the primary pest animal present in the Vegetation Management Areas. Revegetation efforts to date have been hampered in some areas due to the grazing of planted seedlings by feral goats. Efforts to control the populations of feral goats on site have thus far been hampered by the nomadic nature of the goats, and the inherent difficulties of undertaking a culling programme on a mine site. Nevertheless, the following management techniques may be available to limit the impacts of feral goats on the objectives of the Vegetation Management Plan. Monitoring to be implemented to assess the effectiveness of feral animal control techniques are outlined in Section 5.1.

3.8.1 Goat-proof fencing

Goat-proof fencing has been established around part of the Planting Zone with recently planted seedlings. This electrified fence, while costly to install, has thus far been successful in preventing grazing by feral goats. This option is only practicable for the Planting Zones, due to the terrain and the equipment needed to install the fence, and may be used as a short-term option while seedlings are first establishing. Similarly, while this method is highly effective in supporting vegetation establishment, it is not a longer-term solution to the issue of feral goat grazing the Vegetation Management Areas.

3.8.2 Trapping

Trapping of goats may be used as a form of feral animal control. This would involve the construction of a holding pen with a one-way gate, such that feral goats could enter the pen but would be unable to leave. Considerations for animal welfare would guide the construction and operation of any trap, which at a minimum would be checked on a daily basis while in operation. The use of traps would only be undertaken during favourable climatic conditions, and would depend on the availability of a market for the captured animals. If successful, it is likely to offer the most cost effective method for the reduction or elimination of feral goats from the site.

3.8.3 Shooting

Where conditions are not favourable for trapping, shooting of feral goats may be undertaken. This would be undertaken in accordance with the legislative requirements of the NSW Work Health and Safety (Mines and Petroleum Sites) Act (2013) and Regulation (2014), and the NSW *Firearms Act* (1996) and Regulation (2017), and will include notifying fenceline neighbours prior to commencing the culling programme.

4 VEGETATION CLEARING PROTOCOL

The Vegetation Clearing Protocol was previously separately approved in 2006 prior to the initial development of the quarry. It has been revised and is now included here in the Vegetation Management Plan, due to the complementary nature of the two documents. Figure 6 shows those areas of remnant vegetation that will be cleared as part of the quarry development.

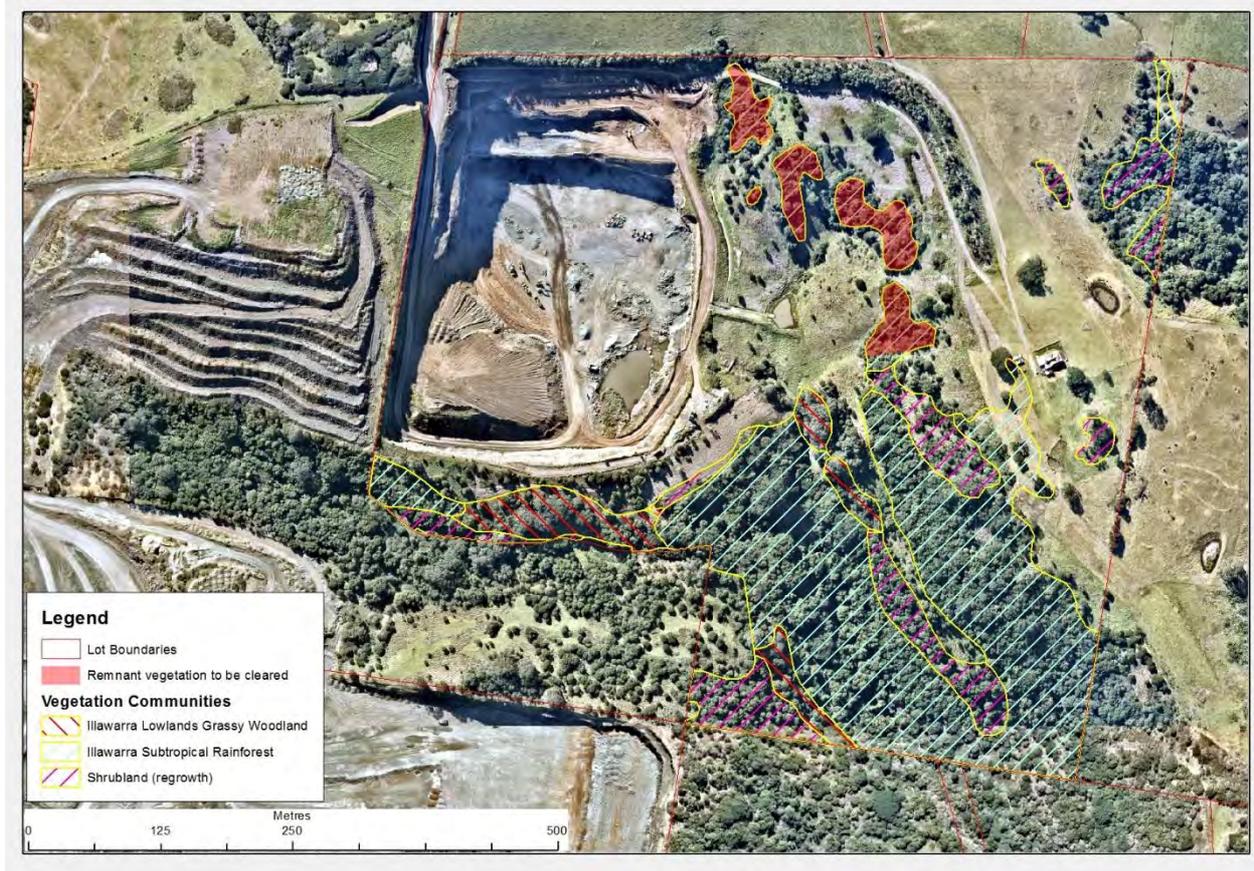


Figure 6 - Areas of Remnant Vegetation to be Cleared.

4.1 Pre-Clearing Surveys

The vegetation to be cleared is described in detail in the Flora and Fauna component of the EIS (Kevin Mills & Associates 2003) for the project. Figure 6 provides a diagram of those areas of remnant vegetation that will be cleared using the methodology described. It is proposed to carry out pre-clearing vegetation surveys prior to the clearing of any remnant vegetation. The purpose of these additional surveys is to:

- Identify any plant material (seeds, rootstock, cuttings) that would be useful to gather for use in propagating plants for the revegetation program elsewhere on the site;
- Identify any material on the site (logs, natural mulch, rocks, soil) that could be used for revegetating the buffer areas south of the quarry site;
- Identify any important plants that may have colonised the site since the 2003 survey;
- Describe the fauna observed and any special habitat features, such as tree hollows; and
- Identify any measures to reduce impacts and prevent harm to arboreal fauna or avifauna found to be present in the area to be cleared.

The pre-clearing survey will be completed by an ecologist prior to the clearing of rainforest vegetation, who will inspect the vegetation and prepare a report dealing with, as a minimum, the above matters for inclusion in the Annual Review.

4.2 Staging of Clearing

The quarry will be developed in several stages. As at October 2017, Stages 2 and 4 of the quarry are currently under development. With approval to continue development into Stages 5 and 6 of the quarry, it is planned to extract these additional stages synchronously with Stages 2 and 4. The clearing of vegetation will be undertaken progressively and only as required for the efficient extraction of hard rock for the development.

The clearing of remnant vegetation from the approved quarry extraction area will only be undertaken at a distance of no more than approximately 120 metres from the current active extraction area.

4.3 Fauna Management

The fauna on and around the site is described in the Flora and Fauna component of the EIS (Kevin Mills & Associates 2003). The amount of native fauna habitat to be removed by the quarry development is very small; no major habitat will be impacted.

Fauna management is a minor aspect of vegetation clearing, nevertheless the following matters will be considered:

- Where practicable, the rainforest remnants will be cleared in Winter, outside the main bird breeding period;
- Feral animal will be controlled as required, particularly foxes and rabbits;
- If special species or habitats are identified during pre-clearing surveys, appropriate action will be taken.

4.4 Treatment of Topsoil

The topsoil is a valuable resource for revegetation and rehabilitation of habitats. The soil below native vegetation often contains propagules (seeds, rootstock) useful for revegetation areas.

Topsoil encountered as part of quarry development will be stripped separately and preferably used as soon as possible on rehabilitation areas. Where there are no rehabilitation areas available for immediate placement, topsoil is to be stockpiled within the approved disturbance footprint, with stockpile heights preferably less than 2 metres high, and in any case no greater than 4 metres high.

4.5 Collecting Propagation Material

The availability of plant propagation material will be identified during the pre-clearing surveys discussed above in Section 4.1. Propagation material includes:

- Seeds, these can be collected and stored for later use;
- Cuttings, many species can be propagated this way;
- Rootstock, some species can be readily transplanted by using their rootstock;
- Whole plants, useful in some circumstances, such as seedlings of rare species and wetland plants.

The propagation material collected during the pre-clearing inspections will be provided to a specialist nursery for propagating the plants required for the Planting Areas or for quarry rehabilitation, depending on the stage of the quarry at the time of collection. If constructed ponds require revegetating, appropriate wetland plants on existing dams will be identified by the ecologist for transplanting.

4.6 Reuse of Cleared Material

Material removed from some areas, particularly the rainforest patches, may be useful in the revegetation areas, to assist in revegetation or for creating habitat. This material will be identified during the pre-clearing surveys.

Material identified during the pre-clearing surveys for being useful in the revegetation will be identified, and the Quarry Manager will ensure that the material is appropriately stored and eventually utilised on the site in Planting Areas or quarry rehabilitation as appropriate.

4.7 Weed Control

Section 3.7 describes the noxious and environmental weeds that have been identified on the site, and the management strategies that will be undertaken to control these weeds. The Quarry Manager will be responsible for monitoring the presence and abundance of weeds on the site. The Quarry Manager will undertake an inspection of the land to be cleared prior to clearing and destroy any weeds to ensure that they are not spread while transporting topsoil.

5 MONITORING, REVIEW AND REPORTING

5.1 Monitoring

5.1.1 Monthly Inspections

As described in Section 3.3.7, monthly site inspections of the Planting Area by the Quarry Manager or delegate will involve checking the following:

- Condition of the plantings;
- Condition of the planting bag and stakes (where used);
- The need for weed control;
- The impact of feral animals;
- The need for follow up planting or watering;
- The condition of fences;
- General condition of the restoration and planting areas.

5.1.2 Biannual Inspections

In or around December and June each year, the Quarry Manager will engage a qualified ecologist to undertake an inspection of the Vegetation Management Areas. The purpose of the biannual inspection is to provide expert feedback on the efforts to improve the biodiversity of the Vegetation Management Areas, and in particular guide activities in the Revegetation Areas. The ecologist will prepare a written report following each inspections, which will cover matters such as compliance with this management plan and any adverse environmental impacts, any recommendations and any additional mitigation measures considered necessary. The report will also include the number and species of seedlings planted since the last inspection, the condition of the fences, the number of hours spent controlling pest species, and any other relevant matter. The written reports will include feedback from the Quarry Manager, and will be included in the Annual Review for the relevant reporting period.

5.1.3 Annual Survey

The June (or thereabouts) inspection by the ecologist each year will include a quantitative survey of the Vegetation Management Areas, which will be included in the Annual Review. The survey is designed to assess the health of the Remnant Vegetation and the performance of the management strategies outlined in the VMP. Surveys will be undertaken in each of the monitoring plots to be established in the remnant vegetation as described in Section 2.1.3, as well as a monitoring plot to be established in the Restoration Zone and one monitoring plot to be established in each of the Planting Zones shown in Figure 5 (once plantings have commenced in the respective zone). The corners of each 20m x 20m monitoring plot will be marked with survey pegs, and the location of the centre of each plot logged using a GPS.

For each plot, the following will be recorded and reported in the annual report:

- Number of plantings surviving for each species (Revegetation Areas only);
- Number of plantings not surviving (Revegetation Areas only);
- Number of stems of each native species;
- Number of stems of each weed species;
- Percentage cover of weed species;
- Percentage foliage cover;

- Percentage ground cover;
- Abundance of threatened plant species or other plant species of conservation significance;
- Presence of threatened fauna species (including presence outside of marked plot);
- Pseudo-density of feral animals as determined by abundance and distribution of traces (scats, prints etc); and
- Health of vegetation community (related to potential water stress).

A survey of the known populations of threatened species in the Vegetation Management Areas will be undertaken as part of the annual survey. The aim of this inspection will be to confirm the known threatened species on site have not been adversely affected by quarrying operations. An assessment will be made as to the health of the population, as well as confirming existing controls to prevent quarry incursion on the threatened species are effective.

5.2 Reporting

The biannual reports including the annual survey will be included in the Annual Review each year. The Annual Review will be submitted to the DPE as per Schedule 6 Condition 2 of the Development Consent. The Annual Review will also be made available on the Cleary Bros website for any other interested parties as per Schedule 6 Condition 9 of the Development Consent.

5.3 Remedial Strategies

Where the biannual report from the ecologist identifies potential threats to the success of the Revegetation Areas, the ecologist will recommend additional strategies that may be undertaken. This will depend on the individual circumstances, but may involve supplementary plantings, additional weed or feral animal control, or a revision in the recommended species used for planting. Any recommendations are to be in line with the conditions of the Development Consent, but may involve a variation to the approved Vegetation Management Plan. In this instance, the Vegetation Management Plan will be updated as part of its next scheduled review. All practicable recommendations made by the ecologist will be implemented by the Quarry Manager.

5.4 Review

The adequacy of the Vegetation Management Plan will be reviewed as part of the Annual Review process. Where it is identified that changes to the VMP are required, the revised document will be submitted to the DPE for their approval. In any case, the Vegetation Management Plan will be revised at a minimum of every five years, in line with Schedule 4 Condition 41 of the Development Consent.

APPENDIX 1 – LIST OF SUITABLE PLANTS

The following local plant species are suitable for use on the Albion Park Quarry site; use of particular species at any one time will depend upon availability. Most of these species have proved successful at Albion Park. The list is targeted at trees to establish a good canopy under which smaller plants can colonise from adjacent forest.

General Use

Scientific Name	Common Name	Common Habit
<i>Alphitonia excelsa</i>	Red Ash	Large tree
<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	Large tree
<i>Cryptocarya microneura</i>	Murrogun	Small tree
<i>Diospyros australis</i>	Black Plum	Small tree
<i>Eucalyptus quadrangulata</i>	Coastal White Box	Large tree
<i>Eucalyptus tereticornis</i>	Forest Red Gum	Large tree
<i>Ficus macrophylla</i>	Moreton Bay Fig	Large tree
<i>Glochidion ferdinandi</i>	Cheese Tree	Small tree
<i>Guioa semiglauca</i>	Guioa	Large tree
<i>Melia azedarach</i>	White Cedar	Small tree
<i>Myrsine variabilis</i>	Muttonwood	Small tree
<i>Notelaea venosa</i>	Native Olive	Small tree
<i>Pittosporum undulatum</i>	Sweet Pittosporum	Small tree
<i>Planchonella australis</i>	Black Apple	Large tree
<i>Stenocarpus salignus</i>	Scrub Beefwood	Small tree
<i>Streblus brunonianus</i>	Whalebone Tree	Small tree
<i>Syzygium smithii</i>	Lilly Pilly	Small tree
<i>Toona ciliata</i>	Red Cedar	Large tree

Moist areas

<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Small tree
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Limited number and well scattered

<i>Acacia maidenii</i>	Maiden's Wattle	Small tree
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Ground Cover species

<i>Gymnostachys anceps</i>	Settler's Flax
<i>Pandorea pandorana</i>	Wonga Vine
<i>Hibbertia scandens</i>	Climbing Guinea Flower
<i>Alchornea ilicifolia</i>	Native Holly
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Pittosporum multiflorum</i>	Orange Thorn
<i>Poa labillardieri</i>	River Tussock
<i>Zieria smithii</i>	Sandfly Zieria
<i>Cissus Antarctica</i>	Kangaroo Vine