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Report:	Vegetation Management Plan 186 – 206 Captain Cook Drive, Kurnell, NSW 2231
Prepared for:	Taleb Property Pty Ltd c/o AMBS Ecology & Heritage Pty Ltd
Prepared by:	Narla Environmental Pty Ltd
Project no:	Ambs1
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Version:	Final

Narla Environmental Pty Ltd

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Report Certification

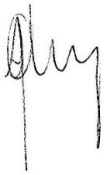
Works for this report were undertaken by:

- Stephen Anstey – Managing Director

  (Accredited Bush Regenerator / Member of the Australian Association of Bush Regenerators)
- Kurtis Lindsay – Principal Ecologist
- Alexander Graham – Ecologist

As Managing Director of Narla Environmental Pty Ltd I, Stephen Anstey, certify that:

- This report has been prepared in accordance with the brief provided by the client.
- The information presented in this report is a true and accurate record of the study findings in the opinion of the authors.



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Contents

1.Introduction

1.1 **Background and Project Proposal**

Narla Environmental Pty Ltd (Narla) was engaged by AMBS Ecology & Heritage Pty Ltd (AMBS) on behalf of Taleb Property Pty Ltd ('the proponent') to produce a Vegetation Management Plan (VMP) in association with Development Application No. DA17/0161 at 186-206 Captain Cook Drive, Kurnell (hereafter referred to as 'the Project Site').

The VMP has been developed as a guide for the mitigation of vegetation/biodiversity impacts associated with the development of the site, including the construction of warehouses, offices, car parking and truck parking, with driveways off Sir Joseph Banks Drive and Chisholm Road (**Appendix A**). This VMP addresses all conditions set out within the letter of requirements – File Reference: DA17/0106 (Dated 2nd June 2017) provided by Sutherland Shire Council.

The VMP has been developed in accordance with all relevant State and Federal legislation, and the following Council documents:

- Sutherland Local Environmental Plan (SLEP) 2015;
- Sutherland Development Control Plan (SDCP) 2015; and
- Sutherland Biodiversity Action Plan (SBAD) 2015.

All revegetation works to take place within Sydney Water – *Water Supply Easement* have been prepared in accordance with the requirements of Department of Primary Industries – Office of Water.

This VMP is intended to operate in conjunction with the recommendations provided within the *Ecological Assessment of 186 – 206 Captain Cook Drive, Kurnell* (AMBS 2017) and inform the Landscape Plan prepared for the Project Site.

1.2 **Project Site**

The Project Site consists of two land parcels (DP402485 and DP652964), situated between Captain Cook Drive, Sir Joseph Banks Drive, Chisholm Road and the Caltex Oil Refinery. The Project Site boundary has been defined by cadastral boundaries provided on the NSW Government Land & Property Information Spatial Information Exchange map viewer (SIX Maps, 2017).

The Project Site comprises an irregularly shaped area of approximately 5.8 ha, with approximate dimensions of 500m from its northern to southernmost point, and approximately 200m from its eastern to westernmost point. Vegetation of the Project Site is separated from Towra Point Nature Reserve (a wetland of international significance) by Captain Cook Drive (**Figure 1**).

Figure 1. Project Site

1.3 **VMP Aims and Objectives**

This VMP aims to guide best-practice native vegetation management and rehabilitation works at the Project Site, in order to mitigate impacts from the proposed construction, including:

- Restoration of indicative local soil profile, to the greatest practicable extent;
- Eradication of priority and environmental weed species;
- Reduction and maintenance of exotic plants species populations to low levels of growth and cover;
- Establishment of self-sustaining and diverse indicative native vegetation assemblage of local provenance species (Kurnell Dune Forest) throughout the Project Site;
- Establishment of self-sustaining and diverse novel native vegetation assemblage of local provenance species within areas that have been impacted/influenced by the proposed works.

The VMP has been produced as a practical document that can be effectively utilised in a field-based scenario. Primary objectives of this VMP are to specify best-practice:

- Control and management of exotic plant populations;
- Provenance plant selection, seed collection and propagation;
- Plant installation and maintenance;
- Ongoing exotic species control, site management and native vegetation establishment.

1.4 **Site Assessment**

Site assessment was undertaken by Alexander Graham (Ecological Consultant) of Narla Environmental on Wednesday 15th August 2017.

Extensive ecological survey has previously been conducted within the Project Site by AMBS Ecology & Heritage (AMBS) between 29 February and 22 March 2016.

2. Site Description

2.1 **Vegetation Communities**

Field survey undertaken by AMBS determined the presence of two distinct vegetation communities within the site; a derived Banksia Forest and Kurnell Dune Forest EEC (AMBS 2017) (**Figure 2**). AMBS has identified the presence of two 'man-made' wetlands within the southern extent of the Project Site, vegetated with typical alluvial shrub and groundcovers and a suite of environmental weeds. Vegetation within the site has been heavily influenced by historical clearing, introduction of exotic species, urbanisation, and a tornado that pass through the site in December 2015.

The remainder of vegetation within the Project Site has been characterised as 'Planted Vegetation' or 'Cleared/exotic species' (AMBS 2017). Details of the vegetation, including their total extent across the Project Site are presented in **Table 1**.

Table 1. Vegetation Communities within the Project Site (AMBS 2017)

Common Name	Total Extent on Project Site	Total Extent to be Removed	Total Extent to be Retained
Banksia Forest	2.43 ha	2.17 ha	0.26 ha
Kurnell Dune Forest (EEC)	0.18 ha	0.18 ha	0.18 ha
Planted Vegetation	0.76 ha	0.05 ha	0.71 ha
Man-made Wetlands and Associated	0.07 ha	0.07 ha	0.07 ha

2.2 **Threatened Species**

Targeted threated flora searches undertaken by AMBS (2017) were performed for species with likelihood to occur within the Project Site:

- *Syzgium paniculatum* (Magenta Lilly Pilly);
- *Callistemon linearifolius* (Netted Bottlebrush); and
- *Pterostylis* spp. (Botany Bay).

AMBS's field survey confirmed the presence of the Magenta Lilly Pilly within the site, as well as a tentative recording of ten individuals of Netted Bottlebrush that could not be confirmed due to the absence of flowers (**Appendix B**). However, vegetation, topography, and soils of the Project Site are not suitable for this species. The examples here, if they are in fact Netted Bottlebrush, have almost certainly been planted (B. Pellow, AMBS, pers. comm.).

2.3 **Priority and Environmental Weeds**

A total of 48 exotic species have been recorded within the Project Site, including nine priority weeds (**Table 2**) (AMBS 2017). Seven of these weeds are also listed as a Weed of National Significance (WONS) due to their debilitating impacts and widespread extent (DPI 2015).

Recommended weed treatment methods can be found within **Appendix C.**

Table 2. Priority Weeds and Weed of National Significance (WoNS) identified within the Project Site

Scientific Name	Common Name	WoNS
Cortaderia selloana	Pampas Grass	
Asparagus aethiopicus	Asparagus Fern	✓
Asparagus asparagoides	Bridal Creeper	✓
Asparagus plumosus	Climbing Asparagus Fern	✓
Chrysanthemoides monilifera subsp. rotundata	Bitou Bush	✓
Lantana camara	Lantana	✓
Olea europaea subsp. cuspidata	African Olive	
Genista monspessulana	Cape Broom	✓
Rubus fruticosus sp. agg.	Blackberry	✓

2.4 **Fauna Habitat**

Two man-made waterbodies within the south of the Project Site offer potential habitat for frogs, water birds and other fauna. Potential habitat for the endangered *Litoria aurea* (Green and Golden Bell Frog) and vulnerable *Crina tinnula* (Wallum Froglet) exists within the two man-made waterbodies within the south of the site. Despite extensive targeted searches, neither of these species were identified.

Other conservation significant species that may occur in this area (intermittently), include *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed migratory wetland birds that may pass through the site whilst foraging within the Towra Point Nature Reserve, however, no habitat that would be typically used by threatened shorebirds was identified within the site (AMBS 2017).

Scattered Eucalyptus botryoides within the south of the Project Site, when in flower, may attract the EPBC Act and *Threatened Species Conservation Act 1995* (TSC Act) listed Critically Endangered *Anthochaera phrygia* (Regent Honeyeater) or *Lathamus dicolor* (Swift Parrot) as well as the Vulnerable *Glossopsitta pusilla* (Little Lorikeet).

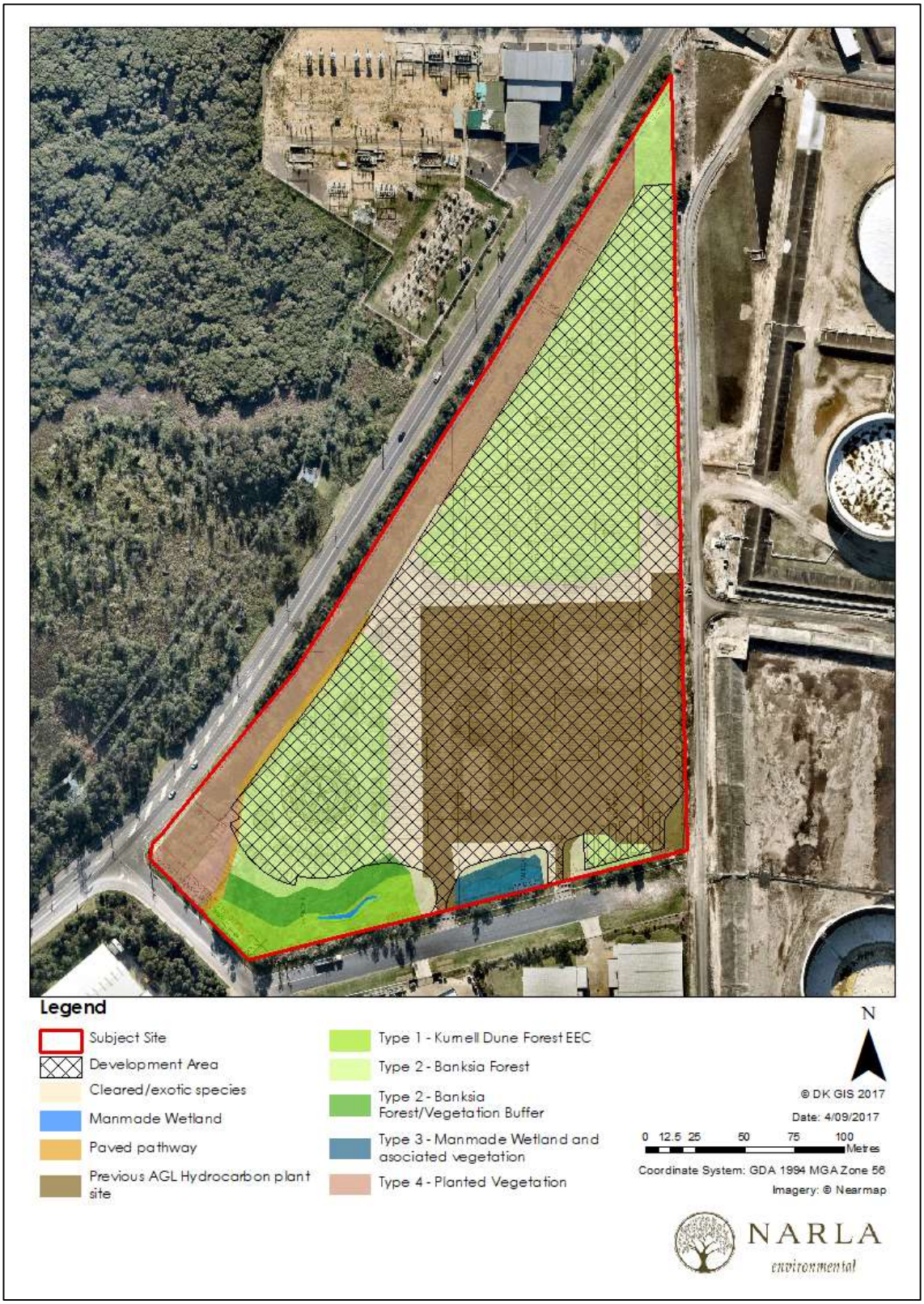

Figure 2. Proposed development footprint and mapped vegetation determined by AMBS (2017)

3. Work Specifications

VMP management zones are provided in **Figure 3** – *Site Map and Vegetation Management Zones.* Information supplementary to the Site Map and Vegetation Management Zones in **Figure 3** is provided below.

All works zones have been derived from a combination of:

- The project design drawings (see Appendix A);
- Vegetation mapping provided within *Ecological Assessment of 186 – 206 Captain Cook Drive, Kurnell* (AMBS 2017);
- The boundaries of the Sydney Water Supply Easement; and
- The most appropriate revegetation and weed control techniques applicable to the area in question.

3.1 **Management Zones**

Vegetation management has been divided into five management zones (**Figure 3**)**.** The work zones are as follows:

- Zone 1: Man-made Wetlands;
- Zone 2: Sydney Water Supply Easement;
- Zone 3: Kurnell Dune Forest (EEC); and
- Zone 4: Buffer
- Zone 5: Revegetation Corridor

The delineation of management zones has been based on their distinct revegetation, and weed management requirements, as well as objectives for the for the zone, as summarised in **Table 3**.

One or more of the following broad activities will take place over the work zones that are to be addressed by this VMP, they are:

- Weed Management
- Revegetation/Planting
- Maintenance

These activities are discussed in more detail in **section 3.3**.

Table 3. Management Zones

Work Zone	Area (m^2)	Description	Objectives	Management Issues
Zone 1 Man-made Wetlands	647	Comprises two broad 'man-made' channels within the south of the site. This zone will not be directly impacted by the development. This zone also includes approximately 200m of cleared/exotic land (AMBS 2017) to be redesignated as a detention basin. Planting within this zone is to consist of water tolerant species only.	Enhance in-situ vegetation through weed control. Enhance locally-indigenous vegetation through the planting of water-tolerant species Enhance habitat for threatened amphibians through revegetation works (revegetation to be limited to aquatic / sedge species).	Weed infestation/ infiltration. Erosion and sediment.
Zone 2 Sydney Water Supply Easement	8350	18m wide Sydney Water Pipeline and access track along the north-west boundary. Disturbed 'planted vegetation' along the north-west boundary of the of the site. All planting must be in accordance with Sydney Water requirements. Planting directly above the pipeline must be limited to groundcovers and mid-storey species, with canopy species to be planted on the periphery of the easement.	Enhance in-situ native vegetation through weed control. Enhance locally-indigenous vegetation through the planting of species that form a part of the Kurnell Dune Forest community in line with Sydney Water requirements. Maintain and enhance existing fauna foraging and nesting habitat.	Weed infestation/ infiltration. Overabundance / infestations of planted *Acacia saligna*.
Zone 3 Kurnell Dune Forest (EEC)	1773	Isolated patch of Kurnell Dune Forest (EEC) within the south-west corner of the property.	Enhance in-situ vegetation through weed control. Protect and enhance area of native of Kurnell Dune Forest through revegetation works.	Located in close vicinity to Chisholm Road, and Sir Joseph Banks Road. Weed infestation/ infiltration. Overabundance / infestations of planted *A. saligna* and *Erythrina sykesii.*

Zone 4 Buffer	2524	The transition zone between the proposed development and the mapped Kurnell Dune Forest (EEC). This area is vegetated by moderate quality 'Banksia Forest' and a suite of native and exotic invasive species.	Provide a buffer area, between Kurnell Dune Forest (EEC) and the development footprint, to protect from weed incursions (edge effects). Enhance locally-indigenous vegetation through the planting of species that form a part of the Kurnell Dune Forest community. Maintain and increase existing fauna foraging and nesting habitat.	Weed infestation/ infiltration. Overabundance / infestations of planted *Acacia saligna*.
Zone 5 Revegetation Corridor	2744	Comprises all remaining vegetation within the site, including, the provision of a new 5m vegetated corridor to be established along the eastern boundary of the site.	Establish and enhance native vegetation within historically cleared land. Provide a vegetated corridor connecting vegetation within the north of the site, to vegetation within the south. Enhance locally-indigenous vegetation through the planting of species that form a part of the Kurnell Dune Forest community. Maintain and increase existing fauna foraging and nesting habitat.	Weed infestation/ infiltration. Overabundance / infestations of planted *Acacia saligna*.

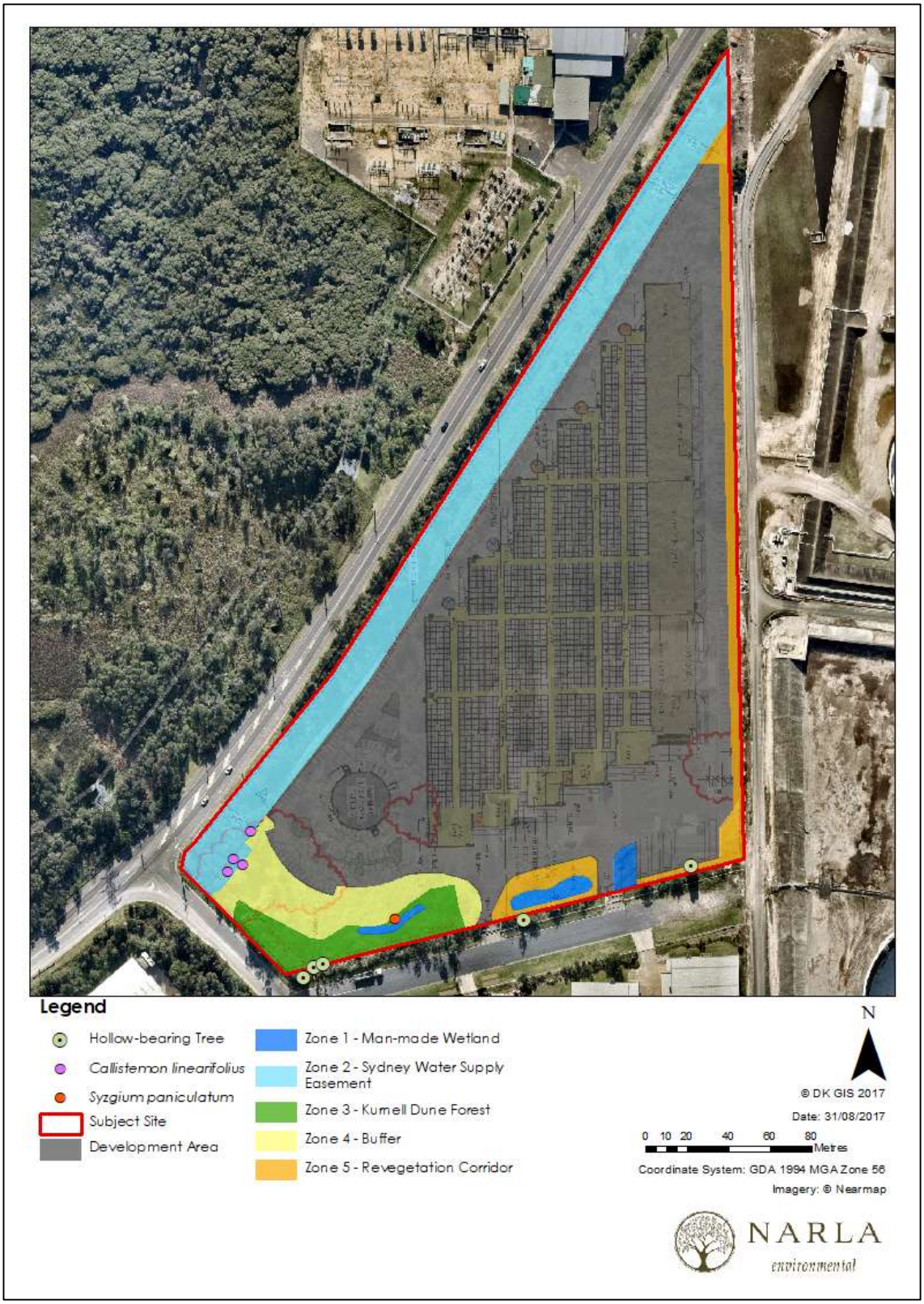

Figure 3. Site Map and Vegetation Management Zones

3.2 **Revegetation Species List**

The native species revegetation list for the proposed works (**Table 4**) is derived from vegetation descriptions taken from the following documents:

- Sutherland Shire Council Letter of Requirements File Reference: DA17/0106 (Dated 2nd June 2017);
- Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale – endangered ecological community listing (Final Determination); and
- Ecological Assessment of 186 – 206 Captain Cook Drive, Kurnell – Appendix G – *List of flora species for landscaping*.

Overall revegetation works aim to increase quality and cover of Kurnell Dune Forest (EEC) within the Project Site. All exotic and non-locally indigenous plantings are to be progressively replaced with species of local provenance.

Table 4. Kurnell Dune Forest Community Revegetation Species List (AMBS 2017) and Defined Densities

Cover Type	Zone 1 – Man-made Wetlands	Planting Density	Zone 2 – Sydney Water Supply Easement	Planting Density	Zone 3 – Kurnell Dune Forest (EEC)	Planting Density	Zone 4 – Buffer	Planting Density	Zone 5 – Revegetation Corridor	Planting Density
	Species		Species		Species		Species		Species	
Cano py	*Melaleuca ericifolia*	1/ 7 m²	*Angophora costata* *Banksia integrifolia subsp. integrifolia* *Casuarina glauca* *Cupaniopsis anacardioides* *Eucalyptus botryoides* *Eucalyptus robusta* *Ficus rubiginosa* *Glochidion ferdinandi*	1/7 m²	*Angophora costata* *Banksia integrifolia subsp. integrifolia* *Casuarina glauca* *Cupaniopsis anacardioides* *Eucalyptus botryoides* *Eucalyptus robusta* *Ficus rubiginosa* *Glochidion ferdinandi*	1/7 m²	*Angophora costata* *Banksia integrifolia subsp. integrifolia* *Casuarina glauca* *Cupaniopsis anacardioides* *Eucalyptus botryoides* *Eucalyptus robusta* *Ficus rubiginosa* *Glochidion ferdinandi*	1/7 m²	*Angophora costata* *Banksia integrifolia subsp. integrifolia* *Casuarina glauca* *Cupaniopsis anacardioides* *Eucalyptus botryoides* *Eucalyptus robusta* *Ficus rubiginosa* *Glochidion ferdinandi*	1/7 m²

Cover Type	Zone 1 – Man-made Wetlands	Planting Density	Zone 2 – Sydney Water Supply Easement	Planting Density	Zone 3 – Kurnell Dune Forest (EEC)	Planting Density	Zone 4 – Buffer	Planting Density	Zone 5 – Revegetation Corridor	Planting Density
	Species		Species		Species		Species		Species	
Mid-storey	Nil	N/A	*Acacia maidenii* *Acmena smithii* *Allocasuarina littoralis* *Homalanthus populifolius* *Myrsine variabilis* *Acacia longifolia subsp. longifolia* *Acacia longifolia subsp. sophorae* *Banksia ericifolia* *Banksia serrata* *Breynia oblongifolia* *Clerodendrum tomentosum* *Leptospermum laevigatum* *Leucopogon parviflorus* *Maclura cochinchinensis* *Melaleuca nodosa* *Myoporum acuminatum* *Notelaea longifolia* *Pittosporum revolutum*	1/m²	*Acacia maidenii* *Acmena smithii* *Allocasuarina littoralis* *Homalanthus populifolius* *Myrsine variabilis* *Acacia longifolia subsp. longifolia* *Acacia longifolia subsp. sophorae* *Banksia ericifolia* *Banksia serrata* *Breynia oblongifolia* *Clerodendrum tomentosum* *Leptospermum laevigatum* *Leucopogon parviflorus* *Maclura cochinchinensis* *Melaleuca nodosa* *Myoporum acuminatum* *Notelaea longifolia* *Pittosporum revolutum*	1/m²	*Acacia maidenii* *Acmena smithii* *Allocasuarina littoralis* *Homalanthus populifolius* *Myrsine variabilis* *Acacia longifolia subsp. longifolia* *Acacia longifolia subsp. sophorae* *Banksia ericifolia* *Banksia serrata* *Breynia oblongifolia* *Clerodendrum tomentosum* *Leptospermum laevigatum* *Leucopogon parviflorus* *Maclura cochinchinensis* *Melaleuca nodosa* *Myoporum acuminatum* *Notelaea longifolia* *Pittosporum revolutum*	1/m²	*Acacia maidenii* *Acmena smithii* *Allocasuarina littoralis* *Homalanthus populifolius* *Myrsine variabilis* *Acacia longifolia subsp. longifolia* *Acacia longifolia subsp. sophorae* *Banksia ericifolia* *Banksia serrata* *Breynia oblongifolia* *Clerodendrum tomentosum* *Leptospermum laevigatum* *Leucopogon parviflorus* *Maclura cochinchinensis* *Melaleuca nodosa* *Myoporum acuminatum* *Notelaea longifolia* *Pittosporum revolutum*	1/m²

Cover Type	Zone 1 – Man-made Wetlands	Planting Density	Zone 2 – Sydney Water Supply Easement	Planting Density	Zone 3 – Kurnell Dune Forest (EEC)	Planting Density	Zone 4 – Buffer	Planting Density	Zone 5 – Revegetation Corridor	Planting Density
	Species		**Species**		**Species**		**Species**		**Species**	
Groundcover	*Baumea articulata* *Baumea juncea* *Carex appressa* *Ficinia nodosa* *Gahnia clarkei* *Juncus usitatus* *Phrahmites australis*	**6/ m²**	*Actinotus helianthin* *Commelina cyanea* *Desmodium varians* *Dianella revoluta subsp. revolute* *Dichondra repens* *Entolasia marginate* *Imperata cylindrica* *Lomandra longifolia* *Oplismenus imbecillis* *Cayratia clematidea* *Clematis aristata* *Clematis glycinoides subsp. glycinoides* *Eustrephus latifolius* *Geitonoplesium cymosum* *Hibbertia scandens* *Marsdenia rostrata* *Parsonsia straminea* *Sarcopetalum harveyanum* *Smilax glyciphylla*	**4/ m²**	*Actinotus helianthin* *Commelina cyanea* *Desmodium varians* *Dianella revoluta subsp. revolute* *Dichondra repens* *Entolasia marginate* *Imperata cylindrica* *Lomandra longifolia* *Oplismenus imbecillis* *Cayratia clematidea* *Clematis aristata* *Clematis glycinoides subsp. glycinoides* *Eustrephus latifolius* *Geitonoplesium cymosum* *Hibbertia scandens* *Marsdenia rostrata* *Parsonsia straminea* *Sarcopetalum harveyanum* *Smilax glyciphylla*	**4/ m²**	*Actinotus helianthin* *Commelina cyanea* *Desmodium varians* *Dianella revoluta subsp. revolute* *Dichondra repens* *Entolasia marginate* *Imperata cylindrica* *Lomandra longifolia* *Oplismenus imbecillis* *Cayratia clematidea* *Clematis aristata* *Clematis glycinoides subsp. glycinoides* *Eustrephus latifolius* *Geitonoplesium cymosum* *Hibbertia scandens* *Marsdenia rostrata* *Parsonsia straminea* *Sarcopetalum harveyanum* *Smilax glyciphylla*	**4/ m²**	*Actinotus helianthin* *Commelina cyanea* *Desmodium varians* *Dianella revoluta subsp. revolute* *Dichondra repens* *Entolasia marginate* *Imperata cylindrica* *Lomandra longifolia* *Oplismenus imbecillis* *Cayratia clematidea* *Clematis aristata* *Clematis glycinoides subsp. glycinoides* *Eustrephus latifolius* *Geitonoplesium cymosum* *Hibbertia scandens* *Marsdenia rostrata* *Parsonsia straminea* *Sarcopetalum harveyanum* *Smilax glyciphylla*	**4/ m²**
		Notes: Only plant specimens in areas where native locally indigenous specimens do not meet recommended densities.								

3.3 Work Specifications and Additional Notes

3.3.1 General

- This VMP assumes that the disturbance caused during construction works will be limited entirely to the area identified within the works area identified in **Appendix A** of this plan (Project Design);
- Prior to commencing the works specified within this VMP the precise location of the rehabilitation areas should be confirmed and delineated by a surveyor in the presence of an Ecologist or qualified person familiar with the VMP;
- Changes to the proposed size of the Project Site will not affect the application of the specifications provided within this VMP;
- Maintenance is to commence following completion of VMP Stage 1 (Establishment Phase);
- All lighting within the site should be designed to minimise light disturbance into retained vegetation and away from Towra Point Nature Reserve;
- Tree Protection Zones (TPZ) are to be determined by a suitably qualified arborist and established prior to the commencement of works within vegetation to be retained;
- Storage, stockpiling and laydown sites should be clearly delineated outside of retained vegetation, prior to commencement of works; and
- Building debris (i.e. sheet metal), and other rubbish scattered by the tornado is to be removed from the site, prior to any revegetation works.

3.3.2 Appointment of Project Ecologist

Prior to obtaining construction certificate, the proponent must commission the services of a qualified and experienced Ecologist Consultant.

The Ecologist will be commissioned to:

- Advise the proponent on best practice methods for managing the Project Site through accurate implementation of this VMP;
- Assist the proponent in identifying and assigning an appropriate skilled Bushland Restoration Professional to implement vegetation restoration and weed control works;
- Supervise the clearance of trees and shrubs (native and exotic); and
- Monitor and report on the conservation management efforts to be implemented by the proponent on an annual basis.

3.3.3 Appointment of Bushland Restoration Contractors

All works under this VMP must be implemented by an appropriately qualified and experienced bush regeneration company.

The Bushland Restoration Practitioner company selected to complete the project works must:

- provide a statutory declaration stating their compliance with provisions of the national Gardening & Landscape Services Award 2010;

- provide completed and signed Subcontractor Statement regarding payment of worker's compensation, payroll tax and remuneration;
- provide established Workplace Health & Safety and Environmental Management Systems. Preferably the company has third-party accredited systems in place;
- demonstrate implementation of safe workplace and appropriate environmental management practices and procedures (e.g. appropriate transport and management of herbicides);
- provide Public Liability (min. $10M) and Workers Compensation Insurance;
- have previous experience undertaking bushland restoration works within coastal areas in Sydney. Contractor references are to be contacted;
- provide supervisor with minimum qualifications and experience including Certificate III Conservation & Land Management and two years full-time equivalent experience as a trained bush regenerator;
- provide a minimum of one trained bush regenerator per team of four (minimum qualifications and experience including Certificate III Conservation & Land Management and one year full-time equivalent experience as a bush regenerator);
- provide a minimum of two trained bush regenerators per team of five/six (minimum qualifications and experience including Certificate III Conservation & Land Management and one year full-time equivalent experience as a trained bush regenerator);
- schedule appropriately resourced regular site visits for the duration of contract period;
- all herbicide usage, including storage and transport, to be in accordance with WorkCover NSW (2006) and all relevant legislation;
- all bush regeneration crew members undertaking herbicide spray applications must hold a current chemicals application training certification to AQF Level III.

3.3.4 Licences for activities within Threatened Ecological Communities (TEC)

Bush regeneration, weed control, maintenance of threatened species and other activities within any EEC (such as Kurnell Dune Forest) or within close proximity to threatened species such as *Callistemon linearifolius* and *Syzygium paniculatum subsp. paniculatum* are subject to the regulations of the *National Parks and Wildlife Act 1974*. The proponent may be required to obtain a section 91 License to cover the on-going management of the Project Site, including EEC and threatened species habitat.

3.4 Establishment Phase

3.4.1 Clearing of Vegetation

During the clearing of any vegetation, or demolition of the existing buildings, it is important that landowners are aware of potential for indirect harm to native animals and loss of their natural habitat (regardless of whether vegetation is native or exotic). Landowners who clear trees and vegetation are not exempt from prosecution under the *National Parks and Wildlife Act 1974* for harm to protected fauna, or for deliberate cruelty to animals under the *Prevention of Cruelty to Animals Act 1979*.

Before any vegetation is damaged or removed, a qualified Project Ecologist with fauna survey experience should be assigned to undertake a pre-clearing survey to determine presence of any suitable habitat for roosting microbats, nesting birds or other fauna in the area of the Project Site due to be cleared. This will include trees bearing hollows and rock outcrops with crevices. The findings of the pre-clearing survey should be compiled in a short report and provided to the proponent before any

clearing works commence in this area. This must be undertaken by a qualified Ecologist, no more than one week prior to any proposed vegetation clearing or removal works.

The following conditions must be adhered to:

- Where possible, clearing must be limited to vegetation within the development footprint;
- Where suitable, woody debris (fallen trees and logs), within the Project Site is to be retained. Woody debris within the development footprint should be relocated, as directed by the Project Ecologist;
- Hollow-bearing dead trees should not be removed without assessment by a qualified Ecologist;
- All trees (including dead trees) should be felled by qualified Arborists using chainsaw and pulleys. No heavy machinery is permitted for vegetation removal;
- Where possible, all clearing should be undertaken during the warmer months (Spring/Summer), when microbats and reptiles are active and are able to self-relocate.

A qualified Project Ecologist with experience in handling wildlife should be present on the Project Site during all vegetation clearing in order to supervise clearing and to capture and relocate any displaced, healthy animals, or care for / rehabilitate any injured or orphaned animals.

3.4.2 Demolition of Disused Building

Microbats often utilise man-made structures including sheds and houses and derelict buildings for roosting habitat. Small cavities that provide similar protection to tree hollows will be utilised by microbats where shortages of natural roosting habitat exist, or may even be used in preference (ABS 2017).

Owing to the potential roosting habitat within the existing disused building, it is recommended that it is inspected by an Ecologist for roosting microbats, prior to demolition taking place. If microbats are found, they will be captured and relocated within a suitably designed bat nesting box by the Ecologist.

Possum traps should be set in the roof of the building to capture any roosting possums prior to demolition. If possums are captured they should be relocated elsewhere on the property.

3.4.3 Fauna Habitat Restoration

Any tree hollows cleared during vegetation clearance, as identified by the attending Project Ecologist should be replaced at a ratio of 1:1 per hollow. Size and type of nest box is to correspond to the size of the hollow lost, or as advised by the Project Ecologist.

Nest boxes should be installed by a qualified Ecologist, a minimum of 4 m above the ground, attached to standing trees using permanent attachment straps or stainless-steel screws within vegetation to be retained.

Large pieces of woody debris containing hollows, including freshly felled trees should be retained and stockpiled for use in wetland and Kurnell Dune Forest restoration works. Such debris is likely to provide habitat values for terrestrial fauna, including the rare *Meridolum maryae* (Maroubra Woodland Land Snail). The amount of debris stockpiled and placed will be subject to availability and guidance by the Project Ecologist.

3.4.4 Fencing

Construction of protective fencing is recommended to delineate areas of vegetation to be retained within the Project Site; particularly areas of mapped Kurnell Dune Forest and *Syzygium paniculatum*

(**Appendix B**). Narla recommend fencing be at least 2.5m high with a weed (sediment) fence incorporated at the base. The establishment of a fence will also protect regenerating flora, by preventing public access, thereby preventing accidental trampling or mowing. Fences must not impede fauna movement and no barbed wire or razor wire is to be used.

Land managers and bush regeneration staff may access fenced off areas, through a locked gate, that prevents the public from entering areas to be retained. Signage should be displayed on gates or in nearby open areas delineating the no-go areas.

3.4.5 Weed Management

All vegetation in the Project Site will be improved with active weed management and appropriate plantings (see **Table 4**). Weed management is to take place across all work zones (the entire area mapped in **Figure 3**; outside of the proposed development site). Bush regenerators involved in the control of weeds must have strong plant identification skills to avoid damage to native regenerating flora. If herbicide application techniques are to be utilised for weed suppression bush regenerators should familiarise themselves with all native flora particularly threatened flora occurring within the zone to prevent accidental damage to native plants.

- All weed management will be delivered by a qualified Bushland Restoration Practitioner (see **section 3.3.3**) and the techniques used for weed management will be subject to the professional opinion of the Bushland Restoration Practitioner and may include:
    - Cut and paint to all weed shrubs and trees - cutting of the plant stem (as low to the ground as possible for safety reasons), and "pasting" or "painting" of herbicide on the cut stem around the outside edge as quickly as possible (apply herbicide within 15 to 20 seconds before the cut 'scabs over') (e.g. Roundup Biactive).
    - Crowning - using a sharp implement (a boning knife in most instances) to cut out the growing point of species that grow from a crown (a central growth point).
    - Digging out / hand-pulling – removing the entire plant, roots and all.
    - Stem scraping - the use of a sharp tool, usually a bush regenerator's knife or hatchet, to scrape the stem and expose the green conducting parts of the plant before applying neat herbicide (e.g. Roundup Biactive). This technique is usually used on woody shrubs with large tap roots and on vines (e.g. Roundup Biactive).
    - Stem injection – using a chisel or drill and injecting neat herbicide (e.g. Roundup Biactive)
    - Spot-spraying – spraying of diluted herbicide (e.g. Roundup Biactive) directly onto herbaceous weeds with an accurate jet
- Weed trees (e.g. Golden Wreath Wattle and Coral Tree) are to be poisoned with herbicide and felled. As directed by the Project Ecologist, these trees may be sawed into logs, allowed to season in to stockpiles and retained in situ to continue providing habitat for fauna on site.
- The removal of all exotic species listed as 'priority' under the *Biosecurity Act 2015*, require immediate attention. These weeds are prohibited and must not be imported into the State or Sold. The full list of priority weed species identified within the site can be found in **Table 2**.
- All weeds; particularly priority weeds, must be bagged and disposed of at a recognised waste repository, and not left on site.
- Recommended weed treatment methods are provided in **Appendix C**.

3.4.6 Stormwater and Sediment Control

Prior to any vegetation clearing or construction works it is recommended that best practice erosion and sedimentation mitigation measures are installed as per the provisions of 'The Blue Book' (Landcom 2004) (**Appendix D**). Sediment fencing must be installed around all vegetation to be retained, particularly Kurnell Dune Forest EEC and the man-made wetlands, prior to commencement of works.

Maintain erosion and sedimentation measures, and monitor for signs of any erosion/sedimentation throughout construction phase.

To prevent contaminated stormwater runoff from entering Towra Point Nature Reserve; a stormwater management plan has been prepared that incorporates bioretention and on-site detention (AMBS 2017).

All detention basins must be planted with recommended species listed in *Zone 1 – Man-made Wetlands* (**Table 4**) in order to maximise habitat features for local fauna.

3.4.7 Fuel Management

Fallen trees and logs in any area of the Project Site provide shelter and foraging opportunities for local fauna. As directed by the Project Ecologist, this habitat should be retained, but may be moved to bushland areas on the outer extent of the site, if presenting bushfire risk for the proposed development. This includes trees to be felled, as a part of the works, that are likely to form valuable fauna habitat.

3.4.1 Application of Mulch

Application of mulch is known to suppress natural regeneration (DEC 2005). Due to the potential for negative impact, mulch is discouraged from use within areas selected for native vegetation restoration.

Restricted applications of mulching may be useful along edges of regeneration areas, particularly in areas which have already been identified weed infested, and bordering cleared areas; mulch may be used at the discretion of the qualified Bush Regenerator to suppress the encroachment of exotic lawn grasses. Only mulch which has been certified to be free of potential exotic/ weed propagules and consist of good-quality native leaf litter or woody material is to be used.

3.4.2 Hygiene Protocol- Preventing introduction of ecological pathogens

Phytophthora and Myrtle Rust are pathogens which can be spread through infected soil, with potentially large detrimental impact. The risk to biodiversity related to each pathogen has resulted in them being listed as KTPs under the TSC Act. Although these pathogens were not observed within the Project Site, as a precautionary measure, hygiene procedures are essential. Such hygiene protocols have the additional benefit of limiting the potential to facilitate the introduction or spread of weed propagules to the Project Site, which can be costly to manage later.

Basic principles include avoiding transport of sediment onto and off site by cleaning all work clothing, gloves, tools and machinery. In some cases, a solution of 70% ethanol or methylated spirits in 30% water may be sufficient to disinfect equipment prior to use.

The report, 'Arrive Clean, Leave Clean' (Commonwealth of Australia 2015) provides further information and best practice methods to reduce spread of these pathogens between work sites.

3.5 Maintenance Phase

In accordance with Council requirements (see file reference: DA17/0106) a 5-year native vegetation maintenance and monitoring period is to be completed at the Project Site this must commence from the date of obtaining Construction Certification.

3.5.1 Work Schedule

Table 5. Summary of management tasks to be undertaken, by whom and approximation of timing. Timeframes are estimates only, and are subject to change based on vegetation growth rates, climatic conditions and other management requirements

Task	Steps Involved	Time Required (per person)	Responsibility	Scheduling																			
				Year 1						Year 2						Year 3		Year 4		Year 5		Ongoing	
Delineation of Construction Area	Mark line of proposed fencing and Install fencing, providing a buffering strip of at least 3 m between fence and construction	TBA	Registered Surveyor and Fence Construction Contractor																				
	Arborist to determine and establish Tree Protection Zones (TPZ) within vegetation to be retained	TBA	Arborist																				
Delineation of Vegetation Management Zones (pursuant this VMP)	Surveyor to mark boundary of management zones under supervision of Project Ecologist	2 days	Registered Surveyor & Project Ecologist																				
Site Works	Vegetation Clearance - Ecologist to investigate all vegetation areas prior to clearing. Ecologist to supervise clearing activity. Must be on hand to capture and relocate any displaced fauna.	TBA	Arborist & Project Ecologist																				

Task	Steps Involved	Time Required (per person)	Responsibility	Scheduling					
				Year 1	Year 2	Year 3	Year 4	Year 5	Ongoing
	Demolition of Disused Building	TBA	Demolition Contractors & Project Ecologist						
Support native regeneration	Removal of metal debris placed on site by the tornado	2 days	Bush Regeneration Contractors (team of 3)						
	Relocation of Woody Debris (as guided by Project Ecologist)	4 days	Bush Regeneration Contractors (team of 3)						
	Suppression of weeds and exotic plants	1 day per quarter (3 months) for duration of VMP	Bush Regeneration Contractors (team of 3)						
	Monitoring of natural native vegetation recruitment	To occur during scheduled works	Bush Regeneration Contractors						
Revegetation	Collection of seed stock. Preparation of tube stock	TBA	Qualified native nursery						
	Preparation of any areas selected for replanting which did not meet required densities. Including weed removal, sediment stabilisation or other tasks deemed necessary by the Project Ecologist following the first round of annual monitoring.	TBA	Bush Regeneration Contractors	TBA					
	Installation of locally indigenous plantings	TBA	Bush Regeneration Contractors						
	Maintenance of plantings	As required based on climatic conditions, expertise of Bush	Bush Regeneration Contractors						

Task	Steps Involved	Time Required (per person)	Responsibility	Scheduling					
				Year 1	Year 2	Year 3	Year 4	Year 5	Ongoing
		Regeneration Contractors and findings of the annual monitoring program.							
Long term maintenance	Any repair or maintenance of fences (incl. sediment fence)	As required	Bush Regeneration Contractors / Land Manager	TBA					
Formal Monitoring and Reporting	Assess progress of remediation works	Annually: 1 person/1-day Project Site visit, 40hrs for reporting	Ecologist/ Bush Regeneration Contractors						

3.6 Monitoring

3.6.1 Bush Regeneration Monitoring

The Bush Regeneration Contractors will monitor the vegetation for changes over time and provide a post-works report (on a monthly basis) the details the extent of works undertaken during the previous month, including staff hours, targeted weeds, area covered and plants planted.

3.6.2 Annual VMP Monitoring

A formal vegetation assessment will be undertaken by the Project Ecologist on an annual basis in late winter – spring each year, assessing the conditions of the retained vegetation and threatened plants within the Project Site. Information collected during the monitoring period will be assessed against zone specific performance criteria (**Table 6**).

A comprehensive monitoring program centred on repeatable methodology is an essential element of any successful environmental restoration project. Ecological processes occurring within a community are complex, consequently, outcomes of bushland restoration practices are not always predictable. Self-sustaining conditions may take many years to reach (DECC 2005). For this reason, it is essential to monitor the Project Site, to determine how it is responding after restoration works have begun.

Monitoring involves identifying any changes to vegetation during and after bush-regeneration practices have begun, as well as keeping records to measure the success of different management techniques. Monitoring is important for two main reasons:

- it provides feedback on the effectiveness of management actions, and hence whether these actions need to be modified; and
- it allows land managers to see whether natural resources are stable, improving or declining.

Records should be consistent, comparable and easily interpreted. Types of documentation can include:

- before and after photographs;
- vegetation maps- identifying condition/ changes;
- flora and fauna species lists;
- records of any new techniques being trialled; and
- reports detailing the initial condition and threats to native vegetation, management actions applied and the outcomes of management.

The Project Ecologist will perform annual monitoring and provide a report to Taleb Property Pty Ltd. The process will identify successes or failures of management actions and allow land managers and bush regenerators to implement corrective actions. This information will assist in implementing an adaptive management approach and to refine or change strategies not achieving conservation objectives.

Table 6. Performance Criteria

Treatment Zones	Year 1	Year 2	Year 3	Year 4	Year 5
All Zones	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation 100% eradication of all 'priority' weeds and Weeds of National Significance (WoNS) Installation of fencing around all retained vegetation. Landscape plantings (development site) are compliant with the environmental outcomes for the Project Site (i.e. locally-indigenous species) 100% survivorship of *Syzygium paniculatum*.				
Zone 1 – Man-made Wetlands	All exotic shrub and canopy cover removed. Exotic groundcover no greater than 20%		Exotic groundcover no greater than 10%		Exotic groundcover no greater than 5%
	Native planting densities achieved		Native survivorship greater than 90%		
Zone 2 – Sydney Water Supply Easement	All exotic shrub and canopy cover removed. Exotic groundcover no greater than 20%		Exotic groundcover no greater than 10%		Exotic groundcover no greater than 5%
	Planting in line with Sydney Water requirements		A demonstrated increase in native cover and diversity and a demonstrated decrease in exotic cover and diversity by the end of Year 5.		
Zone 3 – Kurnell Dune Forest (EEC)	All exotic shrub and canopy cover removed. Exotic groundcover no greater than 20%		Exotic groundcover no greater than 10%		Exotic groundcover no greater than 5%
	Native planting densities achieved		Native survivorship greater than 90%		
	Vegetation structural and floristic qualities progressing toward BioMetric Benchmark		Vegetation structural and floristic qualities within 25% or exceeding BioMetric Benchmark		
Zone 4 – Kurnell Dune Forest (Buffer)	All exotic shrub and canopy cover removed. Exotic groundcover no greater than 20%		Exotic groundcover no greater than 10%		Exotic groundcover no greater than 5%
	Native planting densities achieved		Native survivorship greater than 90%		
Zone 5 – Revegetation Corridor	All exotic shrub and canopy cover removed. Exotic groundcover no greater than 20%		Exotic groundcover no greater than 10%		Exotic groundcover no greater than 5%
	Native planting densities achieved		Native survivorship greater than 90%		

4. References

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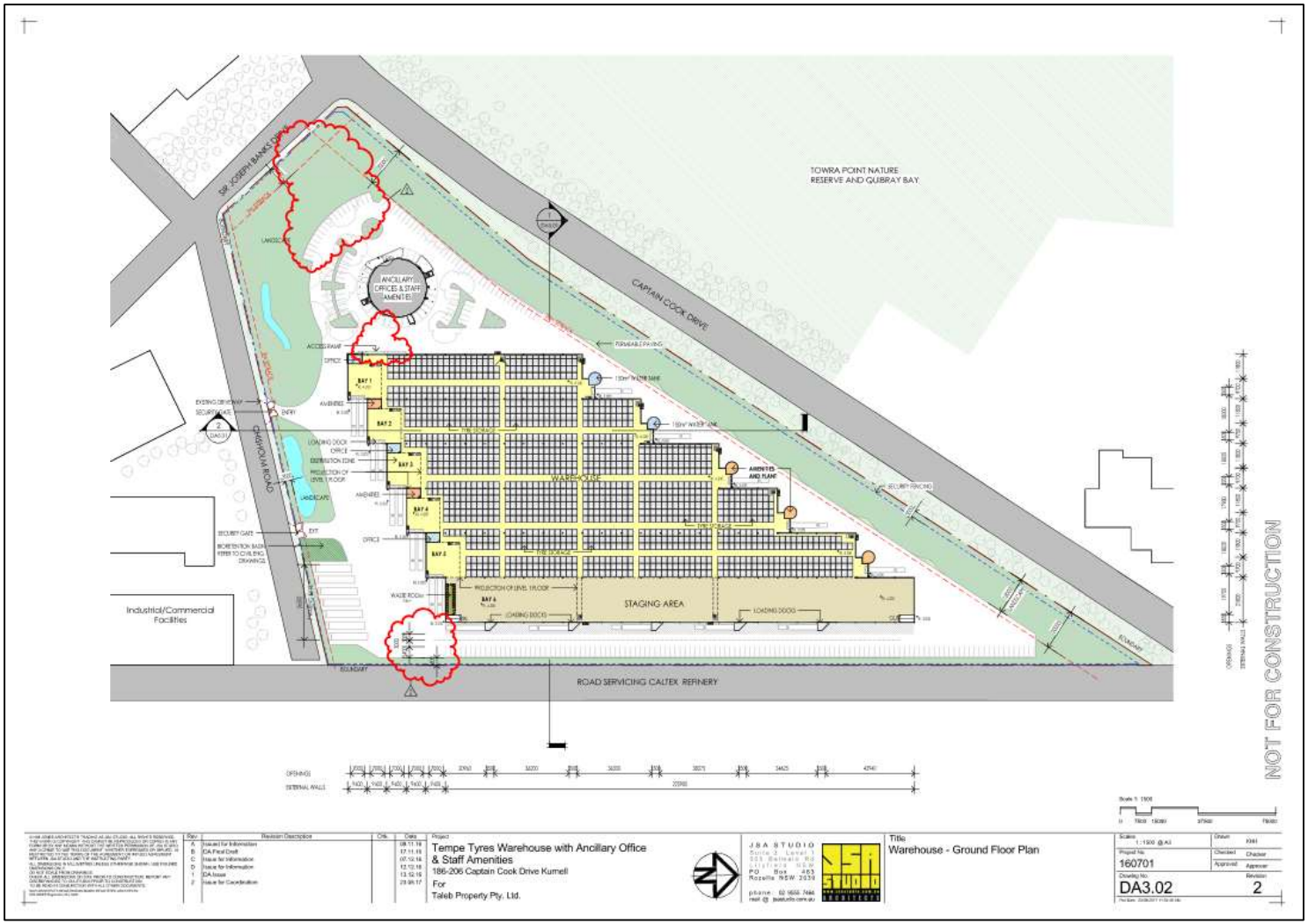
Sutherland Shire Council (2015) Sutherland Development Control Plan (SDCP)

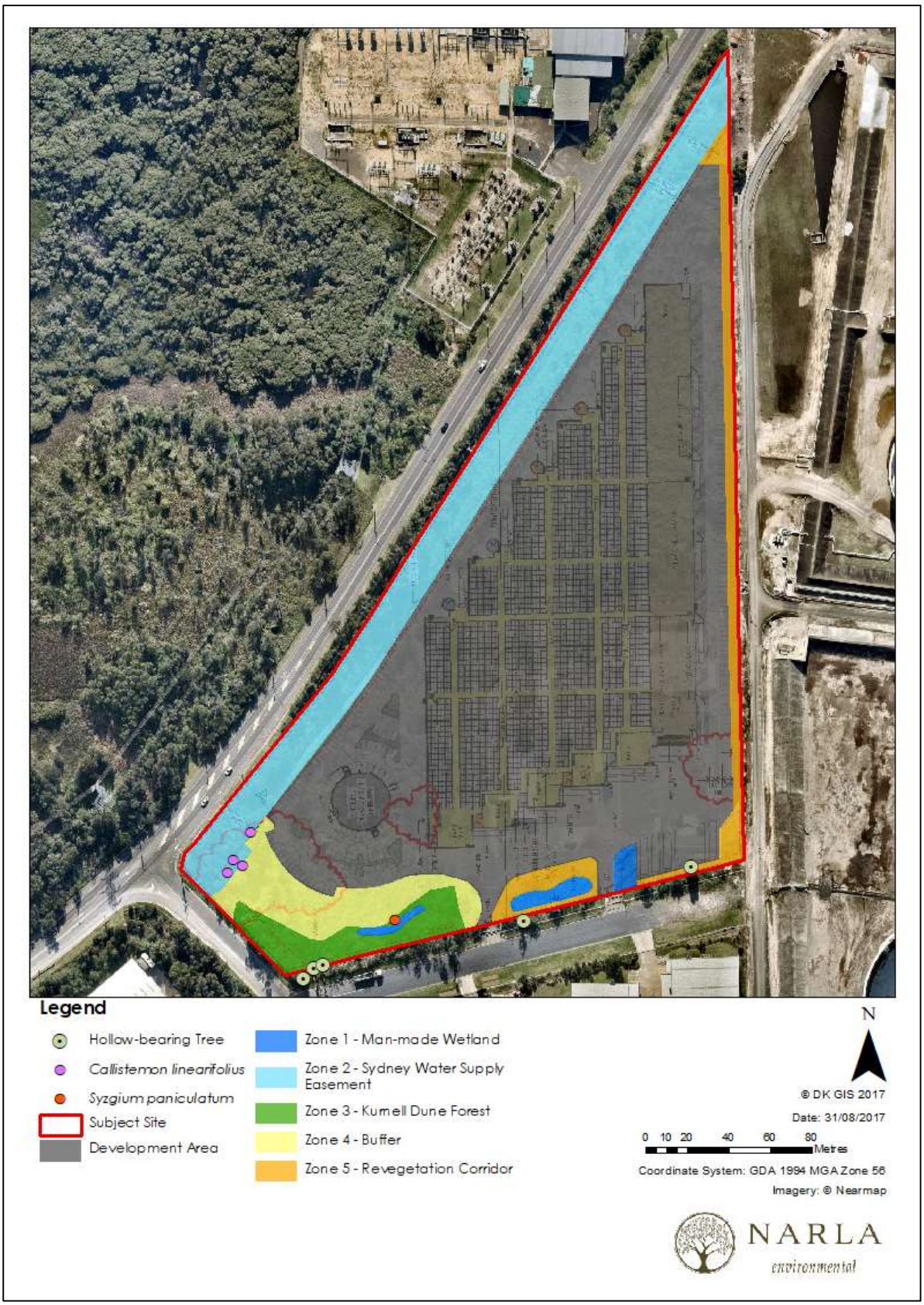
Appendices

- Appendix A – Project Design (JSA 2016)
- Appendix B – Revegetation Management Zones
- Appendix C – Weed Treatment Methods
- Appendix D – Guidelines for the construction of an effective sediment fence
- Appendix E – Weed Densities throughout the Project Site

Appendix A. Project Design (JSA 2016)



Appendix B. Vegetation Management Zones with Threatened Flora Records (AMBS 2017)

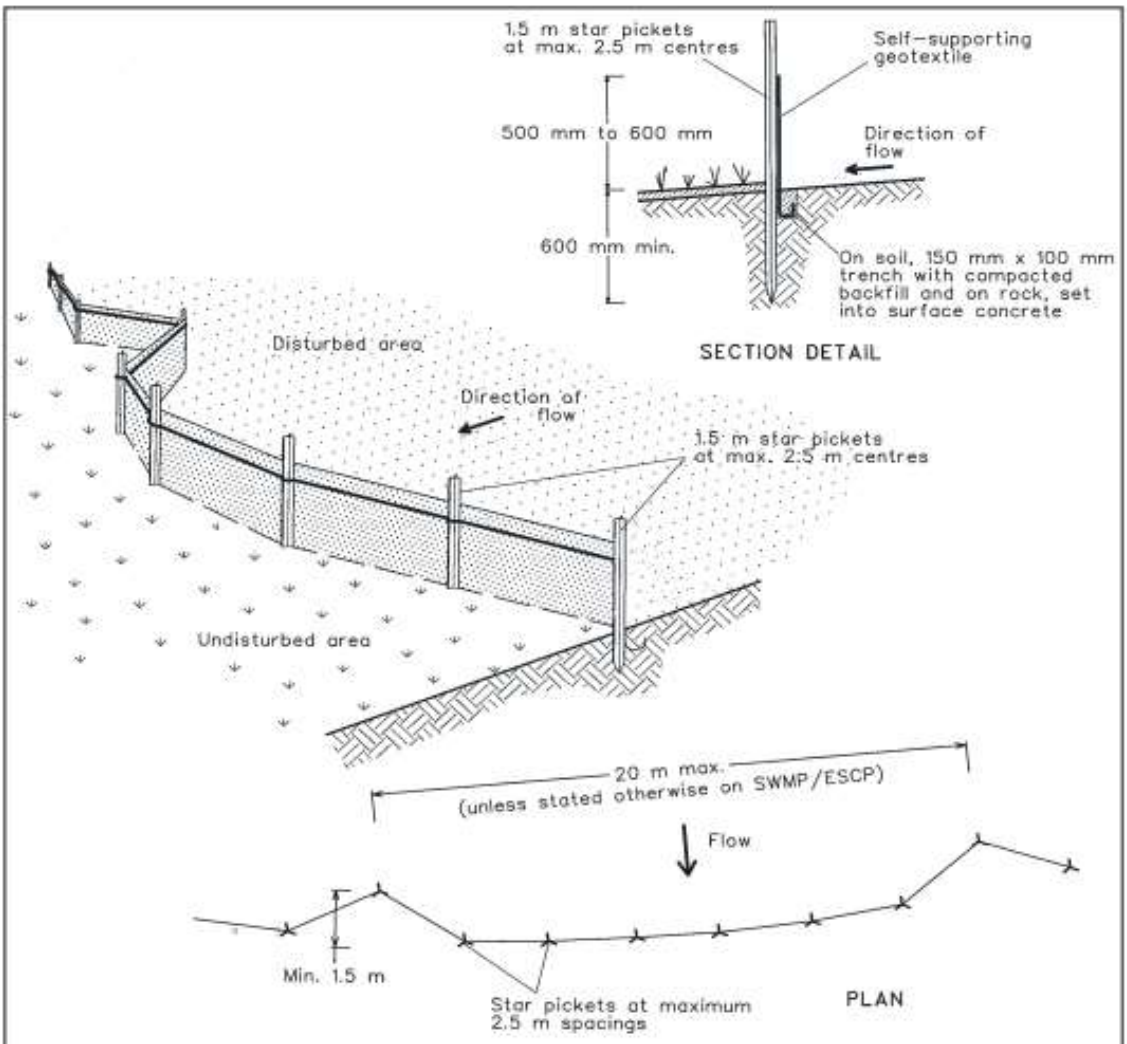


Appendix C. Weed Treatment Methods

Scientific Name	Common Name	Priority Weed	WoNS	Treatment Method
Acacia saligna	Golden Wreath Wattle	-	-	Stem inject woody individuals. All removed plant material and disposed of at a registered green waste facility.
Ageratina adenophora	Crofton Weed	-	-	Manual removal. All seed to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Araujia sericifera	Moth Vine	-	-	Skirt vine from shrubs and canopy. Scrape and paint stems. All tubers seed be carefully collected and bagged.
Asparagus spp.	Asparagus	✓	✓	Crowning / digging out the entire crown or corm (by severing the tough surrounding roots) that sits just below the surface of the soil, and leaving the roots and watery tubers in situ. Large infestations may require spot spraying, and a penetrant should be used in coastal areas where ground asparagus forms a waxy coating.
Bidens pilosa	Cobbler's Pegs	-	-	Manual removal. All seed to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Chrysanthemoides monilifera subsp. monilifera rotundata	Bitou Bush	✓	✓	The plant must be eradicated from the land and that land must be kept free of the plant. Manual removal. All seed to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Chloris gayana	Rhodes Grass	-		Manual removal. All seed to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Conyza sp	Fleabane	-	-	Manual removal. All seed to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Cortaderia selloana	Pampas Grass	✓	-	Manual removal. All seed to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Cyclospermum leptophyllum	Slender Celery	-	-	Manual removal. Control also via spot-spraying using herbicide following careful spray preparation.
Erythrina sykesii	Coral Tree	-	-	Inject stem with neat herbicide. Cut and paint or skirt. Fell entire tree and treat base immediately with herbicide.
Genista monspessulana	Montpellier Broom	✓	✓	Inject stem with neat herbicide. Cut and paint or skirt. Treat base immediately with herbicide.
Hypochaeris radicata	Catsear/Flatweed	-	-	Manual removal. All flowers/seed to be carefully collected and bagged. Control also via spot-spraying following careful spray preparation.
Lantana camara	Lantana	✓	✓	Manual removal. All seed to be carefully collected and bagged. Control also via spot-spraying following careful spray preparation.
Olea europaea subsp. cuspidata	African Olive	✓	-	Manual removal. All seed to be carefully collected and bagged. Control also via spot-spraying following careful spray preparation.
Pennisetum clandestinum	Kikuyu	-	-	All rhizomes to be carefully collected and bagged. Control also via combination of brush-cutting and spot-spraying following careful spray preparation.
Plantago lanceolata	Lamb's Tongue	-	-	Manual removal. All seed to be carefully collected and bagged. Control also via spot-spraying following careful spray preparation.

Scientific Name	Common Name	Priority Weed	WoNS	Treatment Method
Rubus fruticosus sp. aggregate	Blackberry	✓	✓	Scrape/Paint mature plants. Control also via spot spraying with selective herbicide when actively growing or flowering & fruiting, between December to March.
Senna pendula		-	-	Inject stem with neat herbicide. Cut and paint or skirt. Treat base immediately with herbicide.
Solanum nigrum	Black-berry Nightshade	-	-	Manual removal for juvenile plants & saplings. Cut/Paint mature plants. All seed to be carefully collected and bagged.
Sonchus oleraceus	Milk Thistle	-	-	Manual removal. All seed to be carefully bagged and disposed of at a registered green waste facility. Species can also be controlled via a combination of brush-cutting and spot-spraying following careful spray preparation.
Other annual herbaceous	-	-	-	Manual removal. All seed to be carefully collected and bagged. Controlled also via combination of brush-cutting and spot-spraying following careful spray preparation.

Appendix D. Guidelines for the construction of an effective sediment fence

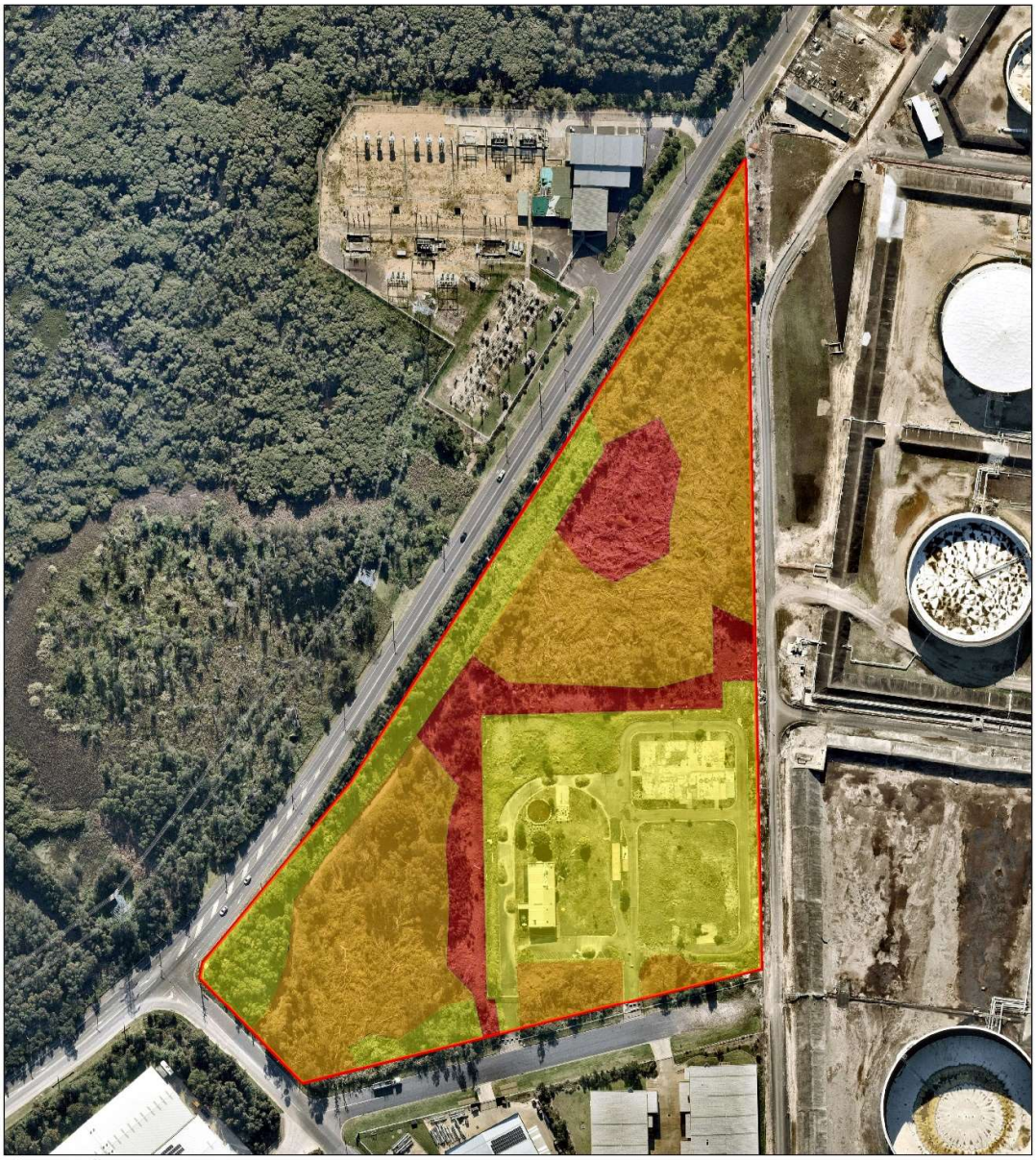


Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE **SD 6-8**

Appendix E. Weed Densities throughout the Project Site.



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