Appendix H2 – Concept Rehabilitation & Landscape Management Plan

JWA PTY LTD
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CONCEPT REHABILITATION AND LANDSCAPE MANAGEMENT PLAN

Tweed Sand Plant – Future Expansion
Altona Road, Cudgen

A Report Prepared for
Hanson Construction Materials Pty Ltd

MARCH 2021

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RW4	11/03/21	Phoebe Chapman / Belinda Whyburn	PC / BW	Adam McArthur	AM

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

JWA Pty Ltd were engaged by Hanson Construction Materials Pty Ltd (Hanson) to prepare a Concept Rehabilitation and Landscape Management Plan (CRLMP) for Hanson's Tweed Sand Plant (TSP) operation in Cudgen, NSW. The CRLMP has been prepared to accompany an application for the expansion of the existing sand plant over a period of approximately thirty (30) years. This CRLMP follows on from rehabilitation work completed as part of the site's existing RLMP that was most recently revised in February 2021.

Due to the long-term nature of the proposed development this CRLMP has been prepared to provide overarching requirements for the restoration and management of site following the completion of sand extraction works. The CRLMP establishes responsibilities and procedures for the progressive rehabilitation of the site following completion of sand extraction works, including the stabilising/reprofiling of banks, planting methods, control of weeds and monitoring requirements.

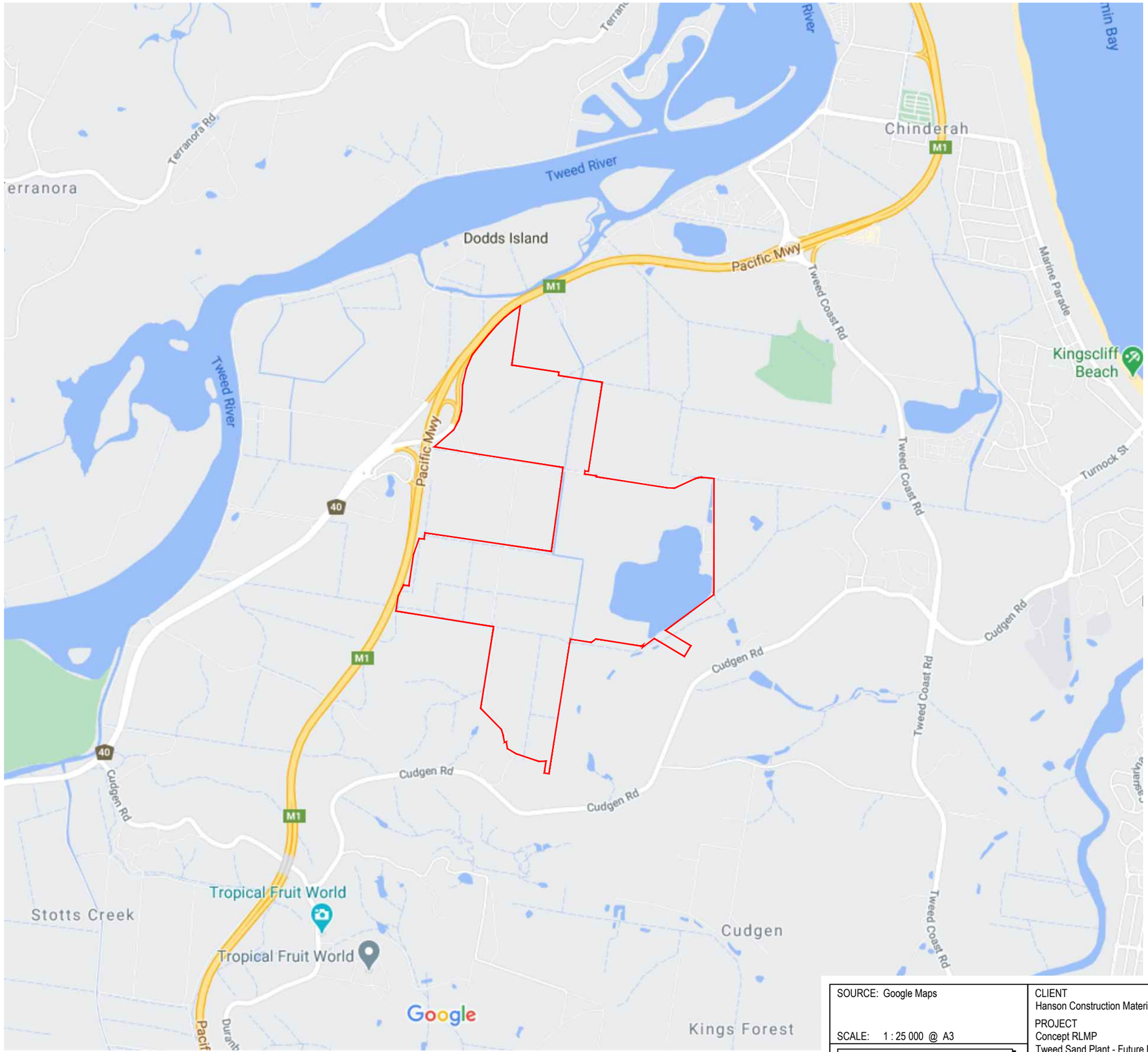
Rehabilitation works on the site will cover approx. 20 ha (almost 10% of the site area) and will be completed on a stage-by-stage basis following completion of sand extraction works within each phase. Prior to the commencement of rehabilitation works within each phase, a phase specific Rehabilitation and Landscape Management Plan (RLMP) will be prepared to provide site specific guidance for the rehabilitation and management of the land to be restored. The phase specific Rehabilitation and Landscape Management Plans will be consistent with the strategies outlined in this report and/or current best practice methods.

1.2 The Subject Site

TSP is located off Altona Road in Cudgen, Northern NSW (**FIGURE 1**). The site is formally described as Lot 22 DP1082435, Lot 23 DP1077509, Lot 494 DP720450, Lot 1 DP1250570, Lot 2 DP1192506, Lot 3 DP1243752, Lot 51 DP1166990 and Lot 50 DP1056966. The site covers a total area of approximately 236 ha, of which 46 ha is currently approved for sand extraction.

TSP is located within the Tweed Valley flood plain and is surrounded by the following land uses:

- North – Tweed Shire Council (TSC)'s wastewater treatment facility; agricultural land (cane, grazing); Pacific Motorway and township of Chinderah in the distance (approximately 2 km).
- East – Cudgen Lake Sand Quarry (Cudgen Lakes); township of Cudgen (approximately 1 km); Township of Kingscliff (approximately 3 km).
- South – Residential receptors located along Cudgen Road ridge; agricultural and partially cleared land.
- West – Australian Bay Lobster Producers Pty Ltd; Melaleuca Station Memorial Gardens and Crematorium; Caltex service station and travel stop; Pacific Motorway; agricultural land (cane, grazing).



LEGEND

Subject Site

Scale 1:25 000 - Lengths in metres

200 0 200 400 600 800 1000

SOURCE: Google Maps SCALE: 1 : 25 000 @ A3 *JWA PTY LTD* *Ecological Consultants*	CLIENT Hanson Construction Materials Pty Ltd PROJECT Concept RLMP Tweed Sand Plant - Future Expansion Altona Road, Chinderah NSW Tweed Shire Council LGA	FIGURE 1 PREPARED: BW DATE: 08 February 2021 FILE: N09007_RLMP_20210208.dwg	TITLE LOCALITY PLAN

An aerial photograph of the site is shown in **FIGURE 2**.

1.3 The Proposed Development

Sand extraction has been undertaken on this site since 1983 with Hanson taking over operation of the existing site in 2007. TSP operates under Development Application (DA) DA 152-6-2005, as modified on 20 August 2018 (Notice of Modification MOD 1). The current MOD 1 approval remains valid until 1 July 2036 and authorises TSP to produce and transport from the site up to 500,000 tonnes of quarry products per financial year. TSP currently operates a single dredge unit which is linked to an onshore wash plant via a floating flow line. Sand product is processed through the wash plant, stockpiled and loaded via a front-end loader into standard highway trucks.

To meet ongoing demand for sand, Hanson is proposing to expand its existing operations into lands to the north and west of the TSP site over a thirty (30) year period. The footprint of the expansion area is approximately 190 ha, giving a total combined footprint of 236 ha for the existing and future extraction areas. Expansion works will also include a construction of an internal haul road connected to the Pacific Motorway and a new sand washing plant and associated buildings. A layout and staging plan for the extraction works expansion is shown in **FIGURE 3**.

1.4 Rehabilitation Areas and Phases

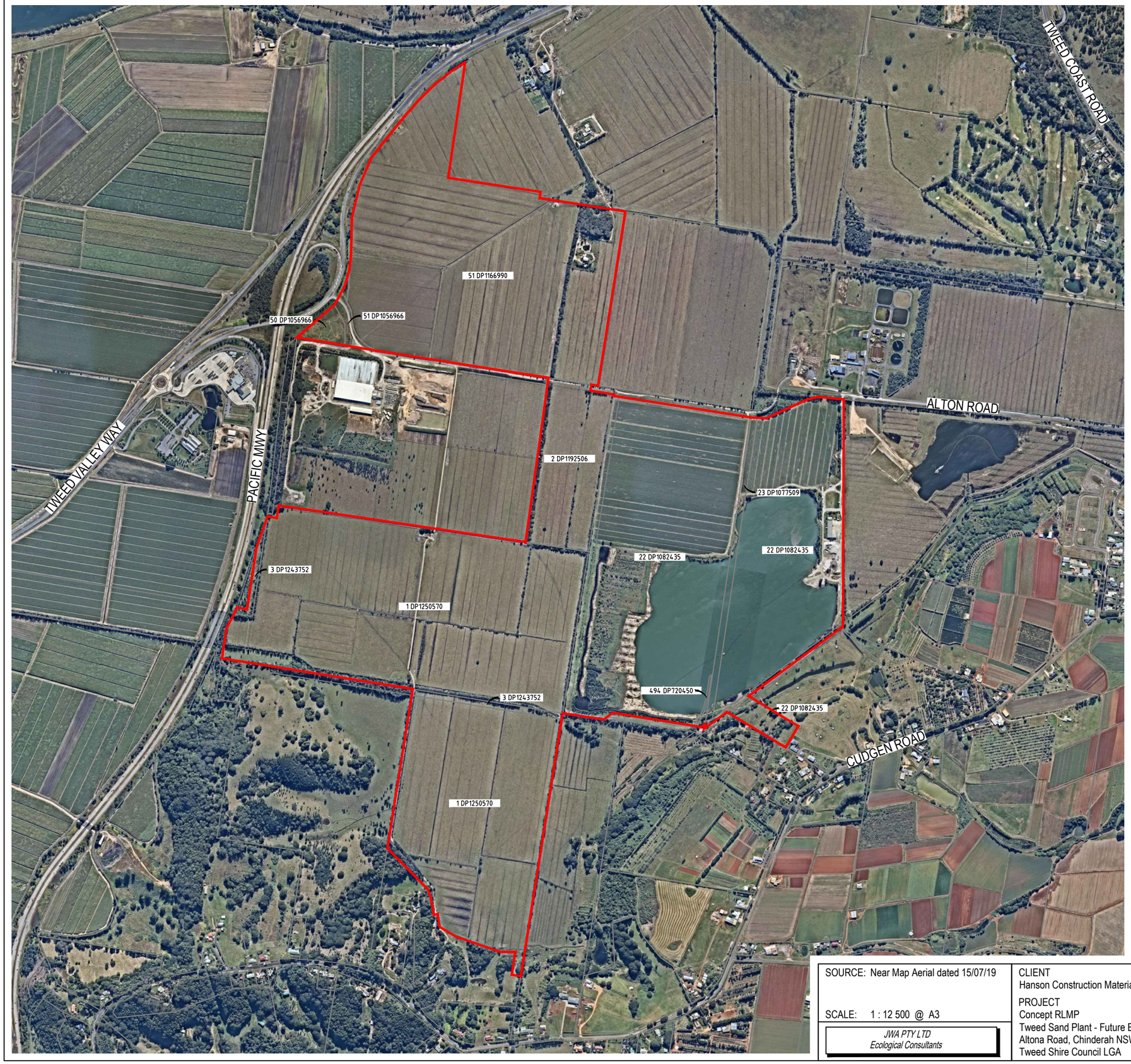
An overall landform concept plan (**FIGURE 4**) has been developed that is to be undertaken following the completion of sand extraction works. This plan will be carried out progressively over eleven (11) phases and divides the site into three (3) Rehabilitation Areas:

- Wetland rehabilitation areas – primarily assisted natural regeneration of water plants/macrophytes around the fringes of the lake;
- Riparian rehabilitation areas – providing a minimum 10m wide vegetated buffer around the perimeter of the subject site; and
- Open space areas – consisting of landscaped and grassed areas.

1.5 Aims and Objectives

The aim of rehabilitation works on the site is to restore the ecological values of the site following the completion of sand extraction works using weed removal techniques and the targeted planting of locally occurring native species.
The objectives of this CRLMP are to:

1. Complete regeneration and/or revegetation works with locally occurring native species to achieve a fully structured vegetation community;
2. Manage weeds using plantings of locally occurring native species and best practice weed control methods;



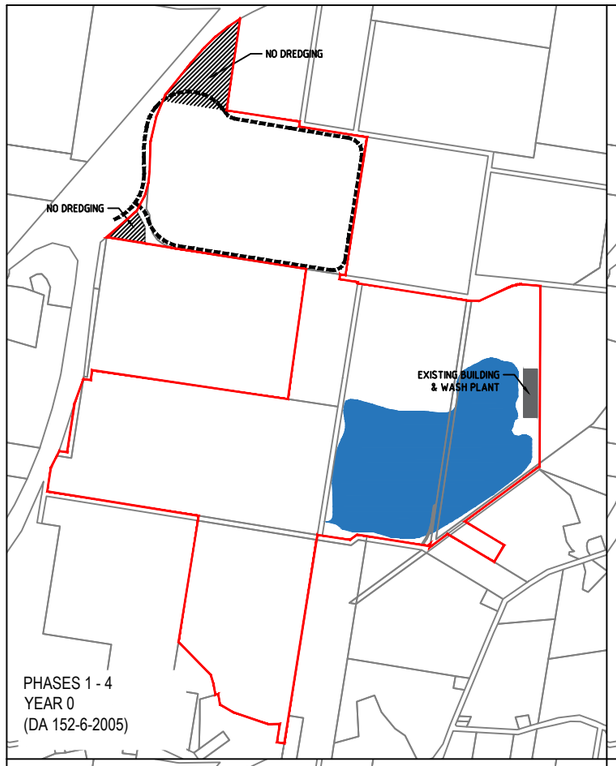
LEGEND

Subject Site

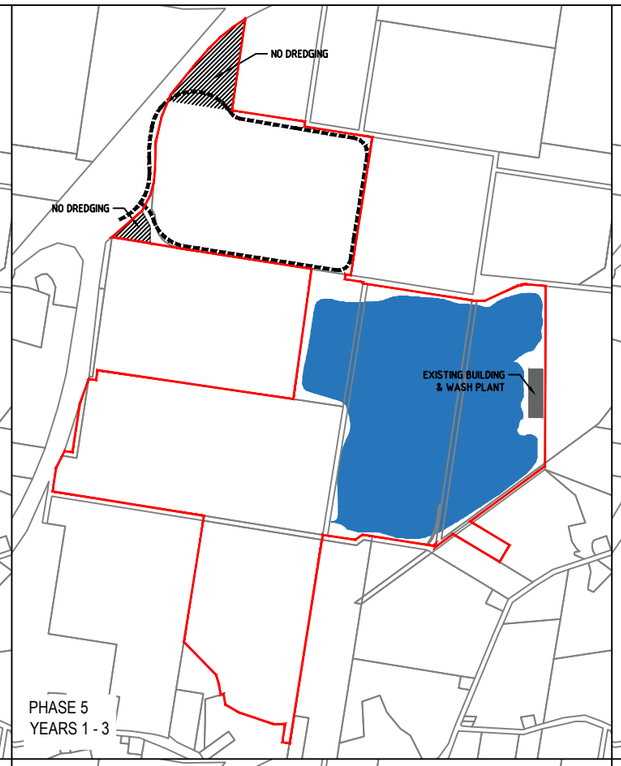
Scale 1:12 500 - Lengths in metres

100 0 100 200 300 400 500

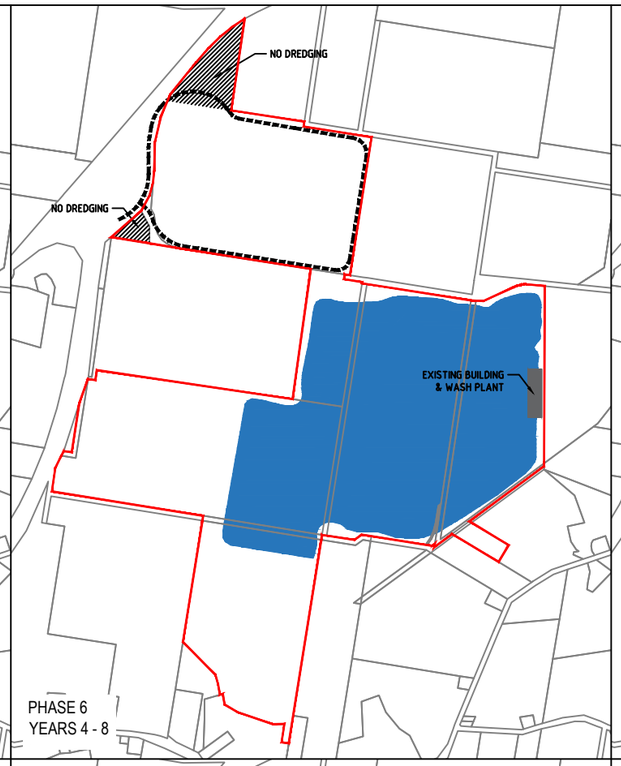
SOURCE: Near Map Aerial dated 15/07/19 SCALE: 1 : 12 500 @ A3 *JWA PTY LTD* *Ecological Consultants*	CLIENT Hanson Construction Materials Pty Ltd PROJECT Concept RLMP Tweed Sand Plant - Future Expansion Altona Road, Chinderah NSW Tweed Shire Council LGA	FIGURE 2 PREPARED: BW DATE: 08 February 2021 FILE: N09007_RLMP_20210208.dwg	TITLE AERIAL PHOTOGRAPH



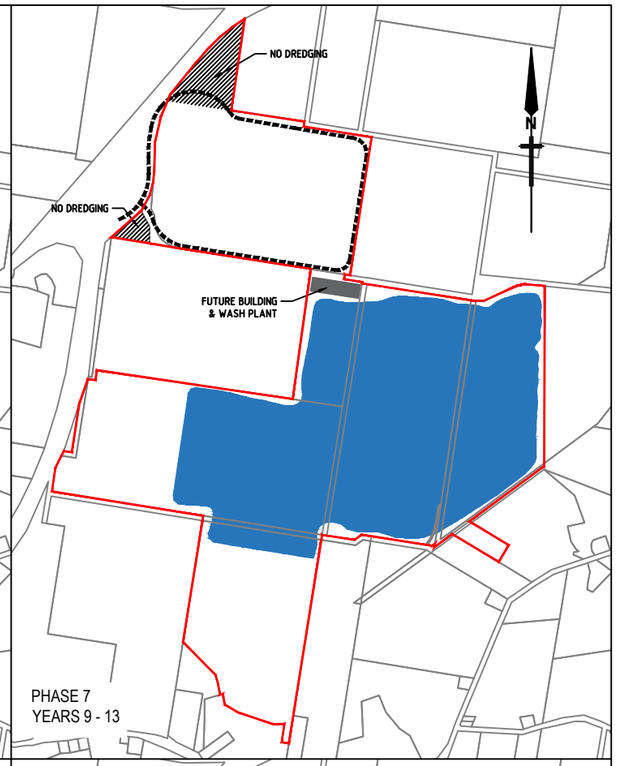
PHASES 1 - 4
YEAR 0
(DA 152-6-2005)



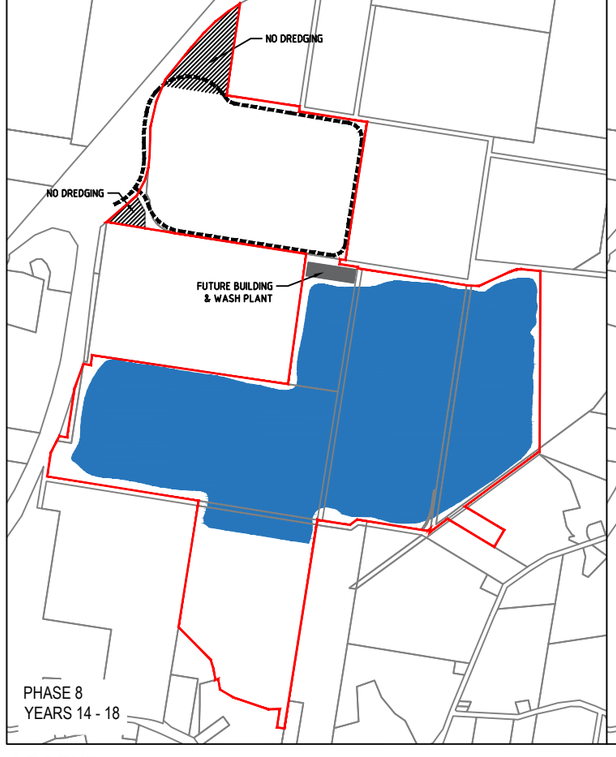
PHASE 5
YEARS 1 - 3



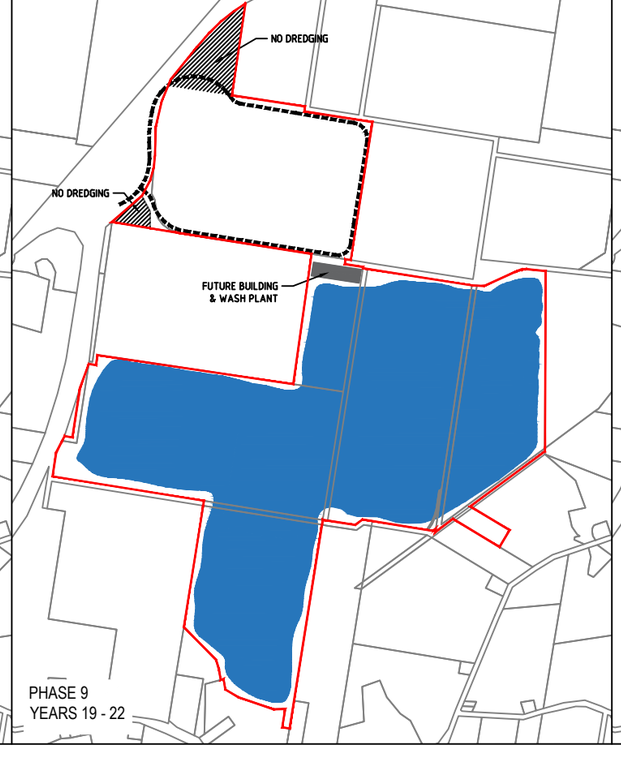
PHASE 6
YEARS 4 - 8



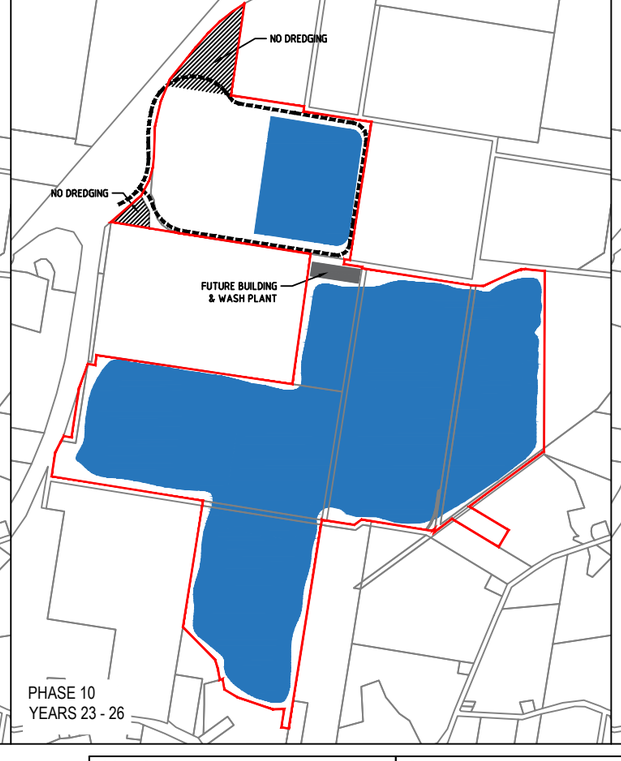
PHASE 7
YEARS 9 - 13



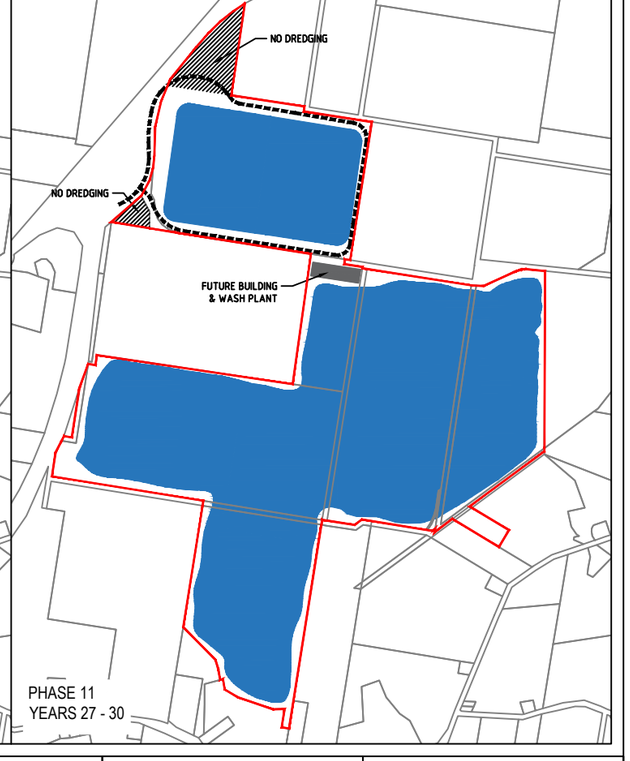
PHASE 8
YEARS 14 - 18



PHASE 9
YEARS 19 - 22



PHASE 10
YEARS 23 - 26



PHASE 11
YEARS 27 - 30

LEGEND

- Subject Site
- Extent of Dredging
- Haul Route
- Building & Wash Plant

Scale 1:25 000 - Lengths in metres

200 0 200 400 600 800 1000

SOURCE: Zone Planning Group - Concept Development Phasing dwg No. Z19163-104 dated 25/01/21(Ref: LAYOUT - PHASING.dwg)

SCALE: 1 : 25 000 @ A3

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Hanson Construction Materials Pty Ltd

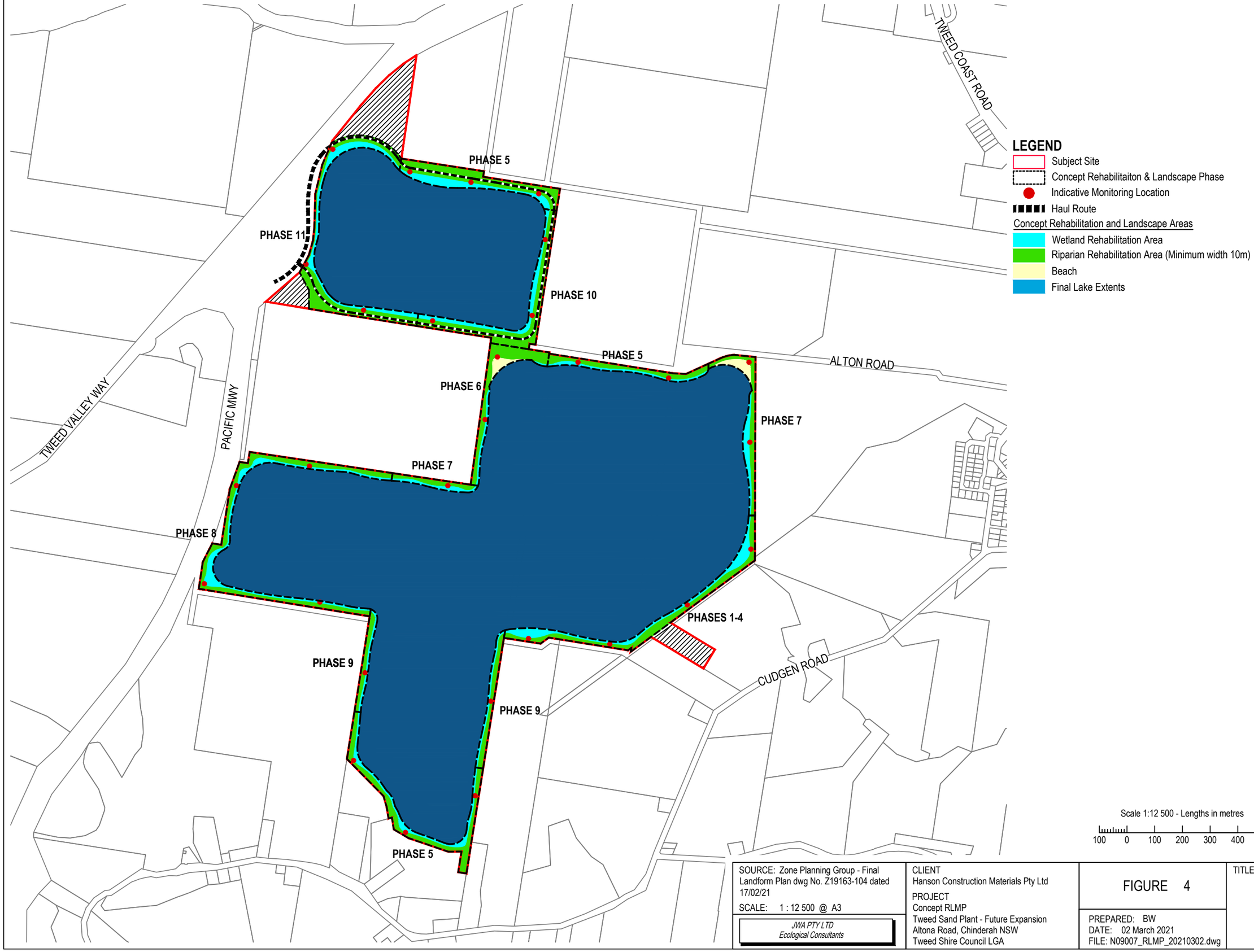
PROJECT
Concept RLMP
Tweed Sand Plant - Future Expansion
Altona Road, Chinderah NSW
Tweed Shire Council LGA

FIGURE 3

PREPARED: BW
DATE: 08 February 2021
FILE: N09007_RLMP_20210208.dwg

TITLE

CONCEPT DEVELOPMENT PHASING



SOURCE: Zone Planning Group - Final Landform Plan dwg No. Z19163-104 dated 17/02/21

SCALE: 1 : 12 500 @ A3

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Hanson Construction Materials Pty Ltd

PROJECT
Concept RLMP
Tweed Sand Plant - Future Expansion
Altona Road, Chinderah NSW
Tweed Shire Council LGA

FIGURE 4

PREPARED: BW
DATE: 02 March 2021
FILE: N09007_RLMP_20210302.dwg

TITLE

CONCEPT RLMP PHASING

3. Utilise endemic species to reduce erosion and improve bank stability, and to control nutrient levels and sediment entering the lakes;
4. Ensure that ecological processes, habitat and corridor function within the identified rehabilitation areas are protected and amplified;
5. Improve the value of the site as habitat for fauna groups; and
6. Enhance the visual amenity of the site.

2 REHABILITATION STRATEGY

2.1 Introduction

This section provides details of the procedures to be used to complete rehabilitation works on the site. Prior to the commencement of rehabilitation works within each phase, a phase specific Rehabilitation and Landscape Management Plan (RLMP) will be prepared to provide site specific guidance for the restoration and management of the land to be rehabilitated. The phase specific Rehabilitation and Landscape Management Plans will be consistent with the strategies outlined in this report and/or current best practice methods.

Rehabilitation works outlined in this section will be completed on a phase-by-phase basis within the three (3) Rehabilitation Areas identified in **FIGURE 4** following the completion of sand extraction works:

- Wetland rehabilitation areas;
- Riparian rehabilitation areas; and
- Open space areas (i.e. in the vicinity of beach areas).

Rehabilitation works on the site will cover approx. 20 ha (almost 10% of the site area).

2.2 Implementation Schedule

Rehabilitation works within each phase will be implemented following completion of sand extraction works based on the following schedule:

i. **Pre-Establishment Period** – The pre-establishment period will include:
   - Assessment of restoration potential within rehabilitation areas.
   - Site preparation works.

ii. **Establishment Period** - The establishment period shall extend for a period of six (6) months and will include:
   - All primary weed control works within the rehabilitation areas.
   - Installation of all plantings within the revegetation zones.
   - Initial supplementary planting to replace dead seedlings.
   - Distribution of mulch where appropriate throughout the revegetation area to a thickness of 100 mm. Jute matting or other forms of groundcover may be used where appropriate.

iii. **Maintenance Period** – the maintenance period shall extend for a further period of five (5) years after the establishment period and include:
   - Ongoing weed control within the rehabilitation areas to be completed every six (6) months for the duration of the maintenance period.

- Replacement planting within revegetation zones (where required to achieve performance criteria) every six (6) months for the duration of the maintenance period.
- Removal of all declared noxious and/or recognised environmental weeds.

2.3 Rehabilitation Team

On-ground restoration works must be undertaken by suitably experienced persons, or under the supervision of a qualified bush regenerator or senior ecologist.

2.4 Assessment of Restoration Potential

Prior to the commencement of restoration works within each phase, the restoration potential of the rehabilitation areas will be assessed by an Ecologist with regards to the ecosystem's ability to naturally regenerate. The assessment will be based on the McDonald (1996) vegetation restoration system (**TABLE 1**) and will consider the condition of the current native vegetation, the level of weed infestation and the amount of work that will be required to return the area to a fully structured native vegetation community. This assessment will be completed to ensure that rehabilitation and revegetation resources can be utilised in the most efficient way by focusing on those areas that are characterised by particular management issues (i.e. weed infestations, lack of canopy cover, poor species diversity) and matching the appropriate restoration measures for those issues.

TABLE 1
VEGETATION MANAGEMENT CATEGORIES AND ACTIONS

Management Categories (Based on restoration potential)	**Management Actions**
1 – Very Good Condition Structure and composition of vegetation community generally intact. Low evidence of degradation. Likely to recover fully with passive intervention.	Maintenance
2 – Good Condition. Structure somewhat altered by low level impacts. Likely to recover fully if casual factors and their secondary impacts are removed by active intervention. Likely to degrade further if no remedial action taken.	Natural or assisted rehabilitation
3 – Moderate Condition Structure altered by high level impacts. High level visual impacts may be present. Likely to recover fully if casual factors and their secondary impacts removed by active intervention, but will take longer to recover than a site of higher condition.	Assisted rehabilitation

Management Categories (Based on restoration potential)	Management Actions
4 – Poor Condition Structure and/or composition highly altered. Sufficient biota remain for natural regeneration if casual factors and their secondary impacts are removed and dynamic processes reinstated. Reintroduction of some species may be required.	Assisted rehabilitation/ revegetation
5 – Very Poor Condition Structure and/or composition severely altered. Either insufficient biota remain for natural regeneration (except some ruderal species), or severe weed infestation occurs and is likely to prevent native regeneration.	Assisted rehabilitation/ revegetation
6 – Nil native vegetation	Revegetation

2.5 Site Preparation

2.5.1 Background

Site preparation includes all works that will take place before the rehabilitation works commence. This includes providing information to site workers/contractors in relation to the Rehabilitation Areas and the restoration strategy, erosion and sediment control measures, bank stabilisation and grading, and site protection and access fencing.

2.5.2 Site Workers Responsibilities

Site workers will be informed of their responsibilities before the commencement of works within the Rehabilitation Areas including:

- Responsibilities under this CRLMP and any other associated management plans where relevant;
- Activities prohibited in the Rehabilitation Areas:
  - storage of goods and equipment;
  - mixing of materials;
  - liquid disposal;
  - machinery repairs and/or refuelling;
  - combustion of any material;
  - stockpiling of soil, rubble or debris;
  - any filling or excavation including trenching, topsoil skimming and/or surface excavation, unless otherwise approved by Council's General Manager or delegate; and
  - unauthorised pesticide, herbicide or chemical applications.

2.5.3 Management and Re-use of Topsoil

In accordance with the Soil and Water Management Plan (G&S 2021), to minimise the risk of erosion during the dredging process, topsoil is to be stripped from the site ahead of the extraction face and used to form (discontinuous) perimeter bunding and to facilitate rehabilitation and landscaping works. Removal of topsoils and vegetation shall be completed in a progressive manner to limit the area of exposed soils at any one time. Topsoil used for bunding or rehabilitation is be stabilised via temporary seeding or temporary/permanent revegetation in accordance with the SWMP (G&S 2021) and this CRLMP.

2.5.4 Erosion and Sediment Control Measures

Erosion and sediment control works shall be completed where necessary in accordance with the Soil and Water Management Plan (G&S 2021). The erosion and sediment control measures are not to be dismantled until the works on site have been completed and all areas where soils have been disturbed have been rehabilitated or covered with a mulch layer to a depth of approximately 100 mm. Jute matting or other forms of groundcover may be used where appropriate.

Erosion and sediment control measures shall be monitored and managed in accordance with the Soil and Water Management Plan (G&S 2021).

2.5.5 Bank Stabilisation and Grading

Dredging within the extraction lake has the potential to result in erosion/de-stabilisation of lake banks. To minimise bank slippage, an average underwater angle of approximately 1:3 is proposed throughout the extraction lake (Pacific Geotech 2021). Following the completion of sand extraction works in each phase, banks of the extraction lake will be graded to the appropriate levels and stabilised where necessary. The banks and batters within and adjacent to the extraction lake are to be non-uniform and exhibit an undulating surface (including areas of deep water) to maximise habitat diversity and mimic natural landform variance. The final form of lake banks will vary from gently inclined sandy 'beach' areas and wetlands to steeper banks reinforced with vegetation, floating wetlands and/or placed rock (or similar).

Plant growth along the bank is expected to promote bank stability in the Rehabilitation Areas. Various additional options for ensuring bank stability may be considered, such as floating silt curtains and geofabric socks, if required. These have not proven necessary to date in the rehabilitation works already completed in Phases 1 – 4.

Bank stability shall be monitored and managed in accordance with the Soil and Water Management Plan (G&S 2021) and additional bank stabilisation mechanisms employed in the event that significant soil deposition occurs.

2.5.6 Site Protection and Access Fencing

Any fencing installed in the Rehabilitation Areas should be installed before weed control and planting works commence. All fencing is to be "fauna friendly" i.e. a minimum 300 mm gap provided between the bottom of the webbing or the bottom strand of wire and the ground.

2.6 Weed Management

2.6.1 Background

Weed control works are to commence at the beginning of the Establishment Period and will be completed across the entire Rehabilitation Area. The weed management program will include the following strategic management actions:

- All weeds shall be managed such that alternative weeds do not become established where declared weeds have been removed;
- Weed management shall include follow up weed control in areas disturbed as a result of weed removal; and
- Assisted regeneration shall encourage native plant regeneration and ensure that bank and soil stability is maintained despite the removal of weed infestations.

Weed treatments are to be completed in accordance with *South East Queensland Ecological Restoration Framework: Code of Practice* (Chenoweth EPLA & Bushland Restoration Services 2012) and/or *Subtropical Rainforest Restoration* (Big Scrub Landcare Group 2005). Preferred treatment methods are provided in **APPENDIX 1**.

2.6.2 Weed Management Protocols

Weed management protocols are as follows:

- Management of all weed species will occur utilising suitable control measures (i.e. chemical and/or physical control) (**APPENDIX 1**). All weeds shall be controlled during the Establishment Period and the Maintenance Period.
- A progressive weeding/planting program should be utilised involving gradually replacing weeds with local native species to manage potential bank stability issues.
- Where weeds are removed, non-fertile material vegetation waste shall be mulched and retained on site for re-use in landscape and rehabilitation works. Vegetation mulching will be suitably controlled to avoid contamination. Any vegetation not suitable for mulching (i.e. fertile weed specimens) will be transported off-site to an appropriate disposal facility.
- Weed or potential weed species shall not be planted within rehabilitation and landscaping areas of the site.
- All nursery stock for revegetation purposes shall be weed, pest and disease free and certified as such by the supplier where feasible. The certificates are to be obtained prior to the commencement of any regeneration/revegetation works on site.

2.6.3 Primary Weeding

Primary weeding will be undertaken through localised treatment of grass and herbaceous species via mechanical removal (hoe/rake, hand pulling and/or slashing) or with Roundup Biactive©. Woody weed species will be hand pulled or controlled using weed control techniques listed within **APPENDIX 1**.

All chemical users shall be experienced and licensed in accordance with the relevant legislation. Utmost care must be taken when utilising chemicals to ensure that no drift or runoff occurs outside of the treatment area. Spraying shall not occur on windy days or within 24 hours of predicted rainfall.

Preparation before spraying, in the form of manual clearing weeds from around native plants, is to be completed where appropriate. Small native plants less than 20 cm in height are to be marked with a stake and flagging tape to indicate retention.

2.6.4 Secondary Weeding

Secondary weeding involves the eradication of weeds that have been overlooked or re-shoot after the primary treatment. Secondary weeding will occur six (6) months after primary weeding.

2.6.5 Weed Maintenance

The Rehabilitation Area will require ongoing weed control as part of the rehabilitation Establishment and Maintenance Periods. Weed monitoring visits will be completed every month for the duration of the establishment period, and every six (6) months during the maintenance period. Weed control methods will be informed by these visits. Once revegetation plantings and regeneration have become established (i.e. achieve canopy closure) it is likely that weed incidence will be minimised through competition with maturing native species. The ongoing maintenance requirements are therefore likely to be reduced over time.

2.7 Rehabilitation Works

2.7.1 Background

Rehabilitation works on the site will consist of a combination of natural regeneration and revegetation works. Natural regeneration will be encouraged throughout the Rehabilitation Area and will be continually monitored for the life of the restoration strategy. Where natural recruitment is poor, active revegetation works through planting will be completed in accordance with the following sections.

2.7.2 Rehabilitation Phases

Revegetation works will be undertaken in five (5) phases:

- **Phase 1**: Initial planting – Initial planting will be installed within six (6) months of commencement of works.

- **Phase 2**: Establishment and maintenance - the establishment period is the period when the greatest assistance is required such as watering and weeding of the newly planted vegetation. The establishment period shall extend for a period of six (6) months.
- **Phase 3**: Supplementary planting to replace dead seedlings - will commence within two (2) months of the initial planting and replacement of any seedlings that have perished will occur.
- **Phase 4**: Additional plantings – will be completed every six (6) months for the duration of the maintenance period where the bush regenerator determines that additional plantings are is necessary to satisfy the objectives of this CRLMP.
- **Phase 5**: Ongoing maintenance - will continue for a minimum period of five (5) years following the initial six (6) month establishment period, or until the revegetation area becomes self-sustaining. A self-sustaining site is achieved once canopy closure is achieved and all weeds are removed.

2.7.3 Species Selection and Planting Densities

2.7.3.1 Introduction

The Rehabilitation Areas are divided into three (3) zones:

- Wetland rehabilitation areas;
- Riparian rehabilitation areas; and
- Open space areas.

The following section provide indicative species lists and planting densities for revegetation plantings within each zone.

2.7.3.2 Wetland Rehabilitation Areas

Wetland Rehabilitation Areas (**FIGURE 4**) along the banks of the lake will be of variable width based upon water depth. The extent of the Wetland Rehabilitation Areas and selection of suitable species for planting will be determined by bank gradients, erosional factors such as prevailing wind and waves and availability of appropriate seed or vegetative material. Erosion in certain parts of the water body may mean it is impossible for a wetland to be maintained in the long term regardless of attempts at rehabilitation.

A palette of recommended species for planting within the Wetland Rehabilitation Areas is provided in **TABLE 2**. This list has been developed based on the existing local flora assemblages and the recommendations contained in the Constructed Wetlands Manual (DLWC 1998). Species listed in **TABLE 2** have been divided into planting zones based on water depth. These zones have been derived from the Constructed Wetlands Manual (DLWC 1998) and advice from Boyd's Bay Garden World.

TABLE 2 also notes the estimated maximum plant density for each planting zone, inclusive of natural recruitment. Plantings will only be required where natural native regeneration does not occur.

TABLE 2
INDICATIVE SPECIES LIST - WETLAND REHABILITATION AREA

Planting Zone	Botanical Name	Common Name	Plant Density*
Planting Zone 1 - Mostly Dry (75%) / Some Seasonal Water Logging	*Baumea juncea*	Bare twigrush	2-3per 1m^2
	Lomandra longifolia	Long-leaved matrush	
	Paspalum distichum	Water Couch	
	Eleocharis acuta	Common spike-rush	
Planting Zone 2 - Wet (50%) / Dry (50%)	*Baumea rubiginosa*	Twigrush	3-4 per 1m^2
	Baumea arthrophylla		
	Baloskion pallens		
	Cyperus exaltatus	Giant sedge	
	Cladium procerum		
	Lepironia articulata		
	Lepidosperma longitudinale		
	Leptocarpus tenax	Slender twine-rush	
	Bolboschoenus fluviatilis	Marsh Clubrush	
	Schoenoplectus validus	River clubmarsh	
	Schoenus brevifolius	Zig-zag bogrush	
	Eleocharis equisetina	Spike rush	
Planting Zone 3 - 0.25m to 1.0m Deep	*Baumea articulata*	Jointed Twigrush	3 per 1m^2
	Schoenoplectus mucronatus		
	Eleocharis sphacelata	Tall spikerush	
	Lepironia articulata	Giant sedge	

Notes:
* Denotes total plant density within each zone, inclusive of natural recruitment.

2.7.3.3 Riparian Rehabilitation Areas

Riparian Rehabilitation Areas (**FIGURE 4**) will be rehabilitated to reflect Plant Community Type (PCT) 1235 – Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion as described within the BioNet Vegetation Classification (OEH 2018).

A palette of recommended species for planting within the Riparian Rehabilitation Areas is provided in **TABLE 3**. **TABLE 3** also notes the estimated maximum plant density for each planting zone, inclusive of natural recruitment. Plantings will only be required where natural native regeneration does not occur.

TABLE 3
INDICATIVE SPECIES LIST - RIPARIAN REHABILITATION AREA

Botanical Name	Common Name	Plant Density*
Ground Layer		
Baumea juncea		1 per 1.5m^2
Enhydra fluctuans		
Fimbristylis ferruginea		
Gahnia clarkei	Tall saw-sedge	
Ischaemum australe		
Juncus kraussii	Sea rush	
Shrubs		
Goodenia ovata		1 per 5m^2
Hibiscus diversifolius		
Melaleuca ericifolia		
Melaleuca styphelioides		
Parsonsia straminea	Common silkpod	
Trees		
Casuarina glauca	Swamp she-oak	1 per 10m^2
Melaleuca quinquenervia	Broad-leaved paperbark	
Eucalyptus tereticornis	Forest red gum	

Notes:
* Denotes total plant density within each zone, inclusive of natural recruitment.

2.7.3.4 Open Space Areas

Open Space areas will occur in the vicinity of beach areas (**FIGURE 4**) and will be planted in accordance with an approved Landscape Plan. Species used in landscaping works within the Open Space Areas should be locally occurring native species in order to provide habitat and foraging resources for the native fauna as well as improving the visual amenity of the subject site. **TABLE 4** provides an indicative list of species suitable for planting within the Open Space Areas. Plantings will only be required where natural native regeneration does not occur.

TABLE 4
SUITABLE SPECIES FOR PLANTING IN OPEN SPACE AREAS

Botanical Name	Common Name
Shrubs	
Trema tomentosa	Native peach
Clerodendrum floribundum	Smooth clerodendrum
Acmena smithii	Common lilly pilly
Macaranga tanarius	Macaranga
Trees	
Cupaniopis anacardioides	Tuckeroo
Banksia integrifolia	Coastal banksia
Syzygium oleosum	Blue lilly pilly

Botanical Name	Common Name
Grevillea robusta	Silky oak
Callistemon salignus	Willow bottle brush
Cryptocarya triplinervis var. *triplinervis*	Three-veined laurel

2.7.4 Planting Program

2.7.4.1 Introduction

The following section outlines the procedures to be employed during planting. If required, the bush regenerator or senior ecologist may make minor alterations to this planting program depending on the site requirements.

2.7.4.2 Terrestrial Planting Procedures

Planting will occur at the optimum time of the year when there is high soil moisture (between January and May), unless irrigation is available and accessible. The following program will be employed:

- Seedling sites will be spot sprayed with Roundup Bioactive © one (1) week prior to commencement.
- Seedlings will be sufficiently developed so as to have a significant chance of survival. Seedlings will be at least the sixth leaf stage and/or 20 cm in height.
- Seedlings will be sun hardened (plants should be held in full sunlight and systematically stressed to the point of wilting for at least two (2) months prior to planting) prior to transport to the site.
- Seedlings shall be planted on the same day as their transport from the nursery, or planted as soon as practically possible. No seedlings will be left unprotected on the site whilst awaiting planting;
- Planting in areas exposed to full sun or westerly sun shall be avoided in the peak summer months, where possible.
- All seedlings will be soaked in water overnight prior to planting.
- All seedlings will be provided with a wetting agent such as rain-saver[1] crystals.
- All seedlings will be protected by a tree guard (commercial tubing or equivalent).
- Freshly planted tube stock seedlings shall be watered with at least one (1) bucket of water (6-9 litres) on the day of planting. Ongoing watering will be undertaken after the seedlings have been planted on an 'as needed' basis.
- A native TPK fertiliser can be placed in the planting environment.
- Weeds will be controlled, in the short term, through the application of suitable mulch around individual plantings (jute matting or other forms of groundcover may

[1] Rain-saver is a polymer water crystal that has been specifically developed for plants. The polymer absorbs and holds water and nutrients at a specific tension which makes it available to plant roots but does not release to the soil. Rain-saver has proven very successful in more difficult environments (e.g. Roadside plantings on the Pacific Motorway between Brisbane and the Gold Coast and in frontal dunes at Pottsville (R. Keene *pers comm.* 2000).

be more appropriate in some areas) and with spot applications of an appropriate herbicide.

- In no areas will the ground surface be left bare.

2.7.4.3 Aquatic Planting Procedures

Where possible planting within the Wetland Rehabilitation Areas is to occur into the available dry substrates. When this is not practical, planting will occur in the shallow water. Wetland plants should be planted in the appropriate zones with regard to water depth. The following program will be employed:

- Selection of planting area;
- Selection of species to be planted and appropriate density;
- Using string line to determine area for each planting zone;
- Digging small spade holes in the appropriate mean water depth;
- Place roots zones into small spade holes; and
- Cover and compress the sediment around the roots.

2.7.5 Restoration Maintenance

Maintenance work will be undertaken for a minimum period of five (5) years after the six (6) months Establishment Period. An indicative maintenance schedule has been formulated to provide the best rehabilitation outcomes (**TABLE 5**).

TABLE 5
INDICATIVE MAINTENANCE SCHEDULE

Activity	Timing
Watering	During planting and as needed within the first six (6) weeks after planting.
Mulch	Applied to 100 mm thick as soon as possible after the site preparation has been completed (dependent on usage of jute matting).
Replacement Plantings	Plant survival will be assessed during maintenance visits. A 90% survival rate will be required during the maintenance period.
Weed Control	Initial weed control during site preparation. Secondary weeding three (3) to four (4) months after primary weeding. Ongoing weed maintenance every six (6) month for the duration of the establishment and maintenance periods.
Inspection of Erosion and Sediment Control Measures	Every month for the duration of the Establishment Period, and every six (6) months during the Maintenance Period.

2.7.6 Long Term Management

This CRLMP proposes a lifespan of five (5) years for Rehabilitation Works within each phase. Beyond this timeframe, maintenance works within the Rehabilitation Areas are likely to be limited to weed management on an as needs basis. These works should be completed in accordance with **SECTION 2.6** if necessary.

3 ADAPTIVE MANAGEMENT

Adaptive management is an approach that involves learning from management actions and using those lessons to improve upon the plan. The principles of adaptive management have been incorporated into the administration of restoration projects within a variety of governmental authorities and programs (Thom 1997).

Comprehensive, long-term monitoring is a component of successful adaptive management. The decision to alter or continue with strategies or management procedures, to ensure the objectives of the CRLMP are achieved, relies on the accumulation of supporting evidence. If established early in the project planning phase and implemented during successive monitoring and management phases, adaptive management can be a powerful method to systematically assess and improve the performance of restored ecosystems.

Before the implementation of any adaptive management strategies, the proposed management actions and the predicted outcomes from such management practices are to be included in the Annual Environmental Monitoring Report (AEMR) which is submitted to the Department of Planning, Industry and Environment (DPIE) as part of the current sand extraction licencing requirements. Any variation to the plan shall be approved by DPIE prior to implementation.

4 MONITORING AND REPORTING

4.1 Introduction

Monitoring and reporting is critical in ensuring the continuing success of restoration works and will be carried out for the duration of this plan. This section provides an indicative monitoring and reporting regime.

Monitoring of the Rehabilitation Areas has been separated into three (3) types:

- Rehabilitation monitoring within Wetland and Riparian Rehabilitation Areas;
- Assessment of biological indicators; and
- Water quality monitoring.

4.2 Rehabilitation Monitoring

4.2.1 Introduction

To assess the success of rehabilitation works, vegetation assessments will be completed by a suitably qualified ecologist using plot-based vegetation surveys (transects and quadrats) and photo point monitoring. In addition, the rehabilitation team will also maintain records of works completed. The following sections outline the methodology to be used to monitoring the rehabilitation works.

4.2.2 Bush Regeneration Team Monitoring

In addition to the rehabilitation monitoring completed by an ecologist, the bush regeneration team will also keep detailed work sheets for all works completed within the Rehabilitation Areas, recording the following:

- All work completed each day;
- Site conditions;
- Chemicals used;
- Problems encountered; and
- Future works required.

An example daily work sheet template is attached in **APPENDIX 2**. These records and general comments on progress will be provided to the Ecologist for consideration and inclusion in the Annual Rehabilitation Monitoring Report (**SECTION 4.2.6.2**).

4.2.3 Plot-Based Vegetation Surveys

4.2.3.1 Monitoring Locations

Indicative monitoring locations are shown on **FIGURE 4**.

4.2.3.2 Timing of Monitoring Events

The monitoring is to be completed by a qualified ecologist. Monitoring events should occur:

- Prior to the commencement of rehabilitation works to set up monitoring transects and quadrats, and to collect the baseline monitoring data;
- Six (6) months after initial planting; and
- On an annual basis after planting until completion criteria have been achieved.

4.2.3.3 Methodology

Plot-based vegetation surveys (transects and quadrats) will be undertaken at each monitoring location. Vegetation survey sites will be permanently marked (i.e. star pickets or wooden stakes) and the end positions identified on a sitemap using a hand-held Global Positioning System (GPS).

The plot-based vegetation surveys will collect the information outlined in **TABLE 6** using the following methods:

- Riparian Rehabilitation Areas:
  - A central 50 m transect; and
  - Three (3) quadrats (5 m x 5 m) located at least 10 m apart along the transect.
- Wetland Rehabilitation Areas:
  - Three (3) 1 m^2 quadrats.

TABLE 6
VEGETATION SURVEY DATA TO BE COLLECTED

Attribute	Applicable Rehabilitation Area	Survey Required
Native Canopy Cover	Riparian Rehabilitation Area	Native canopy cover will be measured via the 'line intercept method' along the 50 m transect. Key canopy species will be noted.
Weed Canopy Cover	Riparian Rehabilitation Area	Weed canopy cover will be measured via the 'line intercept method' along the 50 m transect. Individual canopy weed species should be assessed separately.
Native Midstorey Cover	Wetland and Riparian Rehabilitation Area	Estimate the % foliage cover of each native species within the midstorey across the quadrats (5 m x 5 m quadrats within Riparian Rehabilitation Areas and 1 m^2 quadrats within Wetland Rehabilitation Areas). Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…).

Attribute	Applicable Rehabilitation Area	Survey Required
Weed Presence in the Midstorey	Wetland and Riparian Rehabilitation Area	Estimate the % foliage cover of each weed species within the midstorey across the quadrats (5 m x 5 m quadrats within Riparian Rehabilitation Areas and 1 m^2 quadrats within Wetland Rehabilitation Areas). Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…).
Groundcover/ Macrophytes	Wetland and Riparian Rehabilitation Area	Estimate percentage cover of native species vs. weeds within each of the quadrats (5 m x 5 m quadrats within Riparian Rehabilitation Areas and 1 m^2 quadrats within Wetland Rehabilitation Areas). Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…). Identify each native and weed groundcover species. Within Wetland Rehabilitation Areas a stem count will also be taken.

The full species name (genus species) must be recorded for all native species, unless insufficient diagnostic plant material is present, in which case the genus name followed by a species number must be used. Comments should also be included for all attributes (**TABLE 6**) on any notable variations elsewhere in the relevant management polygon - e.g. weeds occurring in the management polygon that are not (or poorly) represented in the transect.

4.2.4 Photo Point Monitoring

Photo-monitoring points will be completed as a means of demonstrating compliance or otherwise with performance criteria. Permanent photo stations are to be located at each monitoring location. Four (4) colour photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. Photos should be labelled with the:

- Monitoring point code;
- Direction of view; and
- Date and time.

Photos are to be included in the Annual Rehabilitation Monitoring Reports.

4.2.5 Performance Targets and Corrective Actions

TABLE 7 provides the performance indicators and targets for the proposed rehabilitation works within Wetland and Riparian Rehabilitation Areas. Corrective actions are provided that are to be implemented if performance targets are not met.

TABLE 7
PERFORMANCE TARGETS AND CORRECTIVE ACTIONS

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
Survival and continued growth of seedlings (i.e. planted stock).	>90% survival of plantings during all monitoring events.	>90% survival of plantings during all monitoring events	Irrigation if required. Additional planting if required.
Establishment of native ground cover/macrophytes within revegetation areas.	Planted ground covers/macrophytes substantially established.	• >60% after three (3) years; • >80% after five (5) years;	Supplementary planting.
Establishment of native canopy cover (where applicable) within revegetation areas.	Planted trees substantially established.	• >60% canopy cover of native tree species >1.5 m in height after three (3) years; • >80% canopy cover of native tree species >2.5m in height after five (5) years.	Monitoring and maintenance period must be extended until the targets are met.
Natural recruitment of native species throughout rehabilitation areas.	Evidence of natural recruitment of shrub and ground cover species.	Increasing natural recruitment of shrub and groundcover species.	Where natural recruitment fails to meet performance targets discussions with TSC shall be initiated by the proponent or their consultants to consider adjustments to the assisted regeneration strategy being used to improve natural recruitment.
All identified weeds controlled to an acceptable level within retained vegetation areas.	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points: • reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary.

4.2.6 Reporting

4.2.6.1 Baseline Rehabilitation Monitoring Report

Subsequent to the completion of baseline monitoring, a report will be prepared outlining the results. The report will be included in the Annual Environmental Monitoring Report (AEMR) which is submitted to the Department of Planning, Industry and Environment (DPIE) as part of the current sand extraction licencing requirements, and form the baseline for future monitoring.

4.2.6.2 Annual Rehabilitation Monitoring Report

An Annual Rehabilitation Monitoring Report will be prepared which discusses the results of the monitoring of retained vegetation and rehabilitation areas against the Monitoring Performance Criteria identified in **SECTION 4.2.5.** The information provided in the report should include, but not necessarily be limited to:

- Works undertaken (i.e. A summary of bush regenerators daily reports);
- A presentation of the results of the particular monitoring event/s;
- A detailed discussion of the results of each particular monitoring event;
- A detailed comparison with the baseline parameters and with previous survey data, as appropriate;
- A statement of compliance with the Monitoring Performance Criteria identified in **SECTION 4.2.5**;
- Any problems since the previous inspection (death of a significant number of seedlings, broken fences etc.) and what effects these issues have had on the regeneration area;
- Success or failure of measures implemented to rectify previously identified problems; and
- Measures to be taken to rectify new problems.

Each Annual Rehabilitation Monitoring Report will be included in the Annual Environmental Monitoring Report (AEMR) which is submitted to the Department of Planning, Industry and Environment (DPIE) as part of the current sand extraction licencing requirements.

4.3 Assessment of Biological Indicators

4.3.1 Introduction

To assess the suitability of the extraction lakes and Rehabilitation Areas for terrestrial and aquatic fauna, assessments of biological indicators (fish, birds, and macroinvertebrates) will be undertaken by suitably qualified persons using the methodology outlined below.

Monitoring of birds will be completed annually. Monitoring of fish and macroinvertebrates will be monitored at the end of each extraction phase. Results of the assessments will be included in the relevant Annual Rehabilitation Monitoring Report (**SECTION 4.2.6.2**).

4.3.2 Birds

To measure abundance of bird species, bird surveys will be completed annually utilising the 2 ha, 20-minute search technique (Birdata 2020, Auerbach 2016). A radius of 80 m from each Rehabilitation Area photo monitoring point location (**FIGURE 4**) will be searched and the numbers of all birds observed visually and aurally were recorded, including those flying over.

4.3.3 Fish

The fish community composition within the lake will be assessed by a suitably qualified aquatic ecologist at the end of each extraction phase utilising a combination of electrofishing operations and unbaited box trapping.

4.3.4 Macroinvertebrates

Macroinvertebrate sampling will be undertaken by suitably trained and AusRivAS experienced field operators at the end of each extraction phase in line with the approach outlined in the NSW Australian River Assessment System (AusRivAS) Sampling and Processing Manual (Turak *et al*. 2004).

4.4 Water Quality Monitoring

Water quality in the extraction lake will be monitored on a biannual basis in accordance with the Soil and Water Management Plan (G&S 2021). Details of the water quality parameters to be tested and the water quality objectives to be met are outlined in the Soil and Water Management Plan (G&S 2021).

REFERENCES

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Pacific Geotech (2021) Geotechnical Report: Proposed Expansion, Hanson Tweed Sand Plant.

Thom R.M. (1997) System-development matrix for adaptive management of coastal ecosystem restoration projects. *Ecological Engineering* **8**:219–232.

Turak, E., Waddell, N. & Johnstone, G. (2004). New South Wales (NSW) Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual 2004. Natural Heritage Trust.

APPENDIX 1 – WEED CONTROL METHODS

Weed Control Method	Technique
Terrestrial Weeds	
Bagging	Plants which can reproduce from plant material such as bulbs, tubers, corms, runners (stolons), underground horizontal stems (rhizomes), and plantlets formed on leaves should be bagged and removed from the site. Bagged plant material can be composted, burned or disposed in a landfill. Compost piles should be well anchored and positioned away from the flooding zone and from cattle. Compost piles should be appropriately monitored. Any burning should be undertaken away from the riparian zone and from native vegetation.
Basal bark treatment	Used for saplings up to approximately 75 mm in diameter. The entire surface of the stem is treated from ground level to about 300 mm above the ground. Herbicide can be applied by brush or by spraying with a low pressure setting.
Cut	The cut stump method must involve completely cutting the trunk or stem of the plant, at a level below the first branches or as near as practicable to ground level. Follow up maintenance (on an annual or bi-annual basis) to suppress regrowth, suckering and coppicing is essential.
Cut, scrape and paint	The cut, scrape and paint method must involve completely cutting the trunk or stem of the plant, at a level below the first branches or as near as practicable to ground level. Herbicide must then be immediately applied to the cut surface of the cut trunk or stem. Following the cut and paint, the exposed stem or root surface is scraped till a light green coloured layer is visible. Herbicide is then immediately applied to the scraped surfaces.
Debris management	In the case of non-locally indigenous plants species that reproduce or regenerate vegetatively, debris should be managed in a manner to ensure complete death and should not be stacked and burned within 20 m of remaining native vegetation.
Hand held foliar spraying	Foliar spraying involves spraying the foliage of the plant with an appropriate herbicide. Herbicide should be applied with a low-pressure concentrated spray stream sufficient to avoid misting and spray drift. Foliar spraying should only be used on plants that have a total height of 1.5 m or less. In the case of deciduous plants, foliar spraying should only be undertaken when foliage is present on the target weeds and before yellowing and leaf fall commences. Foliar spraying should only be undertaken in a manner that does not cause harm to any adjacent native vegetation. Any native vegetation within one metre of the target plant must be adequately protected from direct spray, splash or drift. Foliar spraying must not occur over any water body (whether still or flowing) or in any manner which may result in direct or indirect application to a water body. Foliar spraying must only be carried out in calm conditions and must avoid spray drift.

Weed Control Method	Technique
Hand pulling	Hand pulling must involve gripping and pulling the stem of the plant by hand to carefully remove the whole stem and root system from the ground. Hand pulling should only be used for plants that can be removed with minimal disturbance to the soil and existing litter or vegetative groundcover. Hand pulling is most effective when the plants to be removed are small and the soil is moist.
Herbicide use	All use of herbicide involved in the carrying out of clearing activities must comply with: • The directions on the attached labelling; or • The National Registration Authority "North Coast Off-label Permit", or NRA permit PER3512 covering methods listed in the Appendix to Common Weeds of Northern NSW Rainforests published by the Big Scrub Rainforest Landcare Group. Any mixing of herbicide must be carried out at least 20 metres away from any watercourse and used herbicide containers must be disposed of in an appropriate manner. All use of herbicide must be undertaken with regard to the provisions of the *Protection of the Environment Operations Act (1997)*. If a risk of pollution exists, a licence may be required from the Environment Protection Authority before work commences. Herbicide clearing methods must only be undertaken, or actively supervised, by a person or persons who have training and accreditation in the safe use and handling of chemicals. Herbicide clearing methods should only be used whilst the target plants are actively growing
Ringbarking	Ringbarking must involve the placing of a continuous sharp cut line (frill) around the entire trunk, to a depth below the sap flow zone, generally using an axe or tomahawk.
Scrape and paint	The scrape/gouge and paint, method is used for vine weeds with tubers such as Madeira vine (*Anredera cordifolia*). Sections of stem at least 300 mm long are scraped firmly, exposing the fibres of the stem, and the scraped sections are painted with herbicide (for Madeira vine, 75% Glyphosate is used). The stems must not be severed. Gouging may also be used in the case of plants with fleshy tubers. Gouging is like 'eying' a potato except that a deeper well is gouged with the tip of a knife and then filled with herbicide.
Stem injection – frilling, drilling, spearing	A series of drill-holes or cuts must be made into the sapwood around the trunk below the branches of the plant. Herbicide must then be immediately injected into each hole or cut at the recommended dosage. Holes and cuts must be angled downwards into the trunk to prevent herbicide escape. Stem injection must not be undertaken immediately before or after rain. In the case of deciduous plants, stem injection must be undertaken during late summer to early autumn. Plants that have been stem injected should be left in place undisturbed for a minimum of 12 months after herbicide application.

Weed Control Method	Technique
Vine removal	Where the vines are generally prostrate on the ground, aerial parts of the vine (stems and leaves) should be rolled into heaps then cut and paint or hand pulling applied. Where the vines are hanging from trees then cut and paint or hand pulling applied. Hand pulling of Madeira vine, Cape ovy and Climbing cactus must be avoided.
Aquatic Weeds	
Mechanical Control – Floating Plants	Salvinia and Water hyacinth are free floating plants and may be removed using a scoop net. A stretcher (scoop net) can be made from two poles and a piece of mesh that allows the weed to be scooped up from underneath the water and catapulted onto land where it can be moved from the edge of the lake for burial.
Mechanical Control - Emergent Plants	Cumbungi and Phragmites can be cut below the waterline in autumn, severely retarding their growth. This is particularly true of Cumbungi. Special underwater cutting machines are available for both submerged and emergent plants, but these are costly and do not eliminate the problem.
Mechanical Control - Submerged Plants	Ribbon weed and Milfoils may be effectively removed by a wire rope weighted at intervals. Alternatively these plants can be cleared by dragging the dam using a heavy chain, anchored at a point on the dam bank. A tractor, with the other end of the chain attached, is driven around the dam. The chain follows the bed of the dam, severing the plants close to the bottom. Where this does not work because of locality, or because trees are in the way, use an excavator or scoop.
Mechanical Control - Weeds that are Anchored to the Banks	Weeds that are anchored to the banks Weeds that are anchored to the banks are difficult to control by mechanical means. Mowing reduces the bulk of material but it is essential that mowing is carried out regularly.
Environmental Control	Control can be achieved by altering the water body in some way to limit the growth of aquatic plants, for example: • Out competing the potential weed growth with a dense, healthy crop of native aquatic species. • Shade the dam using bank-planted trees appropriate for the area.
Chemical Control	When herbicides are to be applied, the treatment must be carefully selected so that it will not kill fish and wildlife or damage native aquatic plants. Chemical control is suitable where the weed infestation is small. A small infestation means that only a small quantity of chemical is needed, and water contamination is minimal. Also, the decay of small amounts of vegetation will not reduce oxygen levels in the water sufficiently to kill fish. It is important to adhere strictly to the following procedures: • Identify the plant or plants correctly;

Weed Control Method	Technique
	• Select a chemical registered for use in water and on that particular plant; • Read the chemical label carefully and observe all special precautions; • Take particular note of toxicity to other plants, fish or wildlife, residual activity and withholding periods for treated water.

APPENDIX 2 – EXAMPLE DAILY WORK RECORD PROFORMAS

This form is to be filled by the team leader for each workday. The team leader will need to allow 15 minutes each day to gather any relevant information for team members and to fill in this form.

Name of Team Leader:			**Date:**	
Vegetation Type:			**Site Number:**	
Weather Conditions:				
Specific Work Zone/s:				
Work Team Details				
Name	**Zone No**	**Time Started**	**Time Finished**	**Hours Worked**
Total No of Workers:		**Total No of Hours:**		

Description of Work Undertaken *(e.g. spraying, hand weeding, replanting, etc.). Mark work progress on project map.*							
Weed Control Undertaken	Weed Species	Material Used (tools/machinery)	Chemical Application (type/ratio/volume)	Zone No(s)	Area Worked (m^2)	No of People	Total Hours Worked
Spraying							
Tree injections							
Cut and paint							
Hand weeding							
Other (specify)							

Replanting Undertaken	Material Used (tools/machinery)	Fertilizer, Mulch, Tree Protection Used (type/ratio/volume)	Zone No(s)	No trees Planted	No of People	Total Hours Worked

Fencing Undertaken	Type of Fence	Material Used (tools/machinery)	Zone No(s)	Km of Fence	No of People	Total Hours Worked

Other Work (describe activity)	Material Used (tools/machinery)	Zone No(s)	Quantity	No of People	Total Hours Worked

Observations:
New native species or native species not previously recorded in work zone (please note date and zone no):

Name and date of any native plant species in flower or fruit, sudden and abundant regeneration of a particular species, or other relevant observations:

New weed species or weed species not previously recorded in work zone (please note date and zone no):

Any animal sightings (please indicate if by visual identification, called, nests, footprints, scats, clawmarks, shed skin, diggings, smell, feeding etc.):

Blank Project Map:
Use map to indicate work undertaken for each day (e.g. hatching weed control progress).

Signature:

Chemical Operators Data Sheet

This form is to be filled by the team leader for each workday. The team leader will need to allow 15 minutes each day to gather any relevant information for team members and to fill in this form.

Location:	**Date:**	**Time:**
Operators:		

Herbicide	Batch No	Dilution Rate	Total	Operator	Equipment
Glyphosate:					
☐ RoundupBioactive®					
☐ Weedmaster Duo®					
Metsulfuron Methyl:					
☐ Brushkiller®					
☐ Brushoff®					
Glyphosate *PLUS* Metsulfuron Methyl:					
☐ RoundupBioactive®					
☐ Weedmaster Duo®					
☐ Brushoff®					
Triclopyr & Picloram:					
☐ Grazon®					
☐ Tordon T/C®					
Marker Dye:					
☐ White field marker					
☐ Red marker					
☐ Other					
Additive:					
☐ LI 700®					
☐ Agral®					
Other:					

Growing Conditions	Temperature	Weather Conditions	Wind Strength	Wind Direction
☐ Very Good	☐ Cool <20º	☐ Showers	☐ Strong	
☐ Good	☐ Warm 21º – 25º	☐ Overcast	☐ Gusty	
☐ Poor	☐ V/Warm 26º – 30º	☐ Clear Sky	☐ Light	
☐ Very Poor	☐ Hot >30º	☐ Variable	☐ Calm	

Zone/Area:
Comments:

Signature: