JWA PTY LTD
Ecological Consultants
ABN 18 862 767 739

REVISED SALTMARSH REHABILITATION PLAN

Lot 1 DP 570076, Lot 2 DP 566529, Lot 1 DP 562222, Lot 1 DP 570077, Lot 1 823679, Lots 46, 54, 55, 199, 200, 201, 202, 205, 206, 209, 228 & 305 DP 755740
Cobaki Lakes, Tweed Heads

A Report Prepared for
Leda Manorstead Pty Ltd

APRIL 2013

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DOCUMENT CONTROL

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd (JWA) was engaged by LEDA Manorstead Pty Ltd to complete a Saltmarsh Rehabilitation Plan (SRP) to accompany the Preferred Project Report for the proposed residential development at Cobaki Lakes.

JWA prepared a SRP for the Cobaki Lakes site in October 2008 in response to the Director-General's Environmental Assessment Requirements (DGEAR's) issued 21st August 2007. The SRP was placed on public exhibition along with various other reports required by the DGEAR's.

Following submissions from the public and State Agencies, some amendments have occurred to the Concept Plan. Additionally, more detailed survey information is now available over the Saltmarsh area on the site. This Revised SRP has been prepared to reflect changes to the Concept Plan and provide additional information where required.

1.2 The Subject site

1.2.1 Site description

The Cobaki Lakes site is located in Northern NSW adjacent to the NSW – Queensland State border. The site occupies the lower or eastern end of the Cobaki – Piggabeen Valley system (**FIGURE 1**).

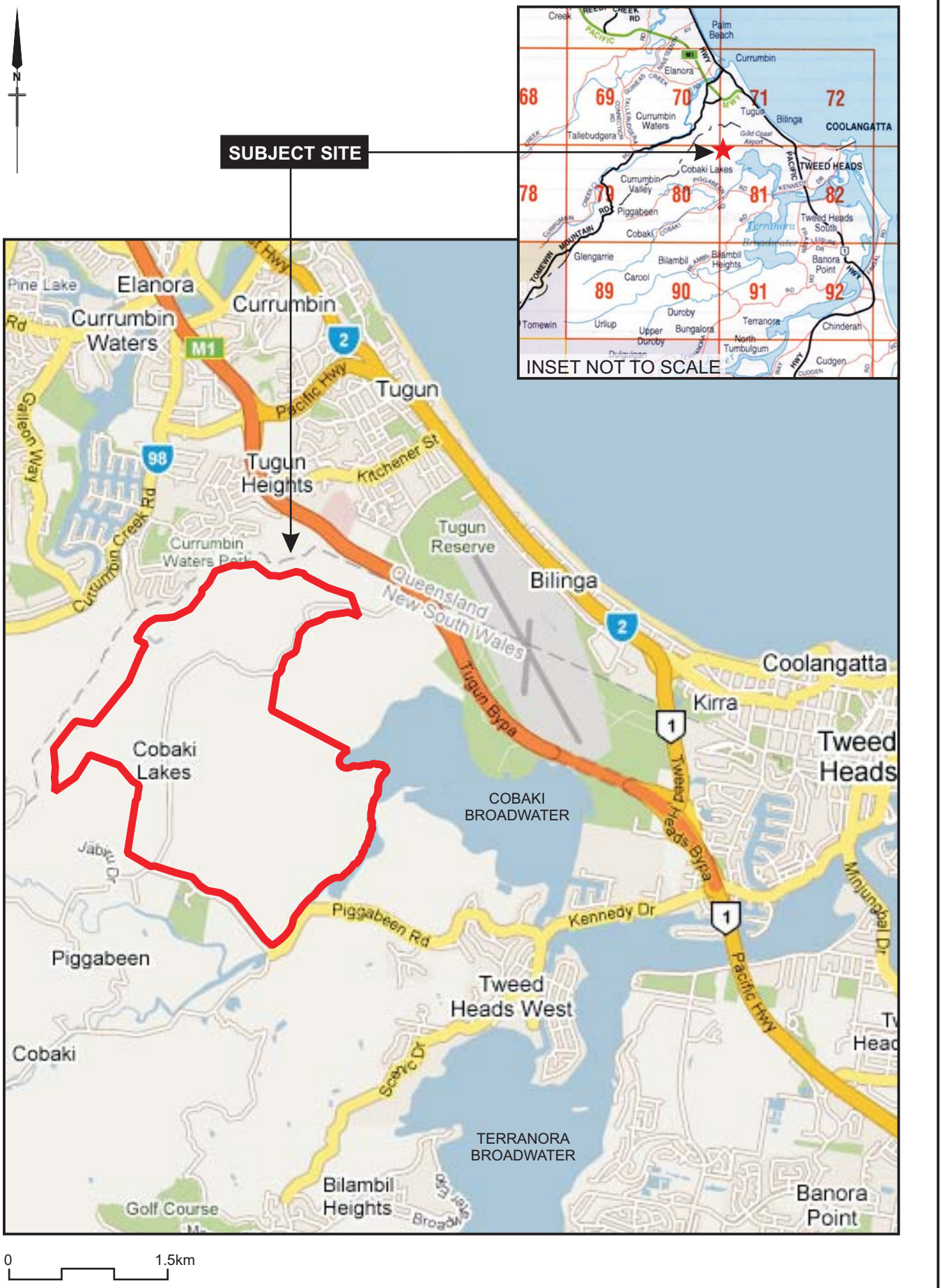
The Subject site consists of land described as Lot 1 DP 570076, Lot 2 DP 566529, Lot 1 DP 562222, Lot 1 DP 570077, Lot 1 823679, Lots 46, 54, 55, 199, 200, 201, 202, 205, 206, 209, 228 & 305 DP 755740, Cobaki Lakes, off Pigabeen Road, Tweed Heads. The site covers an area of approximately 605 hectares.

The site topography is considered as two (2) separate systems.

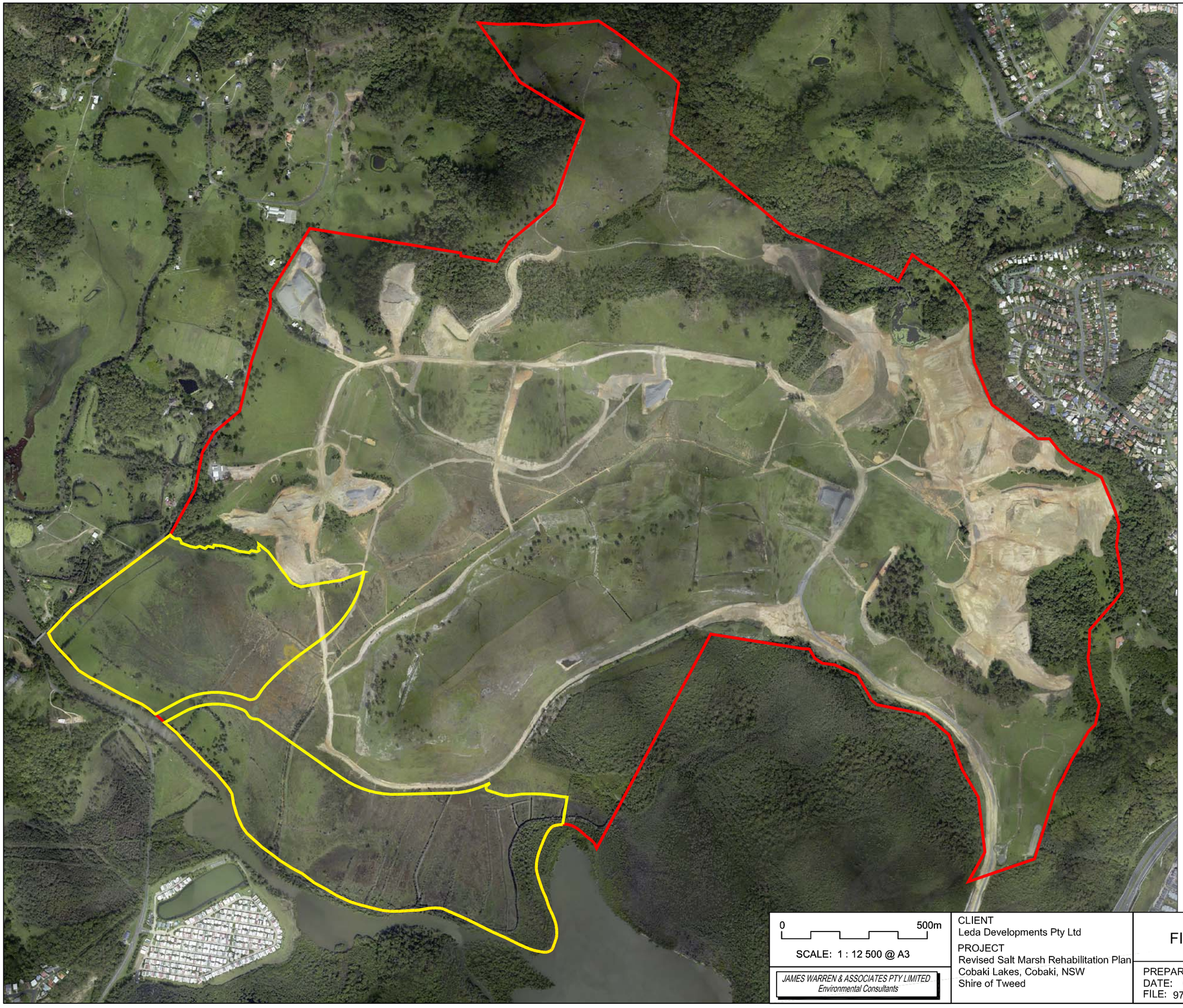
- The Sub-coastal foothills and outcrops of the eastern end of the McPherson Range which comprises the western and northern part of the site, covering an area of approximately 280 hectares.
- The hills enclose a drainage basin comprising the coastal plains in a composite of river/estuarine floodplain and sandplain being former sandbanks, beach or rolled and flattened dunes system.

FIGURE 2 shows a recent aerial photograph of the site. Vegetation clearing and earthworks have occurred in various locations of the Subject site (in accordance with relevant approvals) subsequent to this aerial photograph. However, the vegetation assessment has utilised a combination of aerial interpretation and on-site surveys and reflects the current distribution and extent of vegetation communities.

Previous land clearing for agricultural purposes (i.e. grazing) has occurred across the majority of the site. Currently sixteen (16) broad vegetation associations comprising twenty-two (22) vegetation communities occur on the site.



SOURCE: Google Maps SCALE: 1 : 50 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Revised Salt Marsh Rehabilitation Plan Cobaki Lakes, Cobaki, NSW Shire of Tweed	**FIGURE 1** PREPARED: BW DATE: 06 October 2010 FILE: 97038_SMRP_Locality.cdr	TITLE **LOCALITY PLAN**



N

LEGEND

- Salt Marsh Rehabilitation Area
- Cobaki Lakes Site Outline

SOURCE:
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Revised Salt Marsh Rehabilitation Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 2

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_base.dwg

TITLE

AERIAL PHOTOGRAPH

1.2.2 Existing use rights

The property has been grazed by cattle since the early 1900's. Land use activities which have been a long term and constant feature of this site are defined in Section 106 of the EP&A Act 1979. Existing use rights occur over the Subject site for routine agricultural activities including the construction and maintenance of drains, fencing and firebreaks as well as pasture improvement activities.

1.2.3 Land use Zones

The Subject site currently contains the following land use zones:

- 2(c) Urban Expansion
- 2(e) Residential Tourist Zone
- Recreation (Special Purposes)
- Environmental Protection (Scenic Escarpment)
- Environmental Protection (Habitat)

The current zoning plan is shown in **FIGURE 3.** The Concept Plan proposes amendments to the current zoning of the site. These amendments fall into five categories as follows:

1. Amendments in accordance with Clause 52 of the Tweed LEP 2000;
2. Amendments to zonings contemplated by existing Development Consents;
3. Other proposed additions to the 2(c) Urban Expansion zone;
4. Proposed additions to the 7(l) Environmental Protection (Habitat) zone; and
5. Proposed additions to the 6(b) Recreation zone.

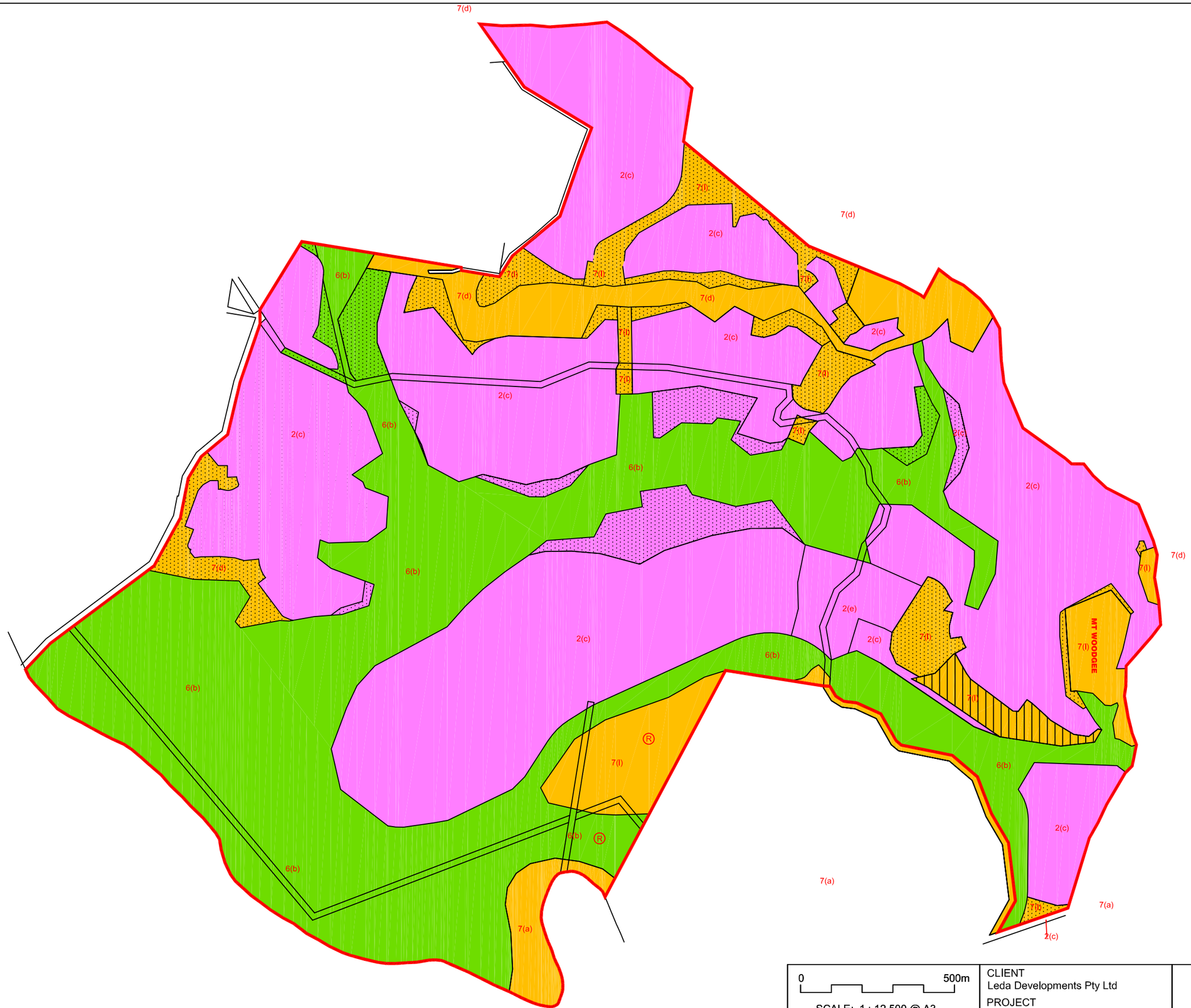
The proposed land use zones are shown in **FIGURE 4.** The entire area comprising Saltmarsh communities, with the exception of road reserves to Sandy Lane and Cobaki Parkway, including proposed Saltmarsh compensatory areas, is proposed to be zoned Environmental Protection (**FIGURE 4**).

1.2.4 Soils and Geology

The Subject site occupies the lower or eastern end of the Cobaki – Pigabeen Valley system**.** The site topography is considered as two (2) separate systems:

- The Sub-coastal foothills and outcrops of the eastern end of the McPherson Range, which comprises the western and northern part of the site and covers an area of approximately 280 hectares, or 42% of the site, and corresponding to a broad north/south line of hills. The terrain of these hills is rolling/hilly to hilly in a series of ridges and spurs with slopes of 10% to 25% and some 16% of the site having slopes in excess of 25%.
- The foothills enclose a coastal plain drainage basin comprising a composite of river/estuarine floodplain and sand-plain formed by sandbanks, beach or rolled and flattened dune systems.

The McPherson range foothills and elevated portions of the site derive from bedrock of deeply weathered argillites (greywackes, siltstones and shales) of the Neranleigh – Fernvale Group (metasediments) overlain in parts by basalt fragments of the tertiary



LEGEND

1. RURAL

1(a)	(a)	Rural
1(b1)	(b1)	Agricultural Protection
1(b2)	(b2)	Agricultural Protection
1(c)	(c)	Rural Living

2. RESIDENTIAL

2(a)	(a)	Low Density Residential
2(b)	(b)	Medium Density Residential
2(c)	(c)	Urban Expansion
2(d)	(d)	Village
2(e)	(e)	Residential Tourist
2(f)	(f)	Tourism

5. SPECIAL USES

5(a)	(a)	Special Uses

6. OPEN SPACE

6(a)	(a)	Open Space
6(b)	(b)	Recreation

7. ENVIRONMENTAL PROTECTION

7(a)	(a)	Environmental Protection (Wetlands & Littoral Rainforests)
7(d)	(d)	Environmental Protection (Scenic/Escarpment)
7(f)	(f)	Environmental Protection (Coastal Lands)
7(l)	(l)	Environmental Protection (Habitat)
S14		SEPP14 - Coastal Wetlands
		Clause 52 (Cobaki Lakes)
		Clause 52 (Cobaki Lakes)
R		Restriction On Use (DP1051024)
		Cobaki Lakes Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 6400-133A.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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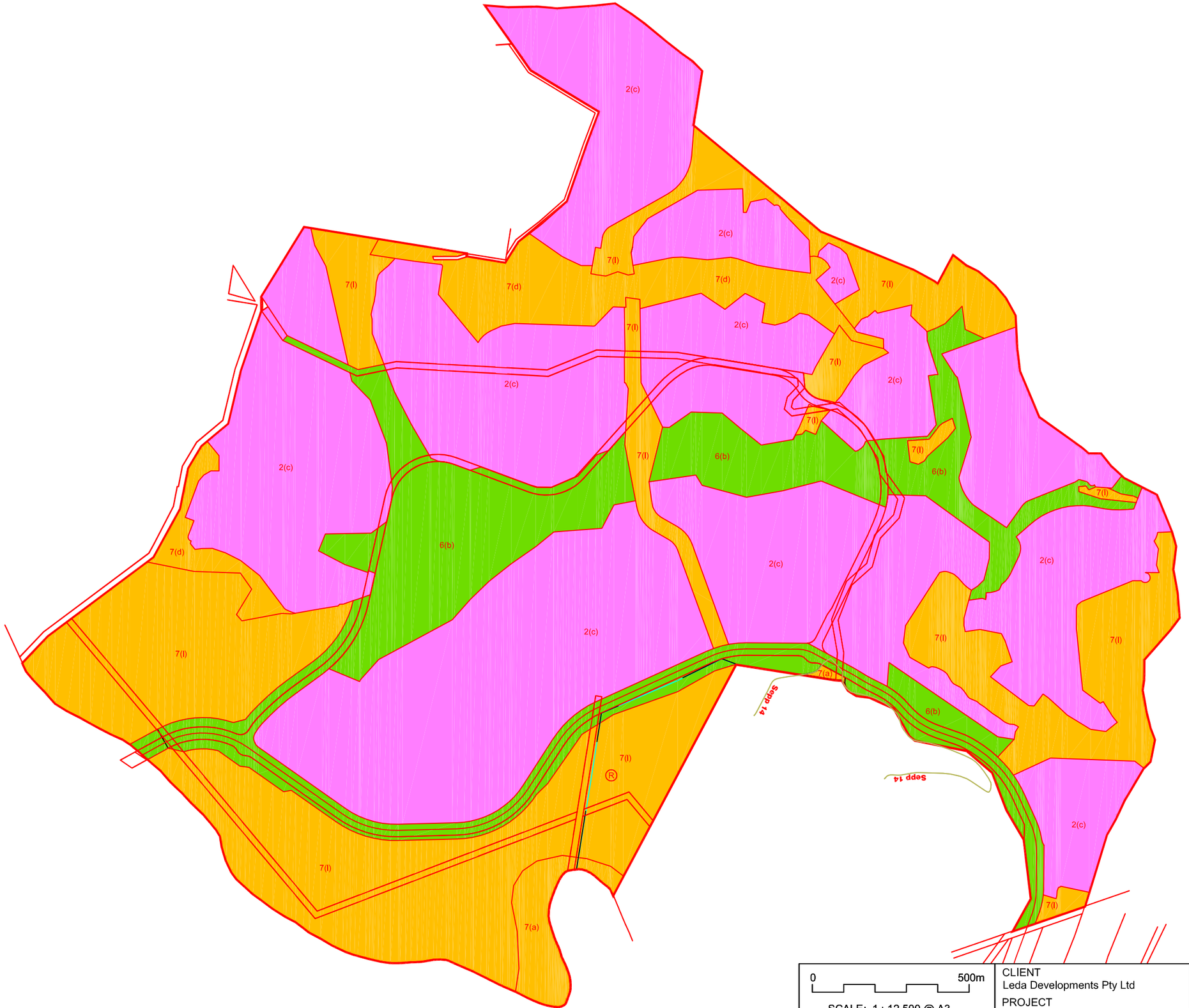
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 3

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_base.dwg

TITLE

ZONING PLAN



N

LEGEND

1. RURAL

- 1(a) (a) Rural
- 1(b1) (b1) Agricultural Protection
- 1(b2) (b2) Agricultural Protection
- 1(c) (c) Rural Living

2. RESIDENTIAL

- 2(a) (a) Low Density Residential
- 2(b) (b) Medium Density Residential
- 2(c) (c) Urban Expansion
- 2(d) (d) Village
- 2(e) (e) Residential Tourist
- 2(f) (f) Tourism

5. SPECIAL USES

- 5(a) (a) Special Uses

6. OPEN SPACE

- 6(a) (a) Open Space
- 6(b) (b) Recreation

7. ENVIRONMENTAL PROTECTION

- 7(a) (a) Environmental Protection (Wetlands & Littoral Rainforests)
- 7(d) (d) Environmental Protection (Scenic/Escarpment)
- 7(f) (f) Environmental Protection (Coastal Lands)
- 7(l) (l) Environmental Protection (Habitat)
- S14 SEPP14 - Coastal Wetlands
- Clause 52 (Cobaki Lakes)
- Clause 52 (Cobaki Lakes)
- R Restriction On Use (DP1051024)
- Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 6400-203F.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 4

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_base.dwg

TITLE

PROPOSED ZONING AMENDMENTS

volcanics. More recent alluvial and estuarine deposits comprise the coastal plains on the site (Woodward-Clyde 1997).

1.3 Proposed Development

The site is proposed to be developed into a master planned residential community. A concept plan for the development is shown as **FIGURE 5**. The proposed development will include the following:

- Development area (346.35 hectares) comprising:
  - Town centre/Neighbourhood centre,
  - Residential precincts, and
  - Community facilities/Education/Infrastructure;
- Public open space (58.20ha); and
- Environmental protection areas (199.86ha).

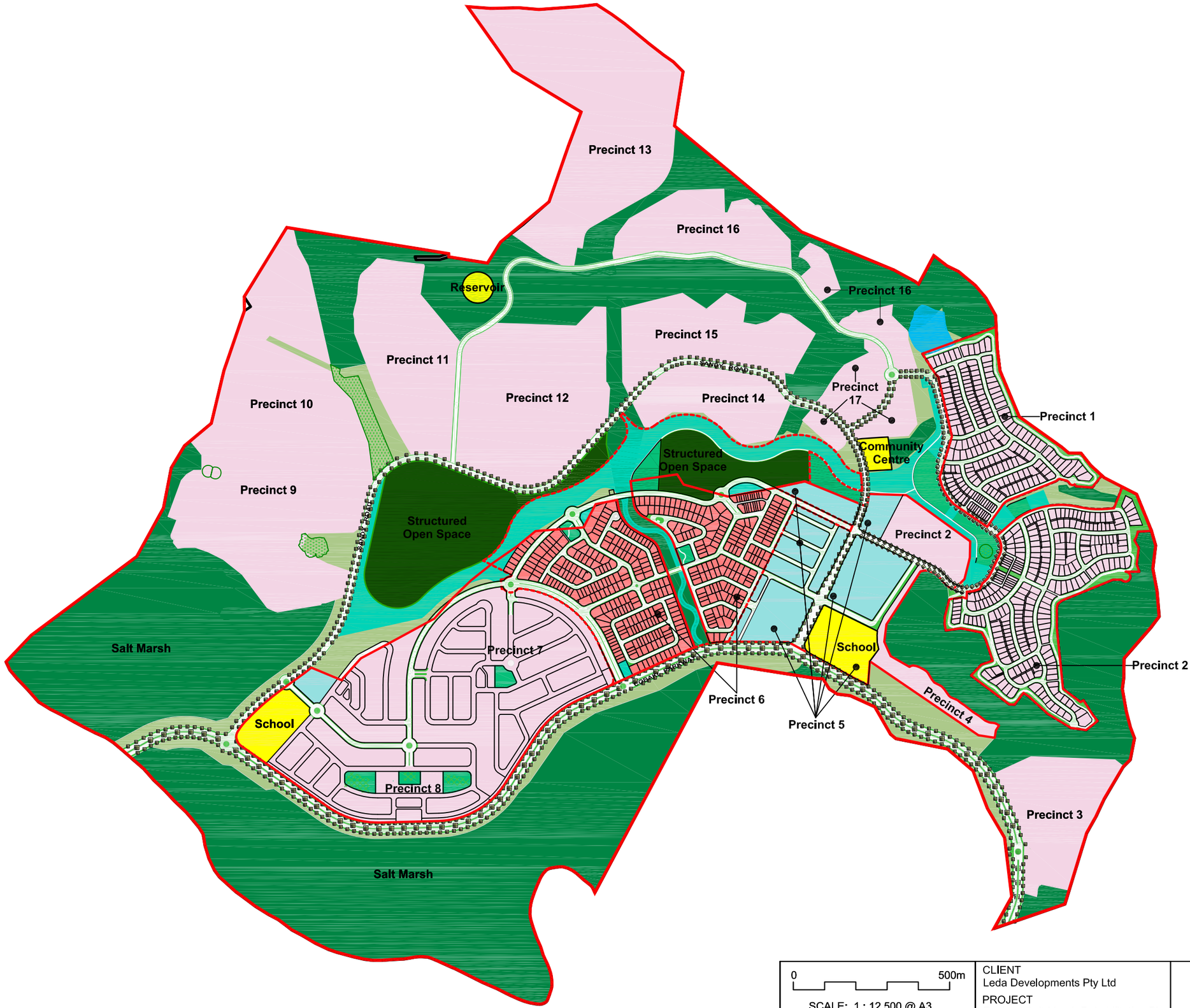
1.4 Scope of the Report

The Cobaki Lakes site covers an area of approximately 605 hectares and is proposed to be developed into a master planned residential community.

A large portion of the proposed open space area in the south-eastern portion of the Cobaki Lakes site is comprised of degraded Saltmarsh communities. The area of land which is subject to this plan occurs adjacent to Cobaki Creek in the south-eastern portions of the Cobaki Lakes development site. The Saltmarsh Rehabilitation Area (SRA) is to occur south of the proposed Sandy Lane and to the east of the proposed Cobaki Parkway and covers a total area of approximately 90.16ha. **FIGURE 6** shows the location and extent of the proposed Saltmarsh Rehabilitation Area (SRA).

Saltmarsh communities have ecological values, which have been recognised at a Commonwealth, State and Local government level. However, the Saltmarsh communities on the Subject site are currently degraded as a result of cattle grazing over a long period of time. Offsets for the removal of degraded Saltmarsh vegetation from the Subject site will include the following:

1. Large areas adjacent to the existing Saltmarsh communities are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh communities in accordance with this Plan.
2. Re-establishment of saltmarsh species will be completed on the batters along the eastern edge of the Cobaki Parkway after construction is complete.
3. This Plan also includes the provision of retreat areas for Saltmarsh communities in the event of sea-level rise.
4. Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.



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LEGEND

- Precinct 6 Proposed Residential Area (extent of application shown below)
- Precincts 1, 2, 4 and 6 to 8 Zone Boundary
- Extent of Precinct 6 Application
- Future Residential Development
- Future Retail / Commercial / Mixed Use
- Future Community Facilities / Education / Utilities Development
- Existing Water Body
- Stormwater Treatment and Delivery Areas
- Cultural Protected Area
- Covenant Protected Area
- Environmental Protection Area
- Open Space
- Casual Park
- Structured Open Space
- 2.5m Shared User Path/Maintenance Access
- Site Outline

SOURCE:
Layout - Design Forum Architects
(Ref: DA 01.01 E Master Plan.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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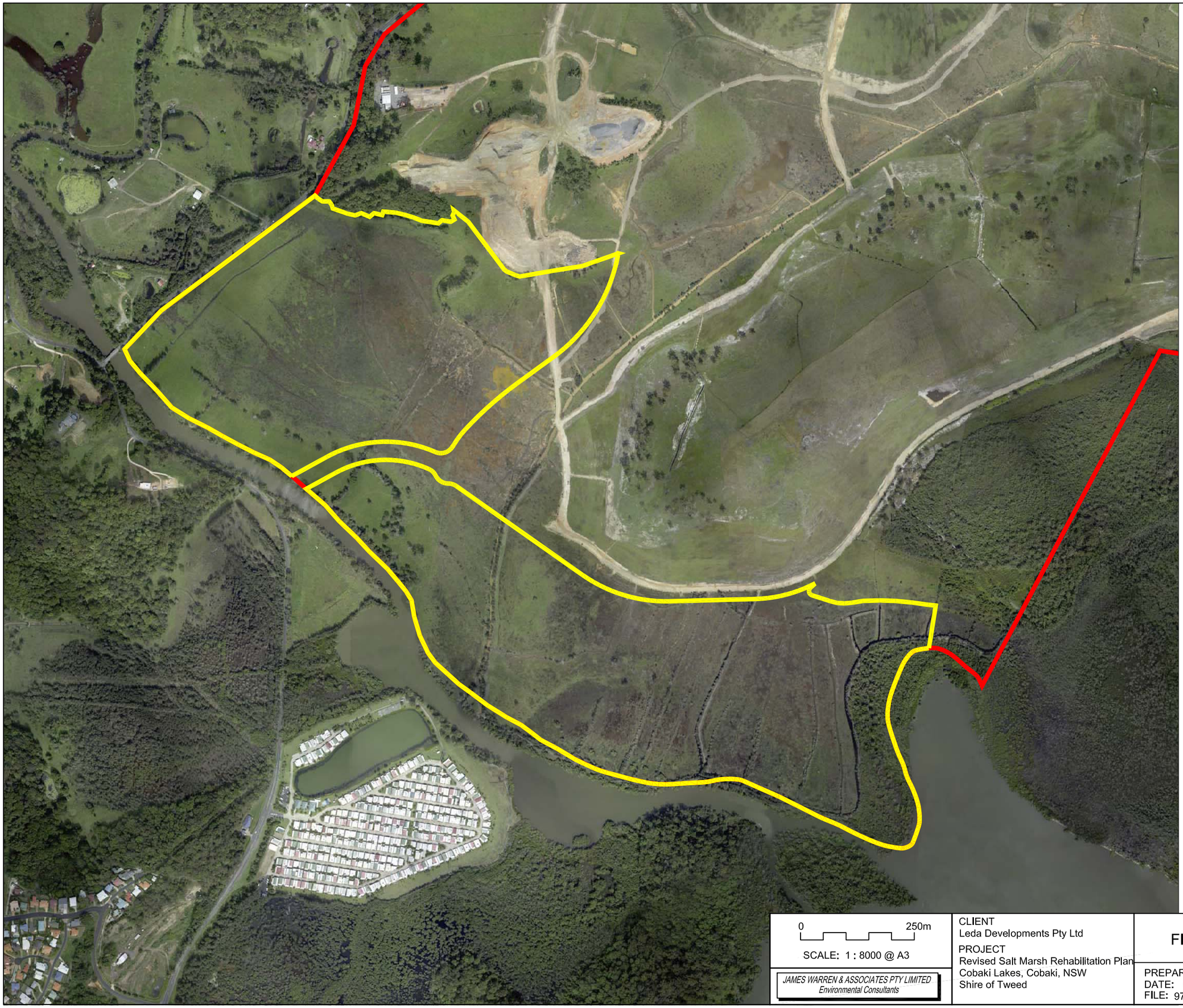
Revised Salt Marsh Rehabilitation Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 5

PREPARED: BW
DATE: 05 April 2013
FILE: 97038_SMRP_base.dwg

TITLE

PROPOSED CONCEPT PLAN



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LEGEND

- Salt Marsh Rehabilitation Area
- Cobaki Lakes Site Outline

SOURCE:
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 250m

SCALE: 1 : 8000 @ A3

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Revised Salt Marsh Rehabilitation Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 6

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_base.dwg

TITLE
SALT MARSH REHABILITATION AREA

5. The entire area of the existing Saltmarsh community which is to be retained (i.e. 54.63ha) will be rehabilitated in accordance with this Plan. This will essentially involve restoring a natural tidal regime to the area.
6. Promote tidal exchange within the rehabilitated Saltmarsh community through re-engineering existing levee and drainage systems and some regrading works.

2 REVIEW OF RELEVANT LITERATURE

2.1 Saltmarsh Ecosystems and the Predicted Effects of Sea Level Rise

Saltmarshes are a major, widely distributed, inter-tidal habitat. They are dynamic systems, responding to changing environmental conditions (Adam 2002). Saltmarshes have a high biodiversity and economic value, supporting threatened and migratory species and commercially important fish nurseries (Jaensch 2005). Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea, Juncus kraussii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis* and *Zoysia macrantha*. Occasionally mangroves are scattered through the Saltmarsh. Tall reeds may also occur, as well as salt pans.

Mangrove swamps and estuarine saltmarsh are generally considered to be highly productive of organic matter (Weslake, 1963; Odum and Heald, 1972; Whittaker, 1975; Turner, 1976). The major pathways for nutrient cycling appear to occur through their leaf and root matter. It is argued that this important source of organic material for detrital food chains infers that the mangroves and saltmarshes are the nurseries for young fish and crustaceans and are thus an integral part of wetland food webs (Odum and de la Cruz, 1967; Odum and Heald, 1972; Odum and Heald, 1975).

Saline wetland communities utilise imported inorganic matter and export matter in the form of plant and animal detritus which then serves as food for marine food webs. Lugo and Snedaker (1974) state that matter transport is driven by physical processes (daily tides, runoff and rainfall) as well as by biological processes (leaf fall, decomposition, mineral uptake rates and certain activities of the fauna).

Saltmarsh and other inter-tidal vegetation communities are of vital importance to the breeding cycle of several fish species. Saltmarshes play an important role as a juvenile habitat for species such as bream and mullet. Crabs are common in Saltmarsh communities, and are a significant food source for bream and other carnivorous species. Some species, such as Common galaxias (*Galaxias maculatus*) deposit their eggs in Saltmarsh vegetation (NSW Fisheries 2008).

Of critical importance to Saltmarsh ecosystems are changes in relative sea level and in tidal range. Relative sea level is affected by changes in absolute sea level, changes in land level and the capacity of Saltmarshes to accumulate and retain sediment. Many Saltmarshes are starved of sediment because of catchment modification and coastal engineering, or exposure to erosive forces, which may be of natural origin or reflect human interference. The geographical distribution of individual Saltmarsh species reflects climate, so that global climatic change will be reflected by changes in distribution and abundance of species, although the rate of change in communities dominated by perennial plants is difficult to predict.

Humans have the ability to create impacts on Saltmarshes at a range of scales from individual sites to globally. Pressures on the environment created by the continued increase in the human population, particularly in developing tropical countries, and the

likely consequences of the enhanced greenhouse effect on both temperature and sea level give rise to particular concerns.

Sea level rise is one of the projected outcomes of climate change documented in the three successive reports over the last decade by the Intergovernmental Panel on Climate Change (IPCC) The most recent IPCC projections (January, 2001) are for sea-level rise of between 9 and 88 cm between 1990 and 2100 and a global average surface temperature rise of between 1.4 and 5.8° C (CSIRO 2001).

By 2025, global sea level rise and warming will have impacts on Saltmarsh communities. However, the most extensive changes are likely to be the direct result of human actions at local or regional scales (Adam 2002).

Management Plans completed for inter-tidal communities need to address the potential for sea level rise and the subsequent retreat of these communities.

2.2 Cobaki Broadwater Management Plan

The Cobaki Lakes site is located immediately adjacent to the western boundary of the Cobaki Broadwater (intertidal) or wetland habitats associated with the Broadwater. There is a significant stormwater and ecological nexus between the Cobaki Lakes site and the Broadwater.

The following is a summary of the findings of the Cobaki Broadwater Management Plan (1998):

> *The Cobaki Broadwater Management Plan was produced in 1998 as a response to the Lower Tweed Estuary Management Plan, which earmarked Cobaki Broadwater as a management priority to conserve all the valuable habitats within the vicinity of the Broadwater.*
>
> *Cobaki Broadwater is an area of high scenic and ecological values. It is located in the lower reaches of the Tweed River Estuary and adjoins Coolangatta airport, west Tweed Heads and potential industrial and residential developments.*
>
> *In 2007 the Cobaki Broadwater Management Plan is under review and an updated version was to be available late 2007(not available in April 2008).*
>
> *The objectives for the Cobaki Broadwater Management Plan are:*
>
> - *To preserve and enhance valuable habitats within the Broadwater.*
> - *To encourage a low level of recreational activities and environmental education that is sensitive to the local environment and its requirements.*
> - *To conserve the valuable ecological assets of the Broadwater.*
>
> *Cobaki Broadwater and its surrounding area support a number of terrestrial and aquatic habitats. The habitats that are significant to Cobaki Broadwater are:*

- *Natural bushlands and wetlands that are present to the north west of the Broadwater. These areas are on crown land, and are in a reasonably pristine condition with the exception of an area of tree dieback that extends from the shoreline. The cause of this dieback is unknown.*
- *Rainforest communities and Aboriginal midden sites located on the north eastern shore of the Broadwater.*
- *Bushland and wetland that has been isolated by Coolangatta airport and surrounding developments to the east of the Broadwater. This area is a potential habitat for endangered plant communities.*
- *Wetland areas along the southern shores of the Broadwater adjacent to Cobaki Village development and along the western bank of Cobaki Creek.*
- *The Broadwater and the mangrove islands present within it.*

Water clarity in Cobaki Broadwater is acceptable, though the clarity of the water decreases due to re-suspension of fine sediments during periods of wind and wave action. The Broadwater is very shallow, generally less than one metre at mean low water, this also affects the turbidity. There is also limited tidal flushing of the Broadwater.

*Whilst the Cobaki Broadwater Management Plan seeks to obtain maximum ecological benefits, it is limited by, (*amongst others*):*

- *Low lying salt marsh/wetland areas to the east which may be impacted by the Cobaki Lakes development.*
- *Sediment and nutrient inputs from existing and proposed development within the catchment area which may affect water quality.*

Ecological opportunities that exist around the Cobaki Broadwater are:

- *Habitat replacement or enhancement. This could compensate for any development which may destroy or downgrade any wetland.*
- *Preserve a habitat reservation present on the north west shoreline of the Broadwater.*
- *Create fresh/salt water wetlands adjacent to the proposed Cobaki Lakes development. This would create a habitat for migratory birds, both those existing in the area and those that have been affected by airport extensions. Such a wetland would also act as a nutrient and sediment filter for runoff discharged from future residential development.*
- *A riparian corridor along the edge of developable lands will be encouraged. This would connect valuable wetland habitats located along the southern boundary of the Broadwater.*

The Revised Saltmarsh Rehabilitation Plan for the Cobaki Lakes site will seek to achieve all ecological opportunities described within the Cobaki Broadwater Management Plan.

3 STATUTORY CONTROLS

3.1 Introduction

The statutory controls which regulate and manage impacts on Saltmarsh communities are contained in Commonwealth, State and Local legislation.

3.2 Commonwealth legislation

3.2.1 Ramsar Convention on Wetlands of International Importance

The broad aims Ramsar Convention are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. Under the Ramsar Convention a wide variety of natural and human-made habitat types, ranging from rivers to coral reefs, can be classified as wetlands. Wetlands include swamps, marshes, billabongs, lakes, salt marshes, mudflats, mangroves, coral reefs, fens, peat bogs, or bodies of water - whether natural or artificial, permanent or temporary.

The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity. Once designated these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites.

Australia was one of the first countries to sign the Ramsar Convention, and Australia designated the world's first Wetland of International Importance. Australia currently has 65 Wetlands of International Importance listed under the Ramsar Convention covering approximately 7.5 million hectares (DEWHA 2008).

Currently there are no Wetlands of international significance (Ramsar wetlands) on the Cobaki Lakes site or within the locality.

3.2.2 Bilateral Migratory Bird Agreements

Migratory waterbirds include species such as plovers, sandpipers, stints, curlews and snipes. These incredible birds make round trip migrations of up to 26,000kms each year between their breeding grounds in the northern hemisphere and their non-breeding areas in the south. These trips are made in several weeks, with brief stops at staging sites along the way to rest and refuel for the next leg of their journey.

The Commonwealth is responsible for the conservation and implementation of several Migratory bird agreements including:

- Japan in 1974 (JAMBA)
- China in 1986 (CAMBA)
- Republic of Korea in July 2007 (ROKAMBA)

The JAMBA, CAMBA and ROKAMBA agreements list terrestrial, water and shorebird species which migrate between Australia and the respective countries. In both cases the majority of listed species are shorebirds. The agreements require the parties to protect migratory birds by:

- limiting the circumstances under which migratory birds are taken or traded;
- protecting and conserving important habitats;
- exchanging information; and
- building cooperative relationships.

All migratory bird species listed in the annexure to these bilateral agreements are protected in Australia as matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

3.3 State legislation

3.3.1 Endangered Ecological Communities (EEC's)

The NSW Department of Environment and Climate Change (DECC) administer the Threatened Species Conservation Act (TSC). This Act lists ecological communities which are endangered in NSW.

In June 2004 the NSW Scientific Committee gazetted Coastal saltmarsh as an Endangered Ecological Community. The Saltmarsh communities within the Cobaki Lakes site are considered to represent the EEC Coastal saltmarsh in the North Coast Bio-region (NPWS 2004). The Scientific listing of this EEC is Included as **ANNEXURE 1**.

EEC's are generally considered to be of a high conservation value. Small size, weed infestation, physical damage and non-natural genesis can lead to the allocation of a lower conservation status.

3.3.2 SEPP 14

The NSW Department of Planning administer State Environmental Planning Policy (SEPP) No. 14 (Wetlands). This SEPP controls proposed developments on or near the States coastal freshwater and saline wetlands. A large SEPP 14 area (Freshwater, Paperbark and Saline communities) occurs to the immediate north of the proposed Saltmarsh Restoration Area (SRA) (**FIGURE 7**). None of the Saltmarsh occurring within the south-eastern portion of the site is mapped as SEPP 14. This may have been because the site was cleared of Paperbark forest in or around 1980. The SEPP 14 Wetland Policy was gazetted in 1985, at which time there would have been no substantive development of Saltmarsh or re-development of Paperbark.

3.3.3 Fisheries

NSW Fisheries are responsible for managing fisheries and their habitat (including inter-tidal lands) along the coast of NSW. Any development of inter-tidal Saltmarsh areas (below HAT) invite comment by Fisheries. Fisheries have published a document dealing with Fisheries Habitat Management (DPI 2008). These guidelines allow for removal of habitat in some instances but require compensation at rates varying between 2 and 5 times the loss due to development.

LEGEND

Area subject to SEPP No. 14

Site Outline

SOURCE:
SEPP - Michel Group Services
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Environmental Consultants

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Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 7

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_base.dwg

TITLE

SEPP 14
COASTAL
WETLANDS

4 CURRENT CONSERVATION VALUES

4.1 Introduction

Several vegetation communities occur throughout the proposed Saltmarsh Rehabilitation Area (SRA), including large patches of Saltmarsh in the low-lying areas. This section discusses the distribution and conservation values of vegetation communities occurring within the SRA.

Scattered patches of the Freshwater wetland EEC also occur in the eastern portions of the site, which are generally dominated by Saltmarsh communities. It is likely that the freshwater communities in this portion of the site are occurring as a result of historical changes to the tidal inundation in this portion of the site. As it is proposed to restore the natural tidal regime in the eastern portion of the Subject site, with the intention of returning the entire area to its original Saltmarsh status, there will be some loss of the Freshwater wetland EEC. Offsets for the removal of Freshwater wetland EEC will be provided off-site. However, the location of this off-site offset is still being determined and will therefore be detailed in subsequent reports.

4.2 Vegetation within the Saltmarsh Rehabilitation Area

4.2.1 Introduction

This section describes the vegetation communities that occur within the SRA.

4.2.2 Methods

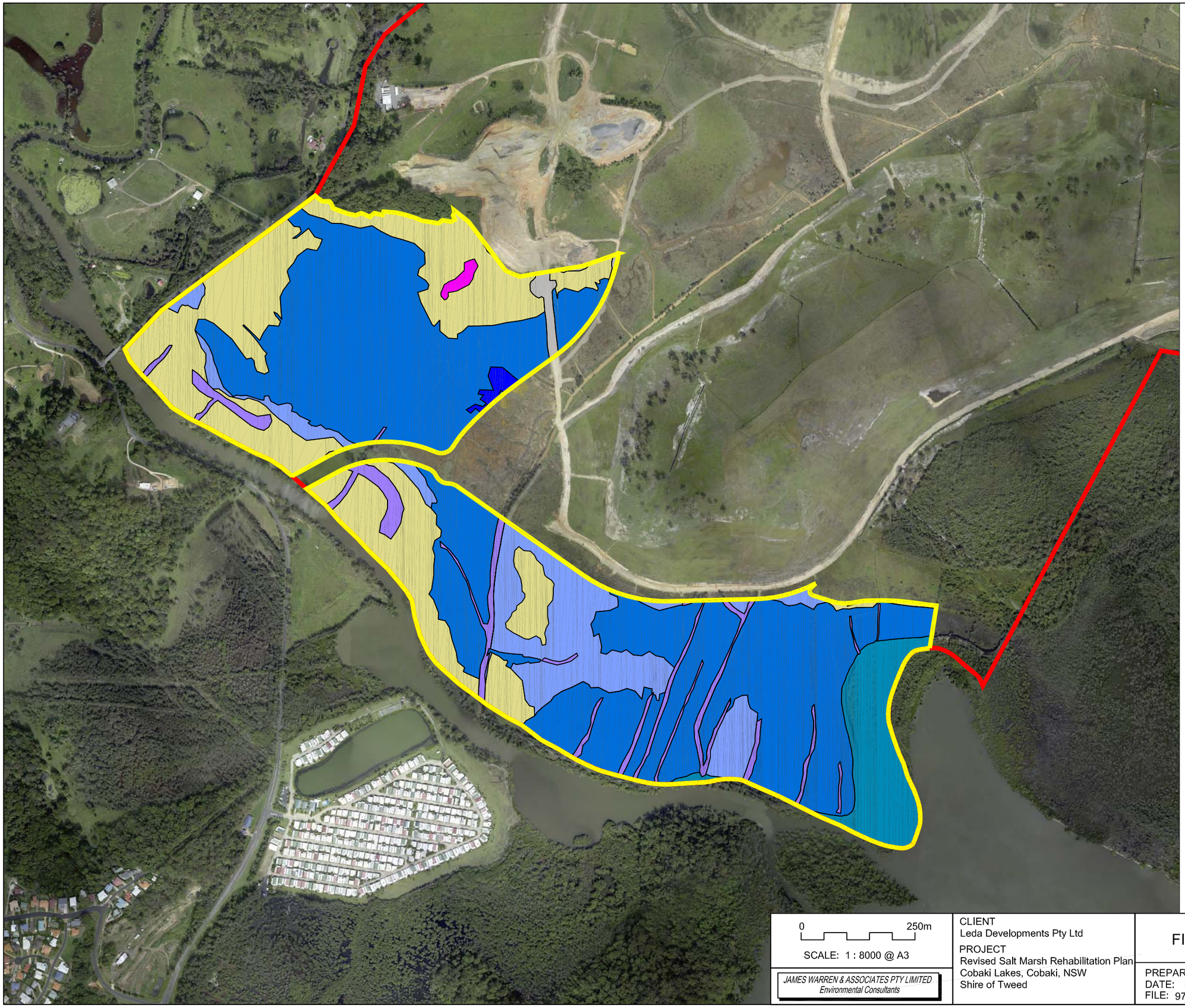
Detailed vegetation mapping for the Cobaki Lakes site was completed in February 2008. Twenty-two (22) vegetation communities were recorded on the site. All of the vegetation communities were mapped and described with reference to Walker and Hopkins (1996), The Regional Forestry Agreement (RFA) and the Tweed Vegetation Management Strategy (2004).

Only the vegetation occurring within the SRA will be described in this Rehabilitation Plan.

4.2.3 Community Descriptions

Seven (7) vegetation communities occur within the Saltmarsh Rehabilitation Area (**FIGURE 8**) including:

- Community 8 - Mid-high open woodland (*E. siderophloia*)
- Community 10 - Low closed grassland with scattered trees (Pastoral grasses +/- mixed species)
- Community 11 - Low closed grassland (*Sporobolus virginicus, Triglochin striata*, + /- *Casuarina glauca*)
- Community 12 - Rushland/sedgeland/grassland (Mixed aquatic species)
- Community 13 - Low to mid-high open mangrove forest (*Avicennia marina* var. *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)



N

LEGEND

- Community 8 - Mid-high open woodland (*E. siderophloia*)
- Community 10 - Low closed grassland with scattered trees (Pastoral grassess +/- Mixed species)
- Community 11 - Low closed grassland (*Sporobolus virginicus*, *Triglochin striata* +/- *Casuarina glauca*)
- Community 12 - Rushland/sedgeland/ grassland (Mixed aquatic species)
- Community 13 - Low to mid-high open mangrove forest (*Avicennia marina* var *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)
- Community 14 - Dams & drainage lines (Mixed aquatic species)
- Community 15 - Low open forest/woodland (*Casuarina glauca* +/- Mixed species)
- Unvegetated land
- Salt Marsh Rehabilitation Area Boundary
- Cobaki Lakes Site Outline

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 250m

SCALE: 1 : 8000 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd

PROJECT
Revised Salt Marsh Rehabilitation Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 8

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_base.dwg

TITLE
SALT MARSH REHABILITATION AREA VEGETATION COMMUNITIES

- Community 14 - Dams and drainage lines (Mixed aquatic species)
- Community 15 - Low open forest/woodland (*Casuarina glauca* +\- mixed species).

FIGURE 8 shows the locations of each of the vegetation communities within the SRA. A description of the composition and structure of each vegetation community is provided below.

Community 8 – Mid-high open woodland (*Eucalyptus siderophloia*)

Location and area
Community 8 occurs in the south-east of the Subject site and covers an area of 0.27 hectares within the SRA.

Description
The canopy of this community is very open and comprised entirely of Northern grey ironbark. The mid-storey is absent and the ground cover is comprised of pasture grass species and is regularly slashed.

Conservation status
The most appropriate analogue considered in the Regional Forestry Agreement (RFA) report is NFE 54: Grey Box - Red Gum - Grey Ironbark.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is best classified as open forests on bedrock – 202 Grey ironbark/ White mahogany/ Grey gum open forest complex. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 12,820 hectares (vegetated land), which is approximately 18.68 of the vegetated land in the Shire;
- This ecosystem is considered to be adequately conserved over a major part of its range.

Community 10 - Low closed grassland with scattered trees (Pastoral grasses +/- mixed species*)*

Location and area
Community 10 occurs throughout the majority the Cobaki lakes site, and covers an area of approximately 22.30 hectares within the SRA.

Description
The grassland is dominated by a mixture of species that vary with location. The foot slopes and grassy areas adjacent to the forests and woodlands are dominated by a mixture of native species including Kangaroo grass, Blady grass, Bracken fern, and introduced grasses including Broad leaved paspalum and Setaria.

The flat areas east of Sandy Lane have been historically slashed and grazed, and are comprised of introduced pasture species including Broad-leaved carpet grass, Paspalum, Rhodes grass and African lovegrass.

Several significant trees occur within this community, including a row of old growth Forest red gums at the Piggabeen Road entrance in the southern portion of the Cobaki

Lakes site. Several other species of trees occur within this community, including Northern grey ironbark, Scribbly gum, Figs, Camphor laurel, Blackwood wattle, Blackbutt, Tallowwood, Pink bloodwood, Grey gum, Hoop pine, Swamp mahogany and Swamp oak. The most common scattered tree species within the SRA include Forest red gum and Swamp oak.

Conservation status
This community is not considered to be analogous with any of the Forest Ecosystems identified within the Regional Forestry Agreement (RFA) report.

The conservation status of this community is considered to be low. Individual trees within this community may have a raised conservation status. The conservation status of the significant old growth Forest red gums (at the Piggabeen Road entrance in the southern portion of the Cobaki Lakes site) is considered to be moderate–high.

Community 11 - Low closed grassland (*Sporobolus virginicus*, *Triglochin striata* +/- *Casuarina glauca)*

Location and area
Community 11 occurs in the low-lying area in the south-east of the Cobaki Lakes site and covers a total area of approximately 46.93 hectares within the SRA.

Description
This community is dominated by a mixture of Saltmarsh species that vary with location. The most commonly occurring species include Saltwater couch, Streaked arrow-grass, Samphire and Fimbristylis.

Stands of regenerating Swamp oak approximately 3-4 metres in height flank drainage lines throughout this community.

Conservation status
This community is best described by Forest Ecosystem 125: Saltmarsh (CRA Unit 1999). The Regional Forestry Agreement document provides the following data on this ecosystem:

- The pre-1750 extent of this ecosystem type has been calculated at 17 hectares. Approximately 16 hectares remains.
- The ecosystem is considered **Rare**.
- The extent of this ecosystem type contained within the Comprehensive, Adequate & Representative (CAR) reserve system has been calculated, with 55.8% protected in dedicated reserves.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is classified as Estuarine complexes – 603 Saltmarsh. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 49 hectares (vegetated land), which is approximately 0.07% of the vegetated land in the Shire;
- This ecosystem is considered to be inadequately conserved over all its range.

This vegetation community is considered to represent the Endangered Ecological Community (EEC) 'Coastal Saltmarsh in the North Coast Bio-region' (NPWS 2004). This EEC is considered to be of high conservation value on the Subject site.

Community 12 – Rushland/ sedgeland/grassland (Mixed Aquatic species)

Location and area
Community 12 occurs in the central portion of the Cobaki Lakes site, covering a total area of approximately 10.09 hectares within the SRA.

Description
Community 12 is comprised of aquatic and semi-aquatic vegetation including Mangrove fern, *Cyperus* sp., Frogsmouth, Swamp water fern, Curly sedge, Bunchy flat sedge, Spike rush, Fringe rush, Tussock rush and Jointed twig rush.

Conservation status
The conservation status of Sedgeland/rushland/grassland communities has not been specifically discussed in the Regional Forestry Agreement document. The most appropriate analogue is NFE 141 Swamp. It is noted that Swamp ecosystems are Rare in the upper north-east section of the NSW North Coast Bioregion.

This community contains species which are indicative of the Endangered Ecological Community (EEC) 'Freshwater Wetlands on Coastal Floodplain'. The conservation value of this community is considered to have been significantly reduced however due a history of drainage construction and maintenance, grazing and slashing. The conservation status of this community on the Subject site is considered to be moderate.

Community 13 - Low to mid-high open mangrove forest (*Avicennia marina* var. *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)

Location and area
Community 13 occurs in the east of the Cobaki Lakes site, and covers a total area of approximately 5.66 hectares within the SRA.

Description
This community is dominated by Grey mangrove with River mangrove also occurring. Swamp she-oak, Black mangrove and Milky mangrove also occur sporadically.

Conservation Status
This community is analogous with the Mangrove non-forest ecosystem (Ecosystem 77) (NPWS 1999). The Regional Forestry Agreement document provides the following data for this ecosystem:

- The extent of this ecosystem pre-1750 has not been determined. Approximately 734 hectares remain in the upper north-east section of the NSW North Coast Bioregion. The ecosystem type is considered to be **Rare**.
- The extent of the ecosystem in the Comprehensive, Adequate and Representative (CAR) reserve system has not been determined.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is best classified as Estuarine complexes – 602 Mangrove low closed forest to woodland.

The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 474 hectares (vegetated land), which is approximately 0.69% of the vegetated land within the Shire and 0.36%;
- Inadequately conserved over all its range.

The conservation status of this community is considered to be high.

Community 14 - Dams & drainage lines (mixed aquatic species)

Location and area
Community 14 occurs sporadically throughout the majority of the Cobaki Lakes site as low lying drainage lines, and as a constructed dam in the north-west of the site. This community covers an area of approximately 0.41 hectares within the SRA.

Description
Community 14 is comprised of aquatic and semi-aquatic vegetation. The vegetation occurring in the constructed dam in the north-west of the site includes Water lilly (*Nymphaea caerulea*) and *Cyperus* sp. The edges of the dam have only recently been constructed and contain very little vegetation. Species present in low abundance include regenerating Paperbark, Prickly moses and Fireweed.

Several drainage lines occur across the SRA. Species which commonly occur within these drainage lines include Frogsmouth, Swamp water fern, Curly sedge, Bunchy flat sedge, Spike rush, Fringe rush, Tussock rush and Jointed twig rush.

Conservation status
The conservation status of dams and drainage lines has not been specifically discussed in the Regional Forestry Agreement document. The most appropriate analogue is NFE 141 Swamp. It is noted that Swamp ecosystems are Rare in the upper north-east section of the NSW North Coast Bioregion.
The conservation value of this community is considered to be low.

Community 15 - Low open forest/woodland (*Casuarina glauca* +/- mixed species)

Location and area
Community 15 occurs across the southern portions of the Cobaki Lakes site and is found most commonly along the low-lying drainage lines. This community covers an area of 3.87 hectares within the SRA.

Description
This community is dominated by Swamp oak and occurs in low lying swamp lands, with very few associated species, the exception being Grey mangrove, Tuckeroo, Umbrella Cheese Tree, Cottonwood and some exotic species in the understorey.

Conservation status
Swamp oak communities in the study area are analogous to forest ecosystem 143 (Swamp she-oak) (NPWS 1999). This ecosystem is considered to be Rare in the upper north-east section of the NSW North Coast Bioregion. The Regional Forestry Agreement document provides the following data on this ecosystem:

- Pre-1750 there was 11,165 hectares of this ecosystem type in the upper north-east section of the NSW North Coast Bioregion; 2,883 hectares (25.8 %) remains.
- The ecosystem is considered to be **Rare**.
- 8.3% of the ecosystem type is present within the Comprehensive, Adequate and Representative (CAR) reserve system, including 7.6% in dedicated reserves and 0.2% in informal reserves. A further 0.5% is protected by tabulated prescriptions.
- Swamp she-oak communities have been identified as a priority for conservation on private land.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is classified as Melaleuca and Swamp she-oak - 402 Broad-leaved paperbark/ Swamp she-oak closed forest to woodland. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 180ha (vegetated land), which is approximately 0.26% of the vegetated land within the shire;
- Inadequately conserved over a major part of its range.

The vegetation community is considered to represent the Endangered Ecological Community (EEC) Swamp oak floodplain forest of the NSW North Coast.

4.3 Conservation Assessment

A diversity of conservation assessment techniques have been developed for wetland plant communities in recent times (e.g. Winning 1990). Most of these schemes relate to an assessment of criteria such as size, shape, hydrological integrity and habitat value. To a certain extent, the inclusion of various wetland communities in either SEPP 14 or in an Endangered Ecological Community (EEC) category means that they have a high conservation value. It should be noted that a quite small and disturbed plant community can still be categorised as an EEC.

Each of the vegetation communities that are currently occurring within the SRA have been assessed with regard to:

- Size;
- Habitat value;
- Hydrological integrity; and
- The classification of the community as an Endangered Ecological Community (EEC's).

TABLE 1 describes the relative conservation values for each of the vegetation communities occurring within the SRA.

TABLE 1
CONSERVATION VALUES FOR EACH OF THE VEGETATION COMMUNITIES OCCURRING WITHIN THE SRA

Vegetation Communities	AREA	Habitat Value	Origin	Hydrological integrity	Current Impacts	EEC	Conservation Value
8. Mid–high open woodland (*E. siderophloia*)	0.27ha	Moderate	Naturally occurring	Receives freshwater run-off	Minor. Cattle grazing is reducing potential recruitment of seedlings.	No	Low - Moderate
10. Low closed grassland with scattered trees (pastoral grasses +/- mixed species)	22.30ha	Low	Introduced pastoral grasses have been sown for agricultural purposes after land clearing.	Limited to flooding	This community is dominated by exotic pastoral / agricultural grasses.	No	Low
11. Low Closed Grassland (*Sporobolus virginicus, Triglochin striata* + /- *Casuarina glauca)*	46.93ha	Moderate	This community has developed as a result of the clearing of the original Swamp forest, construction of drains and installation of tidal flaps.	Tidal flushing + fresh water runoff	Cattle gazing has reduced vegetation cover and continued trampling has caused large parts of this community to become degraded (i.e. patches of bare mud, hoof prints etc.).	Yes	High
12. Rushland/sedgeland/ grassland (mixed aquatic species)	10.09ha	Moderate	This community has developed as a result of the clearing of the original Swamp forest, construction of drains and installation of tidal flaps.	Fresh water runoff + Tidal flushing on spring tides	Cattle gazing has reduced cover in some areas. Tidal inundation is also a potential impact on this freshwater community type.	Yes	Moderate

Vegetation Communities	AREA	Habitat Value	Origin	Hydrological integrity	Current Impacts	EEC	Conservation Value
13. Low to mid-high open mangrove forest (*Avicennia marina var. australasica/ Aegiceras corniculatum* +/- *Casuarina glauca)*	5.66ha	High	Naturally occurring community.	Tidal flushing	Minor. Cattle are unable to access this community due to a permanent tidal drain.	No	High
14. Dams & drainage lines (mixed aquatic species)	0.41ha	Moderate	Aquatic species have colonised the man made drainage lines that have been constructed within the SRA.	Fresh water runoff + Tidal flushing	Cattle grazing. Growth of exotic weeds in drainage lines.	No	Low
15. Low open forest/woodland (*Casuarina glauca* +\- Mixed species)	3.87ha	Moderate	This community has colonised the edges of the constructed drainage lines within the SRA.	Tidal Flushing along the edges of drains.	Minor infestation of the exotic weed species Coastal morning glory (*Ipomoea cairica*).	Yes	Moderate

5 IMPACT & AMELIORATION ASSESSMENT

5.1 Current Management Issues in the SRA

5.1.1 Introduction

This section discusses the various management issues that are currently causing adverse impacts on the SRA.

5.1.2 Background

Portions of the low-lying land at Cobaki Lakes are subject to tidal inundation from the adjacent Cobaki Creek and Cobaki Broadwater. Freshwater Paperbark forest appears to have dominated the area prior to 1980 (C. Easton *pers. comm.* June 2007). Historical farming activities have led to the clearance of the Paperbark, the construction of one (1) major drain (Dunn's Drain) and a number of smaller drains, and the placement of a tidal flap at the mouth of Dunn's Drain. Vandalism of the tidal flap and other breaches of the berm to the Cobaki Broadwater have allowed tidal water onto the site for over twenty years. This has allowed Saltmarsh communities to develop over much of the area south and south-east of the constructed fill base for the Cobaki Parkway. A mixture of Saltmarsh, brackish and freshwater species occur north of the Parkway and on the western margins of Dunn's Drain. All of these communities have appeared as a result of farming activities on the Cobaki Lakes site.

5.1.3 Land use

Cattle grazing has occurred on the Cobaki Lakes site for many years. Grazing has continued alongside residential development activities (bulk earthworks) since 1994. Cattle currently have unfettered access to the SRA in accordance with existing use rights.

5.1.4 Stormwater

Significant land drainage works were completed on the Cobaki Lakes site many years ago. The main drain (Dunn's Drain) was constructed from the middle northern portions on the site to the southern boundary (2.5kms in length). A significant number of smaller drains were constructed particularly in the SRA.

5.1.5 Levee & Tidal flaps

The construction of one (1) major drain (Dunn's Drain) and a number of smaller drains, allowed for tidal water to enter the site. Tidal flaps installed at the mouth of Dunn's Drain to stop saltwater from intruding into the southern portions of the site (the SRA) are damaged. High tides also enter the site by overtopping the Creek levee between the Dunns Drain tidal flap and the Cobaki Broadwater. Tidal inundation has been a regular occurrence over the last twenty (20) years.

5.1.6 Mosquitoes

Within the SRA, the highly altered site conditions have created ideal breeding conditions for a variety of salt and freshwater mosquito species. These breeding

habitats on the site are adding to an already serious mosquito problem in the Cobaki Broadwater area. The prevalence of *A. vigilax* (breeds in saline to brackish intertidal pools) is of particular concern, as it is a known vector of Ross River Virus and Barmah Forest Virus.

Mosquitoes in well drained saline wetlands are principally found in the areas behind the mangrove communities, on what is called the 'high' marsh, where pools of water in mudflats or Saltmarsh vegetation are left by the highest tides (spring tides) of each month, or are filled by rainfall/runoff, and are not flushed by the daily tide movements during the weeks thereafter.

In wetlands that are not well drained, mosquitoes are also able to exploit impounded 'stagnant' pools retained within stands of mangroves, and other vegetation on the 'low' marsh, caused by siltation or other blockage of the normal tidal channels and thus not subject to the normal daily flushing.

The control of mosquito breeding on the Cobaki Lakes site is seen as a significant health imperative. The problem mosquito breeding areas occur within the low-lying saline and fresh-water ecosystems, which have been created by past farming practices.

5.2 Potential Development Impacts on Saltmarsh Communities

The proposed development will potentially have detrimental impacts on the Saltmarsh communities both during and after construction. The Cobaki Parkway will cause a minor fragmentation of the Saltmarsh communities. The location of the road reserve is fixed by Tweed Council planning as a future four lane arterial road funded by the Section 94 Development Contribution Scheme.

Other direct impacts on the SRA may potentially occur as a result of the following activities:

- The construction and re-orientation of Sandy Lane;
- Construction and operation of tidal culverts;
- Construction of the Education centre (the proposed school will occur in an area comprised of Saltmarsh which is currently zoned for Recreation). This proposed location of the school is allowable under the present LEP subject to consent in accordance with Clause 8.2;
- The provision of storm water infrastructure; and
- The provision of buffers.

The property has been grazed by cattle since the early 1900's. Existing use rights occur over the Subject site for routine agricultural activities including the construction and maintenance of drains, fencing and firebreaks as well as pasture improvement activities.

This rehabilitation plan will put into effect amelioration strategies and measures to reduce the following potential impacts, including:

- Road alignment and infilling for the road construction;
- Alteration of salinity and increased nutrient levels resulting from the discharge of stormwater;
- Pollution from road runoff;

- Damage from construction activities;
- Fire outbreak;
- Increased sedimentation;
- Inappropriate tidal regimes;
- Climate change (sea level rise);
- Degradation from trampling by cattle; and
- Elevated nutrient loads due to accumulation of cattle dung.

5.3 Proposed Amelioration Measures

5.3.1 Storm Water Management

A detailed Stormwater Management Plan for the proposed development has been prepared by Yeats Consulting Engineers. The Stormwater Management Plan (SMP) provides a conceptual model of the proposed Stormwater control methods.

Stormwater management will involve a series of stormwater control devices (treatment trains) that will allow for adequate treatment of the stormwater before it is released into the SRA for the final polishing before entering the adjacent Cobaki Creek and Cobaki Broadwater. Stormwater management within the proposed development will include treatments within the individual lots and broad-scale stormwater treatment devices such as constructed wetlands. The stormwater mitigation measures to be implemented in the development will include:

- Rainwater tanks;
- Infiltration systems;
- Porous paving;
- A series of constructed wetlands;
- Grassed filter strips;
- Vegetated swales;
- High-flow bypass; and
- Bio-retention trenches.

One of the main Stormwater control devices relative to the SRA will involve the construction of a tidal barrage toward the southern end of Sandy Lane. The barrage will allow treated stormwater to be released into the inter-tidal communities south of Sandy Lane. The treated low flows will drain towards the barrage and then flows will be directed along a swale/channel within the Sandy Lane and Cobaki Parkway road reserves. The low flows will then drain via the Cobaki Parkway bank of culverts through to Dunn's drain. Higher flows will overtop the swale/channel and disperse over the Saltmarsh community. The proposed Saltmarsh drainage plan is depicted in **FIGURE 9.**

5.3.2 Mosquito Management

A Biting Midge and Mosquito Control Plan for the Cobaki Lakes site has been prepared by Mosquito Consulting Services Pty Ltd (McGinn 2008). This plan has been developed in consultation with JWA and Gilbert & Sutherland. Furthermore, the Stormwater Management Plan provides for the diffuse discharge of treated stormwater through the construction of under-drained swales with level-spreader devices.

OPEN SPACE

OPEN CHANNEL

PRECINCT 8

SANDY ROAD

BANK OF CULVERTS UNDER SANDY LANE

MAJOR FLOW OVERTOPS LOW FLOW CHANNEL

ENVIRONMENTAL RESERVE

COBAKI PARKWAY

CREEK

DUNN'S DRAIN ACCESS TRACK PASSING BAYS AT 100m INTERVALS.

DUNN'S DRAIN ACCESS TRACK TURN AROUND AREA

DRAINAGE RESERVE

ROAD / DRAINAGE RESERVE

SANDY ROAD

ROAD / DRAINAGE RESERVE

PRECINCT 9

BANK OF CULVERTS UNDER COBAKI PARKWWAY

ENVIRONMENTAL RESERVE

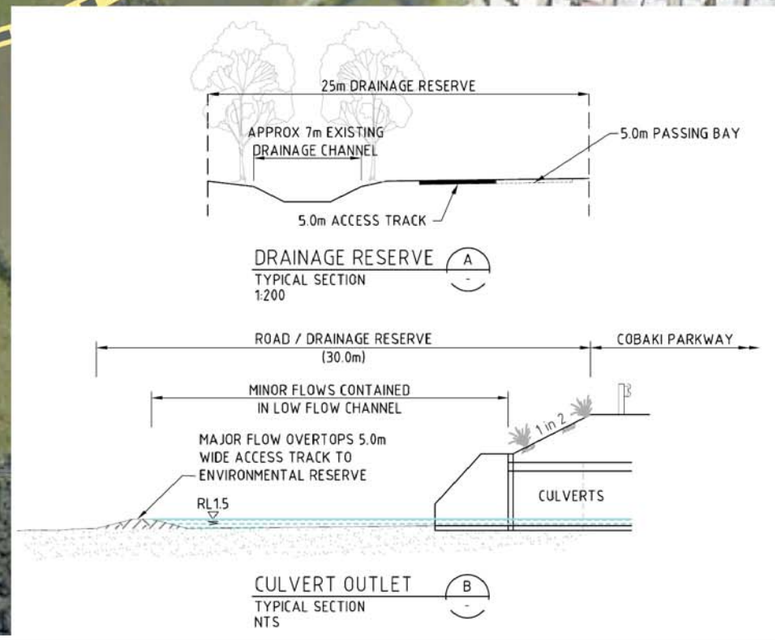
ROAD

COBAKI

PIGGABEEN ROAD

LEGEND

- ROAD / DRAINAGE RESERVE
- LOW FLOW DIRECTION
- MAJOR FLOW DIRECTION
- 5.0 PROPOSED SURFACE CONTOURS



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SOURCE: Yeats (Ref: YC0229-1P1-19_ DRAINAGE LAYOUT - COBAKI PARKWAY AND SANDY ROAD SOUTH -REV C-1.pdf)

SCALE: 1 : 1500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd

PROJECT
Salt Marsh Rehabilitation Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 9

PREPARED: BW
DATE: 06 October 2010
FILE: 97038_SMRP_Drainage.cdr

TITLE

DRAINAGE LAYOUT

The proposed Saltmarsh rehabilitation works include measures to promote tidal exchange through re-engineering existing levee and drainage systems and some regrading works. More details are provided in **SECTION 6.2.2.** By controlling, repairing and improving the surface water management within the rehabilitated areas, the mosquito and biting midge problem is controlled.

This Biting Midge and Mosquito Control Plan (McGinn 2008), in association with the Stormwater Management Plan, is considered to adequately address the potential issue of mosquito breeding within the SRA and has been prepared to address the requirements of Tweed Shire Council DCP 25. Furthermore, both plans have been prepared in consultation with JWA and take into consideration the long-term enhancement and protection of Saltmarsh communities on the Subject site.

5.3.3 Compensation & Rehabilitation

The development proposes to mitigate potential impacts and compensate for any loss of Saltmarsh communities through the provision of offsets. Offsets for the removal of degraded Saltmarsh vegetation from the Subject site will include the following:

1. Large areas adjacent to the existing Saltmarsh communities are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh communities in accordance with this Plan.
2. Re-establishment of saltmarsh species will be completed on the batters along the eastern edge of the Cobaki Parkway after construction is complete.
3. This Plan also includes the provision of retreat areas for Saltmarsh communities in the event of sea-level rise.
4. Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.
5. The entire area of the existing Saltmarsh, which is to be retained (i.e. 54.63ha), will be rehabilitated in accordance with this Plan. This will essentially involve restoring a natural tidal regime to the area.
6. Promote tidal exchange within the rehabilitated Saltmarsh community through re-engineering existing levee and drainage systems and some regrading works.

Rehabilitation of the Saltmarsh community will involve 64.28ha of natural regeneration and 25.88ha of revegetation (**FIGURES 10 & 11**). Coastal Saltmarsh revegetation will occur in combination with Swamp oak floodplain forest revegetation works. The exact location of the revegetation of these communities will be based on topography subsequent to the completion of bulk earthworks (i.e. Swamp oak floodplain forest in areas of higher elevation and Coastal saltmarsh in the lower lying portions of the revegetation area). Approximately 5.88ha of the proposed revegetation area will be utilised to offset the removal of approximately 0.73ha of Swamp oak floodplain forest resulting in a net gain of 5.15ha of this community on the Subject site. The remaining 20ha of the revegetation area will be utilised to offset the loss of 9.69ha of Coastal saltmarsh resulting in a net gain of 10.31ha of this community.