

*Protecting our  
Natural Environment*

**PUTTA BUCCA  
WETLANDS RESERVE**

**PLAN OF MANAGEMENT**

14 DECEMBER 2016

MID-WESTERN REGIONAL COUNCIL  
OPERATIONS

 TOWARDS 2030



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In reference to report by Geolyse – May 2016 – Former Mudgee Sewage Treatment Plant rehabilitation plan.

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## List of Abbreviations

COUNCIL	Mid-Western Regional Council
CMA	Catchment Management Authority
DA	Development Application
DOE	Commonwealth Department of The Environment
FOPBW	Friends of Putta Bucca Wetlands
KTP	Key Threatening Process
LLS	Local Land Services
MSDS	Material Safety Data Sheet
NSW	New South Wales
MSDS	Material Safety Data Sheet
OEH	NSW Office of Environment And Heritage
PBWR	Putta Bucca Wetlands Reserve
POM	Plan of Management
STP	Sewage Treatment Plant
WONS	Weeds of National Environmental Significance

# Executive Summary

The Putta Bucca Wetlands is a reserve located in Putta Bucca, Mudgee in the Mid-Western Regional Council Local Government Area, New South Wales. The reserve covers an area of just over 31 hectares. The total land parcel is comprised of two separate DPs (803206 and 1157592). Part of DP 1157592 is currently under lease by private enterprise with the remaining land managed by Mid-Western Regional Council. This area is zoned RU1 Primary Production.

Under section 36 of the *Local Government Act 1993* it states that public land in the care and control of Council classified as Community Land is subject to a management plan

The Putta Bucca Wetlands is a significant biodiversity area near the Mudgee Township that supports a high diversity of flora and fauna and preserves high quality habitat and vegetation communities.

To date seven threatened bird species listed under the *Threatened Species Act 1995* and migratory bird species listed under the *EPBC Act 1999* have been recorded within the Putta Bucca Wetlands.

The Putta Bucca Wetlands under this plan has been divided into 7 proposed zones based on physical and ecological characteristics. Each zone has its own management strategies except for zone 7 (the old STP which has its own rehabilitation and management plans).

Appendix A and B outline the proposed maintenance requirements (both current and future) and the proposed capital works plan over the next five years. These are proposed improvements and are dependent on funding becoming available through Council's Delivery Program and Operational Plan and/or external grant funding.

# 1. Plan Overview

## 1.1 Vision

Our vision is to conserve Putta Bucca Wetlands Reserve as a natural wetland and woodland habitat whilst still facilitating recreational, social and educational activities.

## 1.2 Purpose and Aim

The PBWR Plan of Management (PoM) is being implemented to provide the framework and guidelines for which PBWR will be managed. The purpose of this plan is to ensure that Putta Bucca Wetlands Reserve (PBWR) is managed consistently and effectively, taking into consideration the natural biodiversity, the recreational enjoyment of the community and vision of community groups such as The Friends of Putta Bucca Wetlands (FoPBW)

The aim of the plan is to ensure the ongoing management of the PBWR to enhance and conserve its significant ecological values, while allowing enjoyment by members of the public may they choose to visit or undertake recreational activities within the PBWR. The implementation of the plan aims to ensure that the ongoing management of the reserve will not only protect the existing biodiversity, including threatened fauna species, it will encourage biodiversity enhancement, community engagement and education by encouraging active habitat rehabilitation and restoration.

Appendix A and B outline the proposed maintenance requirements (both current and future) and the proposed capital works plan over the next five years. These are proposed improvements and are dependent on funding becoming available through Council's Delivery Program and Operational Plan and/or external grant funding.

## 1.3 Objectives

- To manage and protect the natural biodiversity, including both wetland and woodland habitats present within the land defined as the Putta Bucca Wetlands Reserve, and
- To encourage, promote and facilitate recreational, cultural, social and educational pastimes and activities
- To ensure all stake holders observe environmental protection principles
- To manage the land in a way that its natural environment is conserved and sustained
- To conserve the PBWR as habitat for wetland and woodland fauna
- To encourage reasonable public use and enjoyment of the PBWR in accordance to this PoM.
- To provide opportunities for learning and enjoyment of the landscape, fauna and flora
- To acknowledge and respect the cultural significance of the sites to the local indigenous peoples

The Core objectives for management of community land categorised as a wetland under the Local Government Act 1993 are;



- To protect the biodiversity and ecological values of wetlands, with particular reference to their hydrological environment (including water quality and water flow), and to the flora, fauna and habitat values of the wetlands, and
- To restore and regenerate degraded wetlands , and
- To facilitate community education in relation to wetlands, and the community use of wetlands, without compromising the ecological values of wetlands.

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## 2. Introduction

This PoM applies to the Putta Bucca Wetlands Reserve (PBWR), which comprises of all of the land outlined in red in Figure 1.



FIGURE 1: BOUNDARIES OF THE PBWR AND SURROUNDING LAND



## 2.1 Location and Details of Putta Bucca Wetlands Reserve (Status, Purpose and Zoning)

### 2.1.1 Location and status

Putta Bucca Wetlands Reserve is located on the north-western outskirts of Mudgee Township, in the suburb of Putta Bucca, NSW. The PBWR exists as an isolated council-owned reserve along the Cudgegong River. The Castlereagh Highway runs north-south just west of the privately managed landholdings which border the PBWR in the west. Putta Bucca Road borders the PBWR in the east and south. These two significant roads meet to the south of PBWR and a bridge over the Cudgegong River.

The PBWR site shares boundaries with the de-commissioned Mudgee Sewage Treatment Plant (STP), Boral Concrete / Putta Bucca Landscapes and landholdings that are privately managed for agricultural purposes (grazing and cropping). The land currently occupied by Boral Concrete/Putta Bucca Landscapes consists of DP 1157592 Lot 2.

The PBWR is located within Mid-Western Regional Local Government Area and subject to the provisions of the Mid-Western Regional Local Environmental Plan 2012 and is currently zoned 'RU1 - Primary Production'.

The PBWR itself consists of two adjoining land parcels. A satellite image and the corresponding lots that comprise the PBWR are delineated in Figure 1.

**TABLE 1: LAND STATUS AND DESCRIPTION OF LOTS CURRENTLY COMPRISING PBWR**

Tenure	Zoning	Lot	DP	Approximate Area (ha)
Mid-Western Regional Council	RU1 – Primary Production	2	803206	25.6
Mid-Western Regional Council	RU1 – Primary Production	1	1157592	7.3
			Total	32.9

**TABLE 2: LOCATION AND CONTEXT**

Locality:	Putta Bucca
Parish:	Avisford
County:	Wellington
Local Government Area:	Mid-Western Regional
Aboriginal Nation:	Wiradjuri
Local Land Service Area:	Central-western
Local Land Service Office:	Mudgee
Bushfire Management Area:	Region West – Cudgegong District
Topographic Map Sheet:	Mudgee 88324N 1:25000 Topographic Map
Geological Map Sheet (1:100 000):	Gulgong 1:100 000 Geological Sheet
Soils Map:	Soil Landscapes of the Dubbo 1:250,000 Sheet

## 2.2 Administrative Framework and Statutory Context

### 2.2.1 Land Management Principles

A broad range of legislation, environmental planning instruments, policies and strategies are relevant to the PBWR.

The administration, management and use of the PBWR should be carried out in accordance with:

- Environment Planning and Assessment Act 1979 (EP&A Act)
- Local Government Act 1993 (LG Act)
- Work Health & Safety Act 2011 (WHS Act)
- Water Management Act 2000 (WM Act)
- National Parks & Wildlife Act 1974 (NPW Act)
- Noxious Weeds Act 1993 (NW Act)
- Threatened Species Conservation Act 1995 (TSC Act)
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- Fisheries Management Act 1994 (FM Act)
- Native Vegetation Act 2003 (NV Act)
- Rural Lands Protection Act 1998 (RLP Act)
- Soil Conservation Act 1938;
- Protection of the Environment Operations Act 1997;
- Rural Fires Act 1997
- State Environmental Planning Policy (SEPP) (Infrastructure) 2007
- Mid-Western Regional Local Environmental Plan 2012 (LEP)
- Pesticide Notification Act
- Mid-Western Regional Council Towards 2030 Community Plan
- The Central West Councils Environment and Waterways Alliance five year plan
- The Central West Catchment Management Authority management plan

The following principles establish the direction Council and non-council advisory committee will follow in implementing specific strategies to achieve the vision:

- Enhance the understanding of the natural landscape and ecological values of the PBWR through community awareness and education;
- Protection of existing biotic and abiotic natural environmental values of the PBWR ;
- Promote and undertake restoration of the biotic and abiotic natural environmental values of the PBWR;
- Recognise, protect, appropriately interpret and promote the cultural heritage values relating to the PBWR and the local area, including Aboriginal and European heritage values;
- Encourage and promote public use by providing high quality, safe, accessible and enjoyable recreational and leisure facilities catering for the community of the Mudgee region and visitors;
- Encourage active participation of locals and visitors in the development and care of the Common under the guidance of Council

## 2.3 Mid-Western Regional Local Environmental Plan 2012

All of the PBWR land is currently zoned 'RU1 – Primary' pursuant to the LEP 2012. The objectives of RU1 zoning are as follows:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values.
- To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.

Council will seek subdivision of Lot 2 DP 803206 to exclude the old STP site from PBWR. By doing this Council can then rezone the reserve 'E3 –Environmental Management' and the STP and Boral site as 'IN1- General Industrial'.

### 2.3.1 Sewage Treatment Plant

The decommissioned Sewage Treatment Plant (STP) currently exists entirely within the land comprising the PBWR. This site is wholly owned by Council and no longer functions as a Treatment Plant. It shares boundaries with Putta Bucca Road, Boral Concrete/Putta Bucca Landscapes Supplies and the rest of the PBWR.

The STP portion of the PBWR consists of three rectangular treatment ponds (Ponds A, B, C) and associated infrastructure. Two large cylindrical treatment tanks and three smaller cuboid treatment tanks make up the treatment plant. The STP is fenced on all sides with chain wire.

Consultants Geolyse were engaged in 2016 to undertake a contamination assessment of the decommissioned STP and Landfill site (Appendix C) to determine appropriate land use and rehabilitation of the sites. Recommendations from this report as they relate to the old landfill site and Pond D have been included in this report, however recommendations regarding the STP itself are not included as this rehabilitation project will be undertaken by the Water & Waste section of Council which will require a separate rehabilitation and management plan. The proposal for this section of land is to become a stockpile site for Council once it has been adequately rehabilitated.



FIGURE 2: GEOLYSE CONTAMINATION ASSESSMENT AREA



## 3 Land Uses

### 3.1 Traditional Custodians

The land encompassing PBWR was first inhabited by the Mowgee people of the Wiradjuri Nation. It is likely that some of the mature Red Gums and Rough-barked Apple Trees that grow within the PBWR were present, if not used (e.g. for shade or bark fibre) by the traditional custodians of the land. The Cudgegong River was used by the local indigenous peoples as a foraging resource (e.g. for possums and fish). These resources would have been a major component of the diet of these peoples, and were likely used as trade resources. The name 'Putta Bucca' translates from the Wiradjuri language 'puttaba', the name of a hill near a creek, and 'bugga' which is thought to mean 'stinking fish'.

### 3.2 Early European

European Australians first discovered the land encompassing the PBWR in the early 1820's. In 1827, William Lawson took up 2428 ha on the Putta Bucca side of the Cudgegong River at Bombira Hill, where he built a historic homestead (Mudgee Historical Society 2010). While there have been some shifts in its usage, the Putta Bucca area has mostly supported grazing activity since its settlement.

### 3.3 Recent Historical Uses

- Grazing – much of the land along the floodplain of the Cudgegong River, including the area containing the PBWR was leased to local graziers who cleared most of the woodland vegetation, grew rich pastures and raised cattle and sheep.
- Cropping – some of the land along the floodplain of the Cudgegong River, including the area containing the PBWR has been ploughed and planted with pasture and fodder crops.
- Quarry – the site was quarried for sand and gravel aggregates that were used for road construction and building resources prior to being opened as a public reserve. Remnants of this process including disused borrow pits and abandoned machinery are still present.
- Rubbish dump – part of the quarry was used as a rubbish dump for building wastes. In 2013 this dump was capped by council using an impervious clay cap.
- Domestic animal pound - a small compound adjoining the sewage treatment works was used by council to keep lost or abandoned domestic animals.
- Sewage treatment - the most recent use of the wetlands was the last stage of the Mudgee Sewage Treatment Plant where treated sewage water was pumped into the settling ponds and then into the old quarry (quarry lake) before being allowed to flow into the river system.

### 3.4 Current Uses

In February 2014 a selection of members from the Cudgegong Field Naturalists and Watershed Landcare joined to form the "Friends of Putta Bucca Wetlands". The group is a registered sub-committee of Watershed Landcare. In July 2014 a group of Mudgee region volunteers known as "Dad's Army" elected to join the "Friends of Putta Bucca Wetlands". This volunteer group is the main resource for on-ground works and monitoring activities.

The PBWR is already being used for bushwalking, bicycle riding, on-leash dog walking, bird watching, fishing and picnicking. A small car park, a small gravel track network, some permanent outdoor chairs and picnic tables, bollards, safety signage, education signage, minor advertising and two bird hides have already been established.

An extension to the existing walking track network is proposed that will connect all of the tracks into a circuit system that incorporates the entire PBWR. This network of tracks is proposed to connect to the Glen Willow loop in the future.

The first stage of the PBWR project is complete. It has seen the construction of several walking trails, two bird hides, a car park, bench seats and picnic tables. There are additional works left to complete. These staged works will be completed in line with this PoM. Further PBWR management stages will see an extension of walking trails, installation of additional educational facilities and further rehabilitation of native vegetation.

### 3.5 Current Structural Features

**TABLE 3. ARTIFICIAL STRUCTURES WITHIN THE PBWR, THEIR CURRENT AND PROJECTED USES**

STRUCTURE	DESCRIPTION	PROJECTED USE
Access Road	The existing vehicle access road from Putta Bucca Road to the Internal car park.	Should be retained and maintained.
External car park	Located at the end of the main access road and spans between a pedestrian access of the PBWR and the entry to DP1157592 Lot 2.	Should be retained and maintained.
Internal car park	Located in the lower centre of the PBWR, south of the quarry lake and in line with the western fence of DP1157592 Lot 2. Consists of a cleared area with a gravel base. A landscaped garden area and wooden bollard delineates the car parking spaces.	Should be retained and maintained.
Lockable iron vehicle entry gate	A robust, steel gate painted green. Located at the main entry to the PBWR. Can be locked with a pad lock.	Should be retained and maintained.
Gravel walking track	A network of 1.96 km of gravel walking track currently meanders through the reserve. The track is up to 3 m wide in sections. It forms a circuit between the Cudgegong River and wooden bird hide. There are plans to extend this track network to form a circuit throughout the PBWR.	Should be retained and maintained. Extensions should be included to form a walking track circuit throughout the entire PBWR.
Birdwatching Hides	Two permanent hide structures. Hide 1: is constructed from wood and contains open window slots and a bench seat with sills beneath the open window slots. This hide is located on the west bank of the quarry lake; the window slots have an east-facing aspect. This hide will be allocated a name.	Should be retained and maintained for use by birdwatchers.

	Hide 2: is a modified shipping container and contains a bench seat. This hide is located on the north-eastern bank of the quarry lake and the western bank of a large artificial pond which previously formed as an overflow pond for the STP. This hide will be allocated a name.	
Chain wire fencing	Chain wire fencing surrounds both DP1157592 Lot 2 and the entire STP including the settling ponds.	Fencing to be upgraded.
Decommissioned STP	<ul style="list-style-type: none"> <li>• Two large cylindrical treatment tanks;</li> <li>• Three smaller cuboid treatment tanks;</li> <li>• Three rectangular treatment ponds (from south to north, Ponds A, B and C); and</li> <li>• One larger holding pond (Pond D).</li> </ul>	Rehabilitated – refer to Geolyse report recommendations
Quarry Lake	A large historical quarry which is now inundated with freshwater. Forms important wetland habitat for fauna and aquatic plants.	Must be retained and maintained as close to an ephemeral 'natural wetland' system as possible. No artificial in-flow required, as this water body is at equilibrium with the river.
Sand Pit	A small, disused sand pit quarry exists north of the car park and opposite the northern boundary of the Boral / Putta Bucca Landscapes. It is surrounded by wooden bollards.	Must be retained. This sand forms as important nesting habitat for Rainbow Bee-eater and native freshwater turtles.
Heritage Machinery	Abandoned machinery once used during quarry operations.	Retained as a memory of heritage of the site. This debris now forms as a tourist attraction and artificial habitat for fauna.
Picnic and rest facilities	A series of bench seats and picnic tables are present throughout the PBWR.	Existing tables and seats should be retained and maintained. More seating to be installed in future years.
Signage	A series of educational and safety signs.	Should be retained, maintained and enhanced.

## 4 Significance of the reserve

### 4.1 Refuge for Natural Biodiversity

Putta Bucca Wetlands Reserve is one of the last remaining, parcels of natural riparian woodland along the Cudgegong River, downstream of the Windamere Dam, that encompasses relatively undisturbed remnant floodplain, stream bank and in-stream vegetation components. The PBWR contains some of the oldest and largest remnant mature River Red Gum (*Eucalyptus camaldulensis*), River Oak (*Casuarina cunninghamii*), and Rough-barked Apple (*Angophora floribunda*) trees that still occur in a natural context (within an alluvial woodland) along this reach of the Cudgegong River. It is also the only location along the Cudgegong River, downstream of Windamere Dam, where a semi-permanent oxbow lake (billabong) ecosystem exists, albeit one that was established as a result of human activity (quarrying). The quarry lake itself is vegetated with River Red Gum and River Oak on its upper banks and islands, and native sedges (e.g. Giant Reed *Phragmites australis*, *Cumbungi Typha spp.*, *Persicaria spp.*, *Cyperus spp.*, and *Juncus spp.*) on its lower banks and mudflats.

The PBWR is home to over 140 species of native birds, seven species of native mammals, eight species of reptiles, five species of frogs and over 50 species of native terrestrial and aquatic plants. The PBWR contains one of the last known breeding populations of the TSC Act listed Vulnerable Brown Treecreeper (*Climacteris picumnus*) within 5 km of Mudgee Township, and is known to support seven other TSC Act listed Vulnerable birds, the Painted Honeyeater (*Grantiella picta*), Diamond Firetail (*Stagnopleura guttata*), Little Eagle (*Hireeatus morphnoides*), Flame Robin (*Petroica phoenica*), Magpie Goose (*Anseranas semipalmata*), Dusky Woodswallow (*Artamus cyanopterus*) and Freckled Duck (*Stictonetta naevosa*). The PBWR also contains known breeding habitat for one EPBC-listed migratory bird, the Rainbow Bee-eater (*Merops ornatus*) and foraging habitat for six additional EPBC-listed marine and migratory birds, the White-bellied Sea Eagle (*Haliaeetus leucogaster*), Cattle Egret (*Bubuculus ibis*), Latham's Snipe (*Gallinago lathamii*), Glossy Ibis (*Plegadis falcinellus*) and Sharp-tailed Sandpiper (*Calidris acuminata*). In 2014 an extremely rare EPBC-listed migratory bird species, the Citrine Wagtail (*Motacilla citreola*) inhabited the PBWR. This was the third record of a Citrine Wagtail ever in Australia and only one of two records in NSW. The presence of such a high diversity of threatened and migratory birds establishes the PBWR as one of the most significant sites for birdlife in regional NSW.

## 4.2 Valuable Resource for Mudgee and its Residents

The wetlands provide ecosystem services for local landholders, either indirectly such as through supporting natural agricultural pest control agents to the area, in the form of native birds such as ibis and raptors which prey on crop and pasture pests (e.g. locusts and mice); and directly through the natural filtration of high-nutrient, sediment-laden surface and storm water run-off by sedges and aquatic plants that abound within PBWR.

The wetlands provide a breeding ground for native fish species, which provide mosquito control as well as an important recreation pursuit for local and visiting fishermen.

PBWR provides an easily accessible and safe escape from town and urban life of Mudgee Township. Urban Mudgee residents do not have to travel far from their homes to appreciate the natural scenery and diverse and abundant wildlife present at PBWR.

In August and September 2014 the arrival of an extremely rare, vagrant bird to the PBWR, a Citrine Wagtail attracted approximately 200 bird watchers from all over Australia to the Mudgee region to come and see it. As most of these bird watchers remained in Mudgee for multiple days, this event was a valuable boost to Mudgee tourism and the local economy and is but one example of the intense value the PBWR has to Mudgee and the greater population.



**FIGURE 3. THE EXTREMELY RARE, VAGRANT CITRINE WAGTAIL (*MOTACILLA CITREOLA*) RECORDED WITHIN THE PBWR IN 2014 (PHOTO BY KAY PARKIN).**

## 5 Environment

### 5.1 Abiotic features

#### 5.1.1 Geology

The PBWR exists mostly within a low topographical landscape, as is usually associated with alluvial environments. The elevation of the PBWR spans between 440 m in the far west around the Cudgegong River to 461 m above sea level in the far north-east corner on the edge of Putta Bucca Road. This change in topography is reflective of a change in geology from Quaternary alluvial sediments associated with the Cudgegong River and its floodplain in the west of the PBWR, to Devonian-aged sedimentary bed rock in the east. Putta Bucca road runs along the ridgeline.

The PBWR is dominated by the 'Craigmore' soil landscape category. This soil type is defined by "Alluvial high terraces of the Cudgegong River and Eurundury and Wialdra Creeks. 20m above modern floodplain. Relief to 40m; slopes ,2%. Non-calcic brown soils and red earths on very old quaternary alluvium. Yellow podzolic-Solodic soils intergrades on lower lying areas. Moderate to high fertility; level land; weakly structured surface soils, moderate to high available water holding capacity, moderate to high erosion hazard under cultivation." (Murphy and Lawrie 1998).

The geology of the PBWR is dissected by two major geological strata. The western half of the reserve is dominated by Cainozoic sediments of alluvial origin. All of these sediments are Quaternary aged and are made up of silts, clays, sands, pebbles, cobbles and pebble and cobble conglomerates. The presence of the Cudgegong River is the cause of this alluvial sediment dominance. The eastern half is dominated by fine-grained Devonian sediments of the Sutchers Creek Formation which makes up part of the Queens Pinch Group consisting of lithic sandstone, pebbly mudstone and allodapic and allocthonous limestones.

#### 5.1.2 Water

The PBWR exists entirely within the catchment of the Cudgegong River according to the Mudgee Local Creeks Floodplain Risk Management Study and Plan (Lyal & Associates, 2008). All surface runoff eventually flows into the Cudgegong River. The decommissioned sewage ponds and the quarry lake also act as micro catchments for rain water.

The predominant hydrological feature of the PBWR is the Cudgegong River, a prescribed stream under the Water Management Act 2000. The Cudgegong River runs along the Western side of the reserve in a northerly direction toward Gulgong. The wetland component consists of the reach of the entire reach of the Cudgegong River within the boundary of the PBWR as well as the artificial wetlands consisting of the quarry lake and decommissioned sewage ponds. The majority of the reserve is in a floodplain area and is prone to flooding after heavy rainfall.

The quarry lake was created by quarrying aggregates from a naturally abandoned cut-off of the Cudgegong River. The quarry lake now acts as a deep, artificial billabong. It is fed by flow from the creek through pervious sediments, as well as through stream flow when the water level of the river is higher than the quarry. Prior to 2014 the sewage treatment works pumped treated and settled water into the quarry lake, which then flowed into the Cudgegong River via a small channel in the north-west of the quarry lake. When the STW was decommissioned, this flow stopped. The quarry lake was no longer continuously connected to the Cudgegong River. It is believed that surface water flow will only occur after periods of extended rain when the Cudgegong River is higher than the quarry lake.

The only other surface water input into the quarry lake is rainwater intercepted directly from the water bodies surface, and the surrounding edges of the quarry lake. Evaporation slowly dries out a portion of the water in the quarry lake; however, this is reflective of a natural ephemeral wetland

system and is therefore more beneficial to biodiversity. Historically the quarry lake would have received a major flood occasionally.

There is potential to engineer a trench drainage system that will transfer surface runoff from Putta Bucca Road, during heavy rainfall events into the upper sewage pond and then into the quarry lake. The concept of pumping water from the Cudgegong River into the quarry lake has also been discussed, but this is economically and ecologically unfeasible.

The sediment bed of the quarry pond is believed to be semi-permeable and as such, is joined to the river by the waters flowing through the pervious alluvial sands and gravels. It is believed that alluvial sands and gravels within the PBWR maintain an in-situ water level via an alluvial aquifer. This aquifer is believed to facilitate the continuous subterranean flow of fresh water between the Cudgegong River and the main quarry pond within the PBWR.

Historical water quality sampling has been undertaken by the CMA (now LLS) along with local schools. No historical dataset has been maintained. This is a priority for the PBWR. Regular water quality tests have also been conducted by the NSW Environmental Protection Authority (EPA) within the boundaries of the PBWR. This data is maintained in a database by the EPA.

## 5.2 Biotic Environment

This section presents a summary of information from the Flora and Fauna Assessment carried out on the PBWR (Lindsay et al. in litt).

### 5.2.1 Native Vegetation

The vegetation of the PBWR is dominated by riparian woodlands, derived native grasslands and derived wetlands. A total of seven vegetation communities have been identified to occur within the PBWR. These communities are arbitrary and based upon the dominant species present, as well as their landform. The finest scale official vegetation classification system that the vegetation of PBWR can be mapped to is the Biometric Vegetation Type classification system which groups vegetation based on characteristic species, landscape position and former CMA region. A list of four Biometric Vegetation Types have been identified at the PBWR.

<b>Vegetation Community</b>	<b>Corresponding Biometric Vegetation Type</b>
River Red Gum riparian woodland	CW184 - River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions
River Oak riparian woodland	CW180 - River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions
Rough-barked Apple riparian woodland	CW184 - River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions
Derived native grasslands on alluvium	CW184 - River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions
Derived native grasslands of Yellow Box grassy woodland on igneous rock	CW225 - Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion
Cumbungi/Giant Reed/Slender Knotweed freshwater wetlands	CW187 - Semi-permanent open freshwater wetlands of the inland slopes and plains
Mixed native plantings	NA

## 5.2.2 Fauna

A total of seven threatened birds, the Magpie Goose, Freckled Duck, Little Eagle, Painted Honeyeater, Diamond Firetail, Flame Robin and Brown Treecreeper have been recorded within the boundaries of the PBWR. These species are listed as 'Vulnerable' under the TSC Act. Each of these species has been declared threatened as a result of declines in their distributions and/or reporting rates (population) over time.

The PBWR also contains known breeding habitat for two EPBC-listed migratory birds Whistling Kite and Rainbow Bee-eater and foraging habitat for EPBC-listed migratory birds, the White-bellied Sea Eagle, Glossy Ibis, Cattle Egret, Latham's Snipe, Sharp-tailed Sandpiper which have all been observed within the PBWR.

It is also home to populations of two culturally significant Australian aquatic mammals which are uncommon in the mid-western region of NSW, the Platypus (*Ornithorhynchus anatinus*) and Rakali (Water Rat) (*Hydromys chrysogaster*) as well as two large native mammals, the Common Brush-tail Possum (*Trichosurus vulpecula*) and Swamp Wallaby (*Wallabia bicolor*).

The PBWR is likely to support or may have once supported the following threatened and declining woodland birds, threatened wetland birds, threatened forest birds and threatened marsupials and bats.

- Koala (*Phascolarctos cinereus*) – Vulnerable, TSC Act and EPBC Act
- Squirrel Glider (*Petaurus norfolcensis*) – Vulnerable, TSC Act
- Spotted-tailed Quoll (*Dasyurus maculata*) – Endangered TSC Act and EPBC Act
- Grey-headed Flying Fox (*Pteropus poliocephalus*) – Vulnerable, TSC Act and EPBC Act
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) - Vulnerable, TSC Act
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) - Vulnerable, TSC Act
- Little Pied Bat (*Chalinolobus picatus*) - Vulnerable, TSC Act
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) - Vulnerable, TSC Act and EPBC Act
- Large-footed Myotis (Fishing Bat) (*Myotis macropus*) - Vulnerable, TSC Act
- Bush Stone Curlew (*Burhinus grallarius*) – Vulnerable, TSC Act
- Turquoise Parrot (*Neophema pulchella*) - Vulnerable, TSC Act
- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*) – Endangered TSC Act and EPBC Act
- Grey-crowned Babbler (*Pomastomus temporalis temporalis*) - Vulnerable, TSC Act
- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered, TSC Act; Endangered,
- Black-chinned Honeyeater (*Melithreptus gularis gularis*) - Vulnerable, TSC Act
- Hooded Robin (*Melanodryas cucullata cucullata*) – Vulnerable, TSC Act
- Scarlet Robin (*Petrocia boodang*) - Vulnerable, TSC Act
- Red-capped Robin (*Petroica goodenovii*) – Declining (Reid 1999)
- Eastern Yellow Robin (*Eopsaltria australis*) – Declining (Reid 1999)
- Varied Sittella (*Daphoenositta chrysoptera*) - Vulnerable, TSC Act
- Speckled Warbler (*Chthonicola saggitata*) - Vulnerable, TSC Act
- Glossy Black Cockatoo (*Calyptorhynchus lathami*) - Vulnerable, TSC Act
- Masked Owl (*Tyto novaehollandiae*) – Vulnerable, TSC Act
- Barking Owl (*Ninox connivens*) – Vulnerable, TSC Act
- Square-tailed Kite – Vulnerable, TSC Act
- Spotted Harrier – Vulnerable, TSC Act
- Little Eagle – Vulnerable, TSC Act
- Australian Painted Snipe (*Rostratula australis*) - Endangered, TSC Act; Vulnerable and Migrator, EPBC Act
- Australasian Bittern (*Botaurus poiciloptilus*) – Endangered, TSC Act and EPBC Act
- Freckled Duck (*Stictonetta naevosa*) – Vulnerable, TSC Act
- Blue-billed Duck (*Oxyura australis*) – Vulnerable, TSC Act



- Magpie Goose (*Anseranas semiplamata*) – Vulnerable, TSC Act
- Murray-Darling Basin population of the Eel-tailed Catfish (*Tandanus tandanus*) – Endangered Population, FM Act.
- Macquarie Perch (*Macquaria australasica*) – Endangered EPBC Act
- Silver Perch (*Bidyanus bidyanus*) – Critically Endangered, EPBC Act

### 5.2.3 Fauna Habitat

PBWR is a uniquely valuable asset within the region because of the large quantity and variety of potential fauna habitat available, which includes:

- Standing and fallen dead timber / woody debris
- Tree hollows
- Nectar-bearing trees and Mistletoes
- Native grass and herbs
- Shrubs
- Reed lands and sedge lands
- Mudflats
- Open water
- Submerged and emergent snags
- Islands
- Artificial habitat features

### 5.2.4 Invasive Species

A large number of invasive plant species occur within the PBWR, this mostly consists of exotic plants but also contains some non-local invasive Australian plants. Some of the weed species that occur within PBWR are declared Noxious weed species in the Mid-western Regional Council Local Government Area. They include:

- African Boxthorn (*Lycium ferocissimum*)
- Bathurst Burr (*Xanthium spinosum*)
- Blackberry (*Rubus fruticosus* spp. aggregate)
- Blue Heliotrope (*Heliotropium amplexicaule*)
- Bridal Veil Creeper (*Asparagus asparagoides*)
- Willows (*Salix* spp.)
- St Johns Wort (*Hypericum perforatum*)

A list of thirteen exotic feral vertebrate fauna species have been observed within the PBWR, they are the:

- European Red Fox;
- Feral Cat;
- European Rabbit (*Oryctolagus cuniculus*);
- Black Rat (*Rattus rattus*);
- House Mouse (*Mus musculus*);
- Common Starling (*Sterna vulgaris*);
- European Blackbird (*Turdus merula*);
- House Sparrow (*Passer domesticus*);
- European Goldfinch (*Carduelis carduelis*);
- Mosquito Fish (*Gambusia holbrooki*);
- European Carp (*Cyprinus carpio*);
- Goldfish (*Carassius auratus*)
- Redfin Perch (*Perca fluviatilis*)

# 6 Management Approaches

PBWR will be managed in order to maximise its values for biodiversity, and in particular for threatened species, migratory species and threatened ecological communities.

## 6.1 Permitted Uses

### ■ Land Management and Conservation

- Land rehabilitation (including tree planting and riparian restoration)
- Nature conservation and environmental protection (including threatened species)
- Aboriginal and European heritage protection and conservation
- Bushfire control - undertaken in a way that benefits and does not compromise nature conservation
- Weed control –include spraying of weeds in alignment with the Noxious Weed Act and the Pesticide Notification Act
- Feral animal control
- Soil conservation
- Noise, water and air pollution control

### ■ Passive Recreation

- Birdwatching
- Photography
- Fishing (activities must comply with the FM Act and all of its amendments)
- Walking and jogging on designated paths
- Bicycle riding on designated paths
- On-lead dog walking
- Picnicking

### ■ Tourism, Film Making, Education, Community Purposes and Services

- Filming (within the meaning of the *Local Government Act 1993*)
- Emergency occupation
- Guided tours
- Outdoor class sessions for school groups
- Fishing competitions
- Environmental themed courses, classes and training days
- Commemorative events

### ■ Access and Infrastructure

- Public Area maintenance – include mowing, slashing, garden maintenance. This will be alignment with this PoM and consideration of the natural areas as well as recreational areas.
- Walking tracks
- Bollards to mark and guard environmentally sensitive heritage and environmental items/values
- Signage
- Board walks
- Bird Hide
- Car park
- Flood protection levees
- Drainage systems used for the purpose of preventing environmental impact events or enhancing biodiversity
- Pump stations, taps and irrigation for the sole purpose of watering native plants within the PBWR

- Additional *Land Uses/Activities*
  - Other activities or land uses approved by council, subject to their compatibility with this PoM.

## 6.2 Undesirable Uses

Due to PBWR being maintained for the purpose of environmental conservation and safe public enjoyment the following activities will not be permitted:

- Cattle and sheep grazing
- Motorcycle and quad bike riding
- Unauthorised vehicle driving off designated tracks
- Illegal fishing activities (netting, 'opera house' traps, set-lines, undersized fish keeping and illegal bag limits)
- Hunting for consumption or recreational purposes using any form of hunting method.
- Lighting of fires – Illegal fires have been identified throughout the PBWR
- Harvesting of firewood
- Destruction of fauna habitat without appropriate impact mitigation measures
- Introducing exotic pest plants or animals of any kind
- Unauthorised herbicide usage – Any spraying works require prior permission from Council and be undertaken by qualified person(s). Work need to be undertaken in conjunction with Councils Pesticide Notification Act and environmental legislation. Qualifications, spray records and any relevant paperwork can be requested by Council at any time.
- Further quarrying or mining
- Cropping
- Exotic plantations or gardens
- Unauthorised functions, events or parties
- Unauthorised pumping of water in or out of the ponds, old quarry or river

All works undertaken on Council owned / managed property requires prior approval from Council. Only suitably qualified staff, volunteers and contractors will be granted this approval.

# 7 Site Specific management issues and actions

The PBWR has been divided into seven management zones in line with the LG Act. A map displaying all zones is presented in Figure 4. All plans and/or programs of proposed works have to be submitted to Council for approval before commencement. A list of proposed works is outlined in Appendix A.



Map Scale: 1:5,139


<p><b>Disclaimer</b> This map has been created for the purpose of showing basic locality information over Mid-Western Regional Council. Property boundary line network data is supplied by Department of Lands. This map is a representation of the information currently held by Mid-Western Regional Council. While every effort has been made to ensure the accuracy of the product, Council accepts no responsibility for any errors or omissions.</p>	<p><b>PBW Management Zones Legend</b></p> <ul style="list-style-type: none"> <li><span style="border: 1px solid yellow; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 1 - DECOMMISSION TIP</li> <li><span style="border: 1px solid green; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 2 - BUSHLAND (BOX-GUM GRASSY WOODLAND REHAB)</li> <li><span style="border: 1px solid pink; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 3 - WETLAND (HORSESHOE POND)</li> <li><span style="border: 1px solid blue; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 4 - WETLANDS (MAIN POND)</li> </ul>	<ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 5 - BUSHLAND (ALLUVIAL WOODLAND REMNANT)</li> <li><span style="border: 1px solid lightblue; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 6 - PARKLANDS</li> <li><span style="border: 1px dashed red; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> ZONE 7 DECOMMISSIONED STP</li> <li><span style="background-color: yellow; display: inline-block; width: 20px; height: 10px; margin-right: 5px;"></span> PRIVATE LEASEHOLD - PUTTA BUCCA LANDSCAPES / BORAL</li> </ul>	 <p>Printed on Friday, 10 July 2015</p>
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FIGURE 4 MANAGEMENT ZONES OF THE PBWR

The following are overarching management strategies / rules applicable in all zones-

- Visitors must keep to designated tracks
- If any livestock is observed to be present within the PBWR illegally, the owner will be reported to council and police. Livestock may be impounded and the owner may be prosecuted.
- Dogs are to be on leads at all times with any excrement removed and taken away by the owner
- Fire wood or timber collection is not permitted in the PBWR
- Any removal or damage to a native trees in the PBWR by a member of the public is forbidden.
- Private water collection is not permitted from the Cudgegong River or any water body within the boundaries of the PBWR
- No unauthorised vehicles or motorbikes are permitted
- All usage shall fall within the guidelines of the PoM
- The lighting of fires for any reason other than a prescribed ecological burn or RFS approved Hazard Reduction Burn is forbidden at any time.

## 7.1 Zone 1: Decommissioned Tip

**Area:** 7.5 ha



**FIGURE 5. ZONE 1 - DECOMMISSIONED TIP SITE**

Zone 1 is the decommissioned tip site which received municipal waste from the Mudgee Township for the approximate period from the 1960s to the 1980s. Historic landfill operations progressed from south to north and waste was capped. Following closure, additional earthen material of unknown origin has been brought to the site and placed on top of the existing capping material. Levelling of this material occurred after 2013, and spread across the entire landfill area.

Geolyse rehabilitation plan recommends to facilitate establishment of native vegetation, in particular the deep-rooted tree species (i.e. *Eucalyptus* sp.), the capping layer should, in general, possess the optimal characteristics of a landfill phytocap, as described in the draft 'Environmental Guidelines Solid Waste Landfills' (NSW EPA, 2015 – 2nd Edition), including:

*Soil(s) should:*

- be well structured and typically loamy in texture;
- support plant growth;
- have good water-holding capacity;
- have low salinity;
- have moderate to high organic content;
- have a low to moderate hydraulic conductivity that will facilitate rainwater infiltration but not permit drainage through the cap (Note: soils at the base of the cap may have a low hydraulic conductivity, similar to that of a barrier cap, to limit drainage to the waste).
- The depth of the cap will typically need to be at least 1.5 m thick to provide sufficient soil water storage to limit percolation.
- The soil density should not affect the water storage capacity or impede root establishment and penetration.

In the event of the landfill capping layer not complying with these optimal specifications, planting of deep-rooted species should be limited to areas outside the known extent of historic filling activities.

Australian Laboratory Services (ALS) were commissioned to conduct a series of soil, water and sediment investigations at the site to establish the potential for contamination impacts.

Constituents of particular concern are identified in Geolyse rehabilitation plan and need to be taken into consideration. Geolyse has included this zone in their rehabilitation recommendations (Appendix C)

### ***Weed management***

- Targeted mowing/slashing to control weed infestations or prepare sites for tree planting should be carried out
- Regular weed control and weed inspections to be undertaken by Council weeds department.

### ***Native plant management***

- Slash or use a whipper-snipper to slash grass and pasture weeds in proposed planting areas
- Salvage tree guards and stakes from unsuccessful plants and reuse for new plantings or new-found seedlings
- Water plantings using river water where possible. Utilise council water truck or a trailer-mounted water tank which can be refilled by pumping from the Cudgegong River
- Deep rip soil and prep with fertiliser (if necessary) and undertake weed management prior to planting
- Tree planting methods must be appropriate for time of year they are being carried-out
- Only plant trees that are known to occur locally to the box-gum woodlands of the floodplains of the Cudgegong River within 10 km of the PBWR. This assemblage is mostly restricted to Yellow Box, Rough-barked Apple, Blakely's Red Gum (upper slopes), River Red Gum (lower floodplain and drainage), River Oak (lower floodplain and drainage), Kurrajong (*Brachychiton populneus*) and Hickory Wattle (*Acacia implexa*). On the less fertile soils and slopes closer to the road, White Cypress (*Callitris glaucophylla*) and Black Cypress (*Callitris endlicheri*) can be planted
- Only plant shrubs that are known to occur locally to the box-gum woodlands of the floodplains of the Cudgegong River within 10 km of the PBWR. This species assemblage is largely restricted to Western Silver Wattle (*Acacia decora*), Mudgee Golden Wattle (*Acacia spectabilis*), Ausfeld's Whipstick Wattle (*Acacia ausfeldii*), Blackthorn (*Bursaria spinosa*), Sifton Bush (*Cassinia arcuata*), *Dianella revoluta*, *Gahnia aspera* and *Hardenbergia violacea*.
- Clumps of *Allocasuarina diminuta*, *A. gymnanthera* may have once occurred on the less fertile slopes and drier areas in the PBWR. Planting these trees is recommended wherever suitable
- Direct seeding with a mixture of native grass and herb species may eventually be required. Seed mixes should contain locally sourced grass and herb species that will supplement or boost the existing assemblage of native grasses and herbs. Native grass and herb species already identified in this zone to date include *Chloris truncata*, *Austrodanthonia* spp., *Austrostipa* spp., *Digitaria* spp., *Enneapogon* spp., *Bothriochloa macra*, and *Whalenbergia* spp.

### ***Retain and enhance fauna habitat***

- Coarse woody debris (logs and other fallen wood) was absent from this zone at the time of preparation of this PoM. Effort must be taken to emplace woody debris throughout this zone prior or during tree planting. Hollow logs and stags are the most beneficial woody debris for fauna habitat, but younger logs, branches and bark are all highly valuable as fauna habitat and microhabitat for successful seedling establishment.
- A log or other woody debris should replace the removal of any sheet metal or other metal debris.

***Maintenance and construction of amenities and man-made structures***

- The walking path will be extended from its current course up the northern boundary fence line to Putta Bucca Road. No other paths should be constructed within this zone.
- The proposed walking path should be pegged-out in advance of construction, so as to not affect any deep ripping for tree planting, or disturbance to native grasses.
- Paths should be maintained by mowing a maximum of 3m either side of a path.
- Fencing along Putta Bucca Road should be upgraded to provide more security for the PBWR, with existing gates along Putta Bucca road locked for sole use by council.
- A maximum of 2 additional bench seats can be installed only along the proposed pathway
- No picnic tables or other infrastructure is permitted in this zone



## 7.2 Zone 2: Bushland (box gum grassy woodland rehab)

**Area:** 3.45 ha



**FIGURE 6. ZONE 2 - BUSHLAND AREA NORTHERN BOUNDARY LOOKING WEST.**

This is the area of the reserve between the decommissioned landfill site and the horseshoe pond and also runs along the northern boundary.

### ***Weed management***

- Targeted mowing/slashing to control weed infestations or prepare sites for tree planting should be carried out
- Regular weed control and weed inspections to be undertaken by Council weeds department.
- Weed management as per the Noxious Weeds Act 1993 and in alignment with Council Pesticide Notification Act. Effort should be made to remove any willow or elm trees that are encroaching on the mudflats. Regular weed control events should take place to prevent re-infestation. All spraying will be undertaken by suitably qualified staff and / or contractors.

### ***Native plant management***

- Slash or use a whipper-snipper to slash grass and pasture weeds in proposed planting areas
- Salvage tree guards and stakes from unsuccessful plants and reuse for new plantings or new-found seedlings
- Water plantings using river water where possible. Utilise council water truck or a trailer-mounted water tank which can be refilled by pumping from the Cudgegong River
- Deep rip soil and prep with fertiliser (if necessary) and undertake intensive weed management prior to planting.
- Tree planting methods must be appropriate for time of year they are being carried-out.
- Only plant trees that are known to occur locally to the box-gum woodlands of the floodplains of the Cudgegong River within 10 km of the PBWR. This assemblage is mostly restricted to Yellow Box, Rough-barked Apple, Blakely's Red Gum (upper slopes), River Red Gum (lower floodplain and drainage), River Oak (lower floodplain and drainage), Kurrajong (*Brachychiton populneus*) and Hickory Wattle (*Acacia implexa*). On the less

fertile soils and slopes closer to the road, White Cypress (*Callitris glaucophylla*) and Black Cypress (*Callitris endlicheri*) can be planted

- Only plant shrubs that are known to occur locally to the box-gum woodlands of the floodplains of the Cudgegong River within 10 km of the PBWR. This species assemblage is largely restricted to Western Silver Wattle (*Acacia decora*), Mudgee Golden Wattle (*Acacia spectabilis*), Ausfeld's Whipstick Wattle (*Acacia ausfeldii*), Blackthorn (*Bursaria spinosa*), Sifton Bush (*Cassinia arcuata*), *Dianella revoluta*, *Gahnia aspera* and *Hardenbergia violacea*.
- Clumps of *Allocasuarina diminuta*, *A. gymnanthera* may have once occurred on the less fertile slopes and drier areas in the PBWR. Planting these trees is recommended wherever suitable.
- Direct seeding with a mixture of native grass and herb species may eventually be required. Seed mixes should contain locally sourced grass and herb species that will supplement or boost the existing assemblage of native grasses and herbs. Native grass and herb species already identified in this zone to date include *Chloris truncata*, *Austrodanthonia* spp., *Austrostipa* spp., *Digitaria* spp., *Enneapogon* spp., *Bothriochloa macra*, and *Whalenbergia* spp.

### ***Retain and enhance fauna habitat***

- Coarse woody debris (logs and other fallen wood) was absent from this zone at the time of preparation of this PoM. Effort must be taken to emplace woody debris throughout this zone prior or during tree planting. Hollow logs and stags are the most beneficial woody debris for fauna habitat, but younger logs, branches and bark are all highly valuable as fauna habitat and microhabitat for successful seedling establishment.
- A log or other woody debris should replace the removal of any sheet metal or other metal debris.

### ***Maintenance and construction of amenities and man-made structures***

- One walking path will be permitted to be installed to create a loop around the horseshoe pond. This may only be constructed once rehabilitation of the horseshoe pond has been completed.
- Proposed walking paths should pegged-out well in advance of construction, so as to not affect any deep ripping for tree planting, or disturbance to native grasses.
- Paths should be maintained by mowing a maximum of 3m either side of a path.
- Additional bench seats or viewing platforms can be installed
- No picnic tables are permitted in this zone.
- Additional interpretive signs can be installed throughout this zone to act as educational tools

## 7.3 Zone 3: Wetland – Horseshoe/Upper Pond

Area: 3.33 ha



FIGURE 7. ZONE 3 - LOOKING NORTH-EAST FROM THE BIRD HIDE (PHOTO BY KURTIS LINDSAY)

### ***Rehabilitation***

- The Southern half of the pond which has dried out is to be filled and capped
- The Northern end of the pond where water is still present may be retained as an addition to the wetland. This pond will need to be rehabilitated using native vegetation. Signs should be placed near this pond warning people not to enter the water.

### ***Weed management***

- Regular weed control and weed inspections to be undertaken by Council weeds department.
- Weed management as per the Noxious Weeds Act 1993 and in alignment with Council Pesticide Notification Act. Regular weed control events should take place to prevent re-infestation in particular the infestations of perennial weeds. All spraying will be undertaken by suitably qualified staff and / or contractors.
- The group of Athel Pine (*Tamarisk aphylla*) growing in this zone are classified as a noxious weed. As the trees contain native bird nests they may be poisoned but should not be removed until new thickets of native shrubs have been established.
- Avoid any clearing any shrub/tree/weed clearing during spring and summer when native birds are breeding.

### ***Native plant management***

- Use a whipper-snipper to slash grass and pasture weeds in proposed planting areas
- Within this wetland-dominated zone, only plant trees that are local to the Putta Bucca Wetlands or the local stretch of the Cudgegong River. This is mostly restricted to Rough-barked Apple, River Red Gum, River Oak, Spiny Mat Rush and River Bottlebrush and Tree

Violet. Tree Violet is a preferred shrub to plant due to its local prominence and value as nesting habitat for small birds.

- Plantings should only be performed using small trees and shrubs that will naturally survive under the local conditions of this zone. Blackthorn, Tree Violet, Spiny Mat Rush and River Bottlebrush are the some recommended species to plant within this zone.
- Plantings can be performed using tube stock, established plants or direct seeding. Local provenance should be used as a priority.

### ***Retain and enhance fauna habitat***

- Retain dead trees and snags as they are valuable perches, foraging and nesting sites for native fauna, particularly waterbirds.
- Restore fauna habitat throughout this zone by obtaining coarse woody debris and spreading it across the edges and bed of the Upper Pond.

### ***Maintenance and construction of amenities and man-made structures***

- One walking path will be permitted to be installed to create a loop around the horseshoe pond. This may only be constructed once rehabilitation of the horseshoe pond has been completed.
- Existing paths should be maintained by mowing a maximum of 3m either side of a path
- Improvements to the bird hide structure in this zone should be carried out to enhance suitability for bird watching use
- Additional interpretive signs could be installed throughout this zone to act as educational tools for members of the public
- Additional bench seats or viewing platforms can be installed
- No picnic tables are permitted in this zone
- The bridge over the weir between the Upper Pond and Quarry Lake should be upgraded to maximise access by disabled persons
- Develop an artificial stormwater drainage channel to divert stormwater runoff from Putta Bucca Rd, into the pond in this zone

### ***General***

- Educational and recreational activities are permitted in this area.
- A gate, which joins the PBWR to the private landholding to the north of the PBWR, has been utilised for thoroughfare by neighbouring private vehicles and livestock in and out of the PBWR. Private thoroughfare is not permitted into the PBWR through this gate without written consent from council. A lock supplied by council will be permanently attached to this gate and consent must be granted prior to each entry or exit through this gate by any non-council personnel

## 7.4 Zone 4: Wetland – Quarry/Main Pond – Existing maintained / visited site

Area: 5.64 ha



FIGURE 8. ZONE 4 - QUARRY LAKE LOOKING EAST FROM THE WOODEN BIRD HIDE (PHOTO BY KURTIS LINDSAY)

### *Weed Management*

- Regular weed control and weed inspections to be undertaken by Council weeds department.
- Weed management as per the Noxious Weeds Act 1993 and in alignment with Council Pesticide Notification Act. Effort should be made to remove any willow or elm trees that are encroaching on the mudflats. Regular weed control events should take place to prevent re-infestation. All spraying will be undertaken by suitably qualified staff and / or contractors.
- Avoid any clearing any shrub/tree/weed clearing during spring and summer when native birds are breeding.
- Effort should be made to remove any willow or elm trees that are encroaching on the mudflats. Regular weed control events should take place to prevent re-infestation.

### *Native plant management*

- Use a whipper-snipper to slash grass and pasture weeds in proposed planting areas
- The partial drying out of this wetland environment is a natural phenomenon. As the wetland is fed by an alluvial aquifer and rainwater, area of exposed mudflat and reed bed will vary depending on prevailing environmental conditions. There should be no attempt to control/poison/remove any native water plants/reeds/rushes/sedges growing on to the mudflats this area
- Within this wetland-dominated zone, only plant trees that are local to the Putta Bucca Wetlands or the local stretch of the Cudgegong River. This is mostly restricted to Rough-barked Apple, River Red Gum, River Oak, Spiny Mat Rush and River Bottlebrush and Tree Violet. Tree Violet is a preferred shrub to plant due to its local prominence and value as nesting habitat for small birds.

- Plantings that take place under existing tree canopies, should only be done with shrubs that will naturally survive under these conditions. Tree Violet, Spiny Mat Rush and River Bottlebrush are three recommended species to plant within this zone.
- Plantings can be performed using tube stock, established plants or direct seeding

### ***Retain and enhance fauna habitat***

- Retain dead trees and stags
- Retain fallen trees and other coarse woody debris in the Cudgegong River, tributaries and associated wetlands, they are valuable habitat resources for native fish, turtles and Platypus

### ***Maintenance and construction of amenities and man-made structures***

- Improvements to the bird hide structure in this zone should be carried out to enhance suitability for bird watching use.
- Existing paths should be maintained by mowing up to 2m either side of a path
- Additional bench seats, picnic tables or viewing platforms can be installed

## 7.5 Zone 5: Bushland – Riparian and Alluvial Woodlands

**Area:** 9.14 ha



**FIGURE 9. ZONE 5 - CUDGEGONG RIVER (PHOTO BY KURTIS LINDSAY)**

### ***Weed Management***

- Due to the sensitivity of the riparian system in this zone, the management of pasture weeds (grasses and herbs) or seedling tree and shrub weeds should only be conducted using suitable herbicide, or direct hand weeding methods.
- Regular weed control and weed inspections to be undertaken by Council weeds department.
- Weed management as per the Noxious Weeds Act 1993 and in alignment with Council Pesticide Notification Act. Due to the sensitivity of the riparian system in this zone, the management of pasture weeds (grasses and herbs) or seedling tree and shrub weeds should only be conducted using waterway registered herbicide. All spraying will be undertaken by suitably qualified staff and / or contractors.
- Avoid any clearing any shrub/tree/weed clearing during spring and summer when native birds are breeding.

### ***Native plant management***

- Slash grass and pasture weeds to provide space to plant native trees and shrubs in proposed planting areas. The use of a whipper snipper is preferred over a slasher.
- Only plant trees that occur naturally to this vegetation community in the Putta Bucca Wetlands or the local stretch of the Cudgegong River. This species list is mostly restricted to Rough-barked Apple, River Red Gum and River Oak.
- If planting shrubs in this zone, should only select species that naturally occur or are likely to occur in this vegetation community. Tree Violet, Spiny Mat Rush and River Bottlebrush are recommended shrub species to plant within this zone
- Tree Violet is the preferred shrub to plant in this zone due to its local prominence and value as nesting habitat for small birds.
- Plantings can be performed using tube stock, established plants or direct seeding
- Areas of dense exotic grass in this zone (that fall outside the 2m mowing buffer around all paths) can be slashed in attempt to promote the growth of native grasses (e.g. Austrodanthonia spp.) but this may only take place in the late autumn - early winter months when birds are not likely to be nesting in this habitat.

***Retain and enhance fauna habitat***

- Fallen trees and other coarse woody debris in the Cudgegong River and tributaries are valuable habitat resources for native fish, turtles and Platypus so must be retained or enhanced.
- Wood piles have been created by piling the felled trunks and branches of exotic trees and native dead stags. Where practical wood piles should be retained for biodiversity purposes and not burned or destroyed.
- Care should be taken not to remove dense grass which contains nest or shelter/feed for mammals
- Nest-boxes should be custom selected and designed for fauna that are known or predicted to occur in the PBWR. Threatened species are a priority.
- Artificial fauna nest-boxes can be installed on the bird hide and on trees that are too young to have in-situ natural hollows.
- Grow native vines such as Clematis glycinoides or Hardenbergia violacea over and around dead trees and shrubs to enhance small bird nesting habitat. This includes dead exotic or weed trees and shrubs that have been deliberately poisoned. The dead tree forms a skeletal structure and the vine complements this to create optimal bird nesting habitat.

***Maintenance and construction of amenities and man-made structures***

- Existing paths should be maintained by mowing up to 2m either side of a path
- Additional interpretive signs could be installed throughout this zone to act as educational tools for members of the public. Signs should feature varying aspects of the natural environment in the PBWR (e.g. woodland birds, woody debris and dead trees as fauna habitat, mistletoes, tree-hollows, river snags, platypus).
- Signage from NSW fisheries showing pest fish, protected fish and native sport fish size and bag limits should be placed in this zone, in a location near the Cudgegong River.
- Additional bench seats or viewing platforms can be installed
- One picnic table exists in this zone, additional picnic areas may be installed
- No physical modifications to any walking tracks (exceeding general maintenance) can take place without prior consent from council



## 7.6 Zone 6: Parkland

Area: 2.51 ha



FIGURE 10. ZONE 6 – ENTRY TO PBWR AND PARKLAND ZONE (PHOTO BY KURTIS LINDSAY)

### ***Weed Management***

- Regular weed control and weed inspections to be undertaken by Council weeds department.
- Weed management as per the Noxious Weeds Act 1993 and in alignment with Council Pesticide Notification Act. All spraying will be undertaken by suitably qualified staff and / or contractors.
- Undertake regular weeding under all tree and shrub plantings, and along all roads, tracks and in car parks within this zone and in alignment with Council Pesticide Notification Act. All spraying will be undertaken by suitably qualified staff and / or contractors.

### ***Native plant management***

- Plant native trees and shrubs only. It is preferable to choose and plant native trees and shrubs that are local to the Mudgee area.
- Plantings can be performed using tube stock, established plants or direct seeding
- Enhance native tree and shrub plantings along all edges of the private lease hold land adjacent to this zone. Suitable plant species to use in these plantings include River Bottlebrush and River Oak
- Slash / mow to maintain shorter grass which is more aesthetically pleasing to those utilising this area
- Promote native grasses within the planted areas along the private leasehold fence line by collecting native grass seeds during winter and summer and direct seeding.

### ***Retain and enhance fauna habitat***

- A unique form of wildlife habitat in this zone is a sand levee that was once mined for sand aggregates but is now protected as one of the only known breeding location of the Migratory Rainbow Bee-eater in the local area. This area should be preserved and threats such as foxes should be controlled. Remove weeds to maintain exposed sand as necessary.
- Plant nectar-bearing shrubs around the car park and picnic area in order to attract nectar-feeding birds.

***Maintenance and construction of amenities and man-made structures***

- This zone including the main picnic area is to be mown and maintained regularly
- No physical modifications to any tracks can take place without prior consent from council under this PoM.
- Additional interpretive signs should be installed throughout this zone to act as educational tools for members of the public. Different signs should feature varying aspects of the natural environment of the PBWR (e.g. woodland birds, woody debris and dead trees as fauna habitat, mistletoes, tree-hollows, river snags, platypus etc.).
- Additional bench seats or viewing platforms can be installed
- Multiple picnic tables are present in this zone and numbers may be increased
- All man-made structures in this area (e.g. signage, picnic tables, chairs, bins) must be regularly checked for damage and vandalism and maintained
- A toilet facility may be installed
- One gas BBQ may be constructed within this zone
- A permanent shelter area above the BBQ and picnic tables may be installed
- A small lockable garden shed or similar may be installed to store tools and equipment used by volunteer groups
- A weatherproof, community noticeboard should be installed in this zone, preferably in the central carpark or somewhere that is easily accessible and quickly noticed by visitors.

## 7.7 Zone 7: Former Sewage Treatment Works

**Area:** 18 ha



**FIGURE 11. ZONE 7 - LOOKING SOUTH INTO STP FROM ITS NORTHERN BOUNDARY (PHOTO BY KURTIS LINDSAY)**

Ponds A, B and C are to be filled, compacted and capped to allow for establishment of future land uses ancillary to MWRC stockpiling activities. Material used for filling and capping should be clean quarried material or material sourced from Council operations identified as virgin excavated natural material (VENM), as defined in the *Protection of the Environment Operations Act (1997)*, i.e. confirmed to not contain sulfidic ores or be contaminated with manufactured chemicals / residues as a result of industrial, commercial, mining or agricultural activities.

Reinstated Ponds A, B and C are to be graded towards a diversion drain aligned between the ponds and the adjacent former STP operational area.

The former STP operational area be adopted as a stockpiling area.

- Based on ASL results the concentrations of certain constituents found in Ponds exceed guidelines for freshwater aquatic toxicity and/or recreational waters.
- Possible future construction of a drainage system to capture the water runoff from Putta Bucca Road and diverted into Pond D may improve water quality along with planting of vegetation.
- Based on impacts present in the sediments of the holding pond (Pond D), successful revegetation would likely require rehabilitation (i.e. removal) of sediments impacted by heavy metals.

Geolyse has included this zone in their rehabilitation recommendations. A separate rehabilitation and management plan for this site is to be developed.

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## Appendix A. Operations Plan for PBWR

Item	Task*	Priority (1 high – 5 low)	Responsible Parties	Proposed timeframe
<b>Pathways</b>				
1.	Design and peg-out walking track extension loop around northern part of PBWR	2	FOPBW MWRC	2017/18
2.	Construct an additional pathway to create a loop around the horseshoe pond	5	MWRC	2018/19
3.	Marker posts/signs showing name and length at start of all gravel walking tracks	5	MWRC FOPBW	2017/18
<b>Signage</b>				
4.	Large sign at carpark, showing map of entire PBWR, detailing walking tracks and lengths of each track	1	MWRC FOPBW	2016/17
5.	Signposts with blank frame (e.g. clipboard style) to be set up at car park. This will enable MWRC to place important information signs instructing when the reserve is closed (e.g. for weeding of pest control).	1	MWRC	2015/16
6.	Information signage to be installed around car park and in bird hides – Waterbirds of Putta Bucca Wetlands. This sign would replace the current sign and contain a full list of waterbirds known to occur at the wetlands – Woodland birds and hollow-nesters of Putta Bucca Wetlands – Platypus, Eastern Long-necked Turtle, Macquarie Short-necked Turtle and Water Rat – Reptiles of Putta Bucca Wetlands – Native fish of Putta Bucca Wetlands	2	MWRC FOPBW LLS	2016/17
<b>Infrastructure</b>				
7.	Construct a small shed that can be used to store water tanks, trailer, digging, planting and weeding tools for use in the PBWR	3	MWRC FOPBW	2018/19
8.	Installation of a toilet facility within Zone 5. Dependent on external funding available	2	MWRC	2018/19
9.	Installation of BBQ and shelter facility in main picnic area	3	MWRC	2019/20
10.	Install bins at car park and picnic area	2	MWRC	2018/19
11.	Design and construct a small, engineered drainage channel from Putta Bucca Road to the Horseshoe pond	3	MWRC	2017/18
12.	Construct a permanent crossing over the quarry outlet at the northern end of the site with boardwalk approaches	1	MWRC Men's Shed	2016/17
13.	Construction of a wider bridge over the channel between the upper pond and quarry, including safety handrails to allow disabled access and safer access	3	MWRC	2019/20

Item	Task*	Priority (1 high – 5 low)	Responsible Parties	Proposed timeframe
14.	Removing of all unused fencing materials (e.g. barbed wire and pickets), except those which constitute boundary fences with adjoining and neighbouring land holders.	2	MWRC	2016/17
15.	Construct a third Bird Hide on the northern shore of the main lake	5	MWRC FOPBW Men's Shed	2020/21
<b>Rehabilitation</b>				
16.	Increase and enhance native shrubs (bird-attracting plantings/gardens). Replace dead plants	2	Dads Army FOPBW MWRC	Ongoing
17.	Continue to increase tree plantings and tree density (e.g. River Oak) along the edge of all fenced boundaries to private leasehold land	4	Dads Army FOPBW MWRC	Ongoing
18.	Collect native grass seeds and establish native grass patches in designated zones	2	MWRC FOPBW Landcare	Ongoing
19.	Kill and remove all Willow and Elm within PBWR. Areas of focus are Zone 3 and Zone 4. Retain the dead tree logs and stags for habitat purposes within the woodlands	2	Dad's Army MWRC FOPBW	Ongoing
20.	Replace killed willow and elm with plantings of native River Oak, River Red Gum and Rough-barked Apple.	3	MWRC FOPBW Dad's Army	Ongoing
21.	Install nest boxes suited for local threatened fauna, particularly Brown Treecreeper, Squirrel Glider, Little Lorikeet, Barking Owl and microbats (e.g. Large-footed Myotis).	4	MWRC Dads Army FOPBW Men's Shed	Ongoing
22.	Rehabilitation outlined in Geolyse recommendations in zones 1 and 3 (old landfill site and horseshoe pond)	1	MWRC	2017/18
23.	Re-vegetation of remaining horseshoe pond	1	MWRC FOPBW Dads Army	2017/18
<b>Events</b>				
24.	Run an annual photography competition centred on the wetlands	3	FOPBW	Ongoing
25.	Run regular events such as Clean up Australia Day, National Tree Day and Carp Musters.	5	FOPBW MWRC	Ongoing

\*Proposed improvements are dependent on funding available

## Appendix B. Maintenance requirements

Item	Task	Frequency	Responsible
<b>Current</b>			
1.	Mowing/slashing picnic area and pathways	Every three weeks or as required	MWRC- Contractor
2.	Cleaning bird hides	Quarterly	MWRC
3.	Cleaning of picnic tables	Every 2 months	MWRC
4.	Tree planting	Ad hoc- Recommended in Autumn and Spring	MWRC Dads Army FOPBW
5.	Tree planting maintenance	As required	MWRC Dads Army FOPBW
6.	Weed control	Bi-annual	MWRC weeds dept.
7.	Steering Committee Meetings	Quarterly	All
8.	Seek grant funding	Ad hoc	MWRC
9.	Re-sheet gravel pathways	Every 2 years or after a major flood event	MWRC
<b>Future</b>			
10.	Cleaning toilets- wash out, replace toilet paper	Fortnightly	MWRC
11.	Toilets- pumping out septic tank	Monthly	MWRC
12.	Collect rubbish bins	Weekly	MWRC
13.	Maintenance of BBQ	Monthly	MWRC

\*Proposed schedule is dependent on funding available

# Appendix C. Geolyse Report





**GEOLYSE**

**FORMER MUDGEES SEWAGE TREATMENT PLANT  
REHABILITATION PLAN**

**PUTTA BUCCA ROAD, MUDGEES**

**PREPARED FOR  
MID-WESTERN REGIONAL COUNCIL**

**MAY 2016**



• Civil, Environmental & Structural Engineering • Surveying • Environmental • Planning • Architecture

**FORMER MUDGEES SEWAGE  
TREATMENT PLANT  
REHABILITATION PLAN**

PUTTA BUCCA ROAD, MUDGEES

PREPARED FOR:

**MID-WESTERN REGIONAL COUNCIL**

MAY 2016



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<b>Report Title:</b>	<i>Former Mudgee Sewage Treatment Plant</i>
<b>Project:</b>	<i>Rehabilitation Plan</i>
<b>Client:</b>	<i>Mid-Western Regional Council</i>
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Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

All information contained within this report is prepared for the exclusive use of Mid-Western Regional Council to accompany this report for the land described herein and are not to be used for any other purpose or by any other person or entity. No reliance should be placed on the information contained in this report for any purposes apart from those stated therein.

Geolyse Pty Ltd accepts no responsibility for any loss, damage suffered or inconveniences arising from, any person or entity using the plans or information in this study for purposes other than those stated above.

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- Table 1: Site Investigation Sampling Results - Former Mudgee STP, Ponds: Water Analysis  
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- Drawing 1 – Site Location  
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*Stakeholder Responses*

**APPENDIX B**

*Wildlife Strike Guidelines*

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*Analytical Results*

**APPENDIX D**

*AHIMS Basic Search*

**APPENDIX E**

*Site Conceptual Landform*

**APPENDIX F**

*Vegetation Plan*

# Introduction

## 1.1 GENERAL

Geolyse Pty Ltd has been engaged by Mid-Western Regional Council (MWRC) to prepare a report outlining the rehabilitation process for the site known as the former Mudgee sewage treatment plant (STP), for possible redevelopment in the future. A preliminary investigation of the site was undertaken to identify any major environmental constraints that would render the site unsuitable for specific redevelopment purposes.

## 1.2 SETTING AND LOCATION

The Mudgee STP site is approximately 18 hectares (ha) in area and is located approximately 2 km to the north-west of the Mudgee town centre.

The site is located on the western side of Putta Bucca Road, which follows a south-west to north-east aligned ridge between Lawsons Creek (approximately 400 m to the south-east) and the Cudgegong River (approximately 450 m to the west). The fall of the land is generally from the east to the west, i.e. from Putta Bucca Road to the Cudgegong River.

The site is bounded to the east by Putta Bucca Road and to the west by the Putta Bucca Wetlands and an operational concrete batching plant. Agricultural land uses are present to the north of the site and rural-residential land is located to the south.

The site is defined as a portion of Lot 2 in Deposited Plan 803206, and is shown on the attached Site Locality Map (**Drawing 1**). Details of the general land use, topography and watercourses within the vicinity of the site are also presented on **Drawing 2**.

## 1.3 SCOPE OF REPORT

This report provides a preliminary investigation of the opportunities for and constraints to future redevelopment of the former Mudgee STP site for a range of land uses, for forward planning and budgeting purposes. It does not replace full environmental assessment as required under the *Environmental Planning and Assessment Act 1979*. For example, proponents of future development(s) would still need to undertake the required and necessary investigations, including flora and fauna assessments with respect to Section 5A of the *Environmental Planning and Assessment Act 1979* and (where relevant) the *Threatened Species Conservation Act 1995*.

This report outlines rehabilitation works considered necessary to allow for new land-uses at the site to be adopted without an increase in the risk to health or the environment from exposure to contamination that has resulted at the site from previous land uses. An indication of the cost and timeframes required to rehabilitate the site is also provided. This report does not provide any warranty, statement or representation of any kind concerning whether the site is or can be made suitable for any proposed land-use, with particular reference to *State Environmental Planning Policy No. 55 – Remediation of Land*. Such considerations would be addressed at later stages of the planning approvals process and would be subject to identification of proposed land uses (noting that the standard of any remediation will vary dependent on the end land use).

# Regulatory and Community Consultation

In consultation with MWRC, Geolyse has contacted relevant stakeholders, regulatory authorities and community groups (including the 'Friends of the Putta Bucca Wetlands'), requesting feedback regarding the potential redevelopment of the site. Input from this consultation has assisted in evaluation of the potential for various land uses being considered at the site.

Stakeholder responses are summarised in **Table 2.1** and attached in **Appendix A**.

**Table 2.1 Stakeholder Responses to Potential Site Redevelopment**

Stakeholder	Aspect(s) Requiring Consideration / Assessment
NSW Department of Primary Industries (Water)	<ul style="list-style-type: none"> <li>• Connectivity between groundwater and surface water to the existing lagoons.</li> <li>• Water quality of the lagoons and the adjacent soil characteristics.</li> <li>• All potentially contaminating sources are to be removed on final rehabilitation of the site.</li> <li>• How the final landform may impact on flooding. Drainage patterns in relation to the site.</li> <li>• Infrastructure removal methods and long term impacts on surface water and groundwater.</li> <li>• Interception of groundwater during construction.</li> <li>• The final landform is recommended to not intercept groundwater.</li> <li>• Voids with connection to the groundwater system would need consideration of licensing for any ongoing water extraction.</li> <li>• Land uses with minimal risk of contamination are recommended based on the high groundwater table, vulnerable to contamination.</li> <li>• Fill used at the site should be clean fill to mitigate impacts to the local groundwater and surface water system.</li> <li>• Maximum Harvestable Rights Dam Capacity for the property would need to be considered where dams capture runoff on minor streams.</li> <li>• Groundwater monitoring bores should be decommissioned.</li> </ul>
NSW Office of Environment and Heritage	No comments on proposed redevelopment
NSW Environment Protection Authority	<ul style="list-style-type: none"> <li>• An environment protection license for scheduled activities is not required for any works undertaken as part of redevelopment of the site.</li> <li>• Works should not result in the pollution of land or waters, and an environment protection license for non-scheduled activities (pollution of waters) is not required.</li> <li>• MWRC is to comply with the requirements of the Protection of the Environment Operations Act 1997 (POEO Act) during construction and redevelopment.</li> <li>• Specific consideration of the following aspects are recommended during the assessment for redevelopment of the site:               <ul style="list-style-type: none"> <li>- Noise and vibration</li> <li>- Air quality and odour</li> <li>- Land contamination</li> <li>- Water contamination, and erosion and sediment control</li> <li>- General flooding impacts</li> <li>- Waste management</li> <li>- Storage of chemicals and/or fuels</li> <li>- Incident management procedures</li> </ul> </li> </ul>

**Table 2.1 Stakeholder Responses to Potential Site Redevelopment**

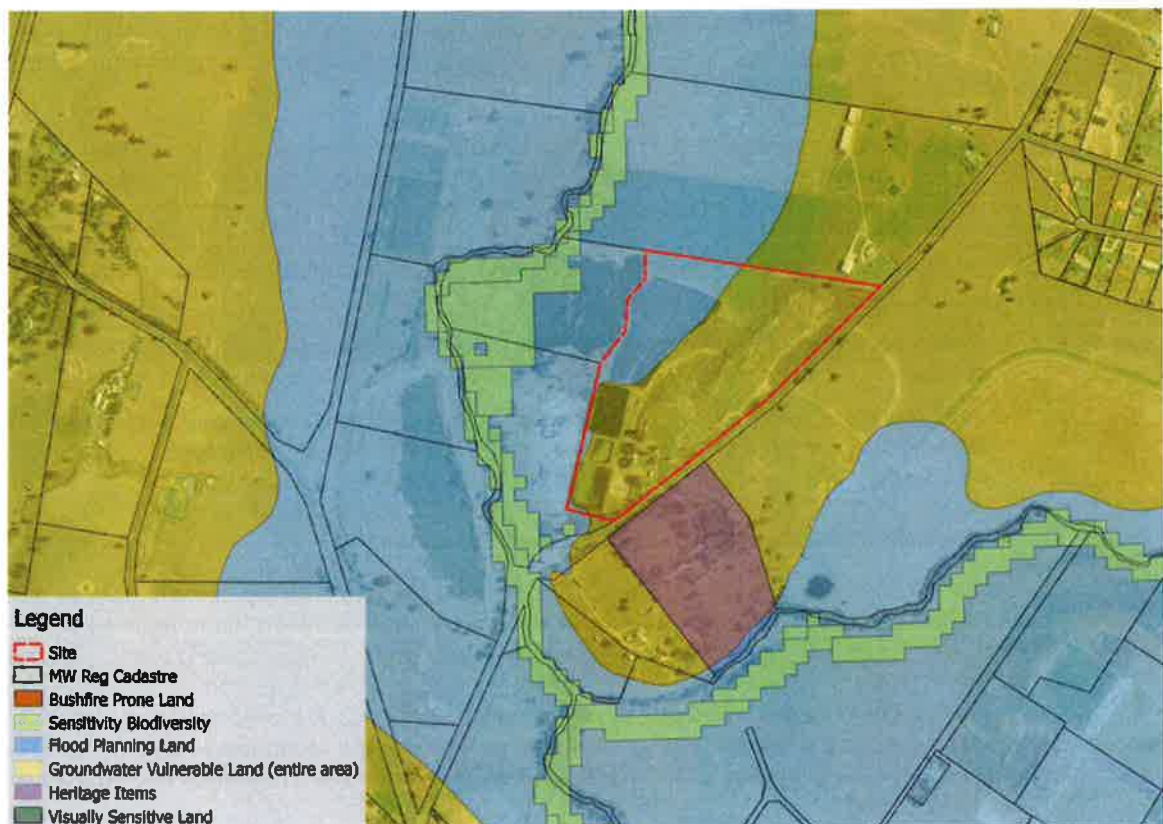
Stakeholder	Aspect(s) Requiring Consideration / Assessment
The Friends of Putta Bucca Wetlands	<ul style="list-style-type: none"> <li>• Settling pond (Pond C) and overflow pond (Pond D) support a suite of native wildlife species, including waterbirds, turtles, native fish and frogs.</li> <li>• Birds listed as Threatened and Migratory under the Threatened Species Conservation Act 1995 and Environment Protection and Biodiversity Conservation Act 1999 have been recorded using these sites for foraging and roosting purposes</li> <li>• Ponds are requested to be retained, and (where possible) enhanced for continued use by local wildlife.</li> <li>• Chain wire fence around the ponds is requested to be retained to provide security and refuge for the wildlife that use the ponds</li> <li>• Excavation or alteration of Pond C may present a risk to Macquarie Short-necked Turtles (<i>Emydura macquarii</i>). Friends of Putta Bucca Wetlands request notification of such works to allow relocation of turtles.</li> <li>• Vegetation rehabilitation of the ponds and their surrounding banks is recommended using only locally indigenous native wetland trees and shrubs.</li> <li>• Other forms of fauna habitat should be included in any site rehabilitation effort.</li> <li>• Construction of a stormwater drain that diverts hard surface runoff from Putta Bucca road, downslope and into the overflow pond is requested.</li> </ul>



# Constraints and Opportunities

## 3.1 CONSTRAINTS TO DEVELOPMENT

The site contains a number of potential constraints to development. The severity of the constraints depends upon the intended end use of the land. Potential constraints identified in the vicinity of the site, as derived from the Mid-Western Regional Local Environmental Plan (LEP) 2012 are shown on **Figure 3.1**.



**Figure 3.1 Site Locality Constraints Map**

In conducting this constraints analysis, Geolyse has not considered provision of utilities (sewer, water, electricity, etc.), geotechnical aspects, vehicular traffic or aviation restrictions (including bird-strike). Such considerations would be required to be addressed at later stages of the rezoning and/or development approvals process (refer to **Section 4.1**).

### 3.1.1 NATURAL HAZARDS

The western extent of the site closest to the Cudgegong River is prone to flooding, and is considered unsuitable for structural development(s). The portion of the site considered 'flood-prone' is approximately 4.2 hectares, and represents the level of a 1:100 ARI (average recurrent interval) flood event for the Cudgegong River plus 0.5 metre freeboard, as defined by the Mid-Western Regional Council Local Environmental Plan 2012 – Flood Planning Map.

No portions of the site are mapped as bush fire prone land.

### 3.1.2 SURROUNDING LAND USE

The Mudgee STP site is located approximately 2 km to the north-west of the Mudgee town centre. The site is bounded to the east by Putta Bucca Road and to the west by the Putta Bucca Wetlands and a concrete batching plant. Agricultural land uses are present to the north of the site and rural-residential land is located to the south. The areas further east and west support small farms. Residential areas of Putta Bucca and the northern extent of the Mudgee township are respectively locations approximately 500 m to the north-east and 800 m to the south of the site. Mudgee Airport is approximately 2 km to the east / north-east.

Aircraft noise may cause occasional minor nuisance to surrounding residential development, noting that the approach path for the primary runway (04/22) is generally aligned with the site. Traffic accessing the Mudgee Airport passes the site, however the total volume of traffic is not considered likely to create severe limitations to potential future site uses, and the majority of air traffic is understood to comprise light passenger / cargo planes.

Recreational or environmental uses of the site have the potential to impact on the operation of the airport in the event such use resulted in an attraction of greater numbers of bird life. It is difficult to quantify the extent of such impact however it is prudent to involve the airport in any discussion over future land uses. Further, as described in Guideline C of the National Airports Safeguarding Framework – Managing the Risk of Wildlife Strikes in the Vicinity of Airports (Australian Government – Department of Infrastructure and Regional Development, 2012):

***Managing off-airport wildlife strike risk – the role of airport operators and council / land use planning authorities***

*land use planning authorities should ensure that airport operators are given adequate opportunity to formally comment on planning applications for new or revised land uses that fall within the guidance provided in Attachment 11. Airport operators will be expected to respond with comments on how the proposed changes to land use might increase the risk of wildlife strike and on any regulatory actions that could increase the risk of wildlife strike, such as permits related to land uses of concern;*

The Putta Bucca Wetlands (adjacent to the subject site but located on the same legal land parcel) were formed when an adjacent quarry site ceased operation in the 1960s or 70s. It appears that the quarry was not rehabilitated or decommissioned and the empty quarry began holding water, either formed of discharge from the former STP, recharge from groundwater or recharge from the adjacent Cudgegong River. Geolyse has not been advised of any formalised approval of the Putta Bucca wetlands however they are acknowledged to represent a publically accessible and recognised tourism, recreational and educational site of importance within the local area. Threatened and migratory bird species are known to utilise the habitat.

Surrounding land uses are not considered to present significant constraints to future land use. However, any proposal to redevelop the site would require adequate consideration of aviation related restrictions, including bird-strike.

### 3.1.3 PREVIOUS / EXISTING LAND USE

The Mudgee STP is understood to have operated from the 1930s until 2013, when the new treatment plant (off Hill End Road) and pump station (on Putta Bucca Road, opposite the former STP operational area) were commissioned. The STP was flushed during decommissioning and the drying beds were left to dry out.

Treatment infrastructure at the site included:

- Two large cylindrical treatment tanks;
- Three smaller cuboid treatment tanks;
- Three rectangular treatment ponds (from south to north, Ponds A, B and C); and

<sup>1</sup> Appended to this document as **Appendix B**

- One larger holding pond (Pond D).

The former Putta Bucca landfill is also present on the site, which received municipal waste from the Mudgee township for the approximate period from the 1960s to the 1980s and encompasses an area of approximately 7.5 ha. Historic landfill operations progressed from south to north and waste was capped. Following closure, additional earthen material of unknown origin has been brought to the site and placed atop the existing capping material. Levelling of this material occurred after 2013, and is understood to have been spread across the entire landfill area.

Given the known previous land-uses at the site (in particular sewage treatment and municipal landfilling), MWRC commissioned Australian Laboratory Services (ALS) to conduct a series of soil, water and sediment investigations at the site to establish the potential for contamination impacts. Sample locations are indicated on **Drawings 3** and **4**. Constituents of particular concern (COPC) identified for the site are summarised below:

**Table 3.2 Constituents of Potential Concern (COPC)**

COPC	Soil	Sediment	Water
pH			✓
Salinity			✓
Turbidity			✓
Nutrients (Nitrate, Ammonia, Phosphate, Sulfate)			✓
Heavy Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc)	✓	✓	✓
Surfactants (as methylene blue active substances – MBAS)			✓
Polychlorinated Biphenyls (PCBs)		✓	✓
Organochlorine Pesticides (OC)	✓	✓	✓
Organophosphorus Pesticides (OP)	✓	✓	✓
Microbiological Analysis (Escherichia coli, Faecal Coliforms)	✓	✓	✓
Microbiological Analysis (Salmonella)	✓	✓	
Microbiological Analysis (Enteric Viruses, Helminth Ova)		✓	
Cyanophytes (Blue Green Algae)			✓
Polynuclear Aromatic Hydrocarbons (PAHs)	✓	✓	
Phenolic Compounds	✓	✓	
Total Petroleum Hydrocarbons (TPH) / Total Recoverable Hydrocarbons (TRH) / Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene (BTEXN)	✓	✓	
Asbestos	✓		

Analytical results are attached as **Appendix C** and summarised in the attached **Tables 1 to 4** (attached), and have been compared to criteria provided in the following guidelines, as applicable:

- National Environment Protection Council (NEPC), National Environment Protection (Assessment of Site Contamination) Measure, 1999 (amended 2013)
  - Health investigation levels for soil contaminants: Recreational 'HIL C', Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths – **Soil and Sediment**
  - Soil health screening levels for vapour intrusion: Recreational / Open Space 'HSL C', – **Soil**
  - Ecological screening levels (ESLs) for total petroleum hydrocarbon (TPH) fractions F1 – F4, benzene, toluene, ethylbenzene, xylene (BTEX) and benzo(a)pyrene in soil: Urban residential and public open space – **Soil and Sediment**

- Soil-specific added contaminant limits for metals (zinc, copper, chromium and lead) in soil: Urban residential and public open space – **Soil and Sediment**
- Management Limits for TPH fractions F1 – F4 in soil: Residential, parkland and public open space – **Soil**
- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, *National Water Quality Management Strategy, Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000)
  - Aquatic Ecosystems – Trigger values for toxicants at alternative levels of protection – **Surface Water**
  - Aquatic Ecosystems – Recommended interim sediment quality guideline (ISQG) values (High) – **Sediment**
  - Water quality guidelines for recreational waters (secondary contact) – **Surface Water**
- NSW Environment Protection Authority (NSW EPA), *Environmental Guidelines: Use and Disposal of Biosolids Products* (2000)
  - Initial Process Verification Standards – **Soil and Sediment**
  - Stabilisation Grade A Microbiological Standards – **Soil and Sediment**

Based on the results of analysis of soil, water and sediment samples collected at the site by ALS, the following constraints have been identified:

- Alkalinity (high pH) and turbidity of surface water in Ponds C and D exceeding guideline for freshwater aquatic toxicity
- Sulfate concentrations of surface water in all ponds exceeding guideline concentrations for recreational waters
- Heavy metal concentrations (including cadmium, chromium, copper, lead, nickel and/or zinc) of surface water in Ponds A, B, C and/or D exceeding guideline concentrations for freshwater aquatic toxicity
- Ammonia and nitrate of surface water in Ponds A, B and D exceeding guideline for freshwater aquatic toxicity
- Anionic surfactants (as methylene blue active substances) of surface water in Ponds A and C exceeding guideline for freshwater aquatic toxicity
- Algae biomass of surface water in Ponds A, B and C exceeding guideline concentrations for recreational waters
- Heavy metal impacts (copper and zinc) exceeding guideline ecological investigation levels (EILs) in sediments of Ponds A, B and C, and to a lesser extent in Pond D. Mercury exceeded the sediment quality guideline for aquatic ecosystems in sediments of Ponds A, B and C.
- Total recoverable hydrocarbons (TRH) in sediments, following silica gel extraction to screen out non-petrogenic hydrocarbons of biological origin (e.g. vegetable oils, humic material, etc.), exceeded guideline EILs in Ponds A, B and C.
- Microbiological parameters in sediments for enteric viruses (Ponds B, C and D) and salmonella (Pond A) exceeded biosolids stabilisation requirements for unrestricted use.
- Microbiological parameters in soil for salmonella exceeded biosolids stabilisation requirements for unrestricted use at one location ('Site 3\_2.0 m') at the former STP operational area.
- A fragment of asbestos containing material (ACM) was identified at the former STP operational area.

The former landfill area of the site was used for disposal municipal waste from the Mudgee township and subsidence, as well as generation of landfill gas (predominantly hydrogen sulfide and methane) cannot be ruled out at this stage. The area has not been used for landfilling for some 30 years, and these aspects are not considered to be major constraints unless structures where gas has potential to accumulate are proposed. Exposed waste material, where identified to have been unearthed through weathering of the capping material, would require additional capping and compaction.

Impacts to groundwater from the treatment ponds, STP infrastructure and/or former landfill may be present. Related constraints are considered to be limited to extraction of groundwater for potable, irrigation and/or stock watering purposes in the vicinity of the site. Associated qualitative impacts to the adjacent Putta Bucca wetlands and the Cudgegong River (e.g. fish kills, algal blooms, stressed aquatic vegetation, etc.) are understood to have not been observed.

No grazing or farming currently occurs on the site, and such uses have not been considered for possible constraints as the site's potential productivity for agricultural purposes is compromised by its proximity to the existing urban edge, and relatively small size.

### **3.1.4 HERITAGE CONSERVATION**

#### ***Historic Heritage***

A review of the Mid-Western Regional LEP (2012), reveals no sites of non-indigenous heritage at the site. The closest heritage items to the site, as identified in Schedule 5 of the LEP include:

- Item I371 – “Loneragan homestead (Putta Bucca House)” located to the east of the site, on the opposite side of Putta Bucca Road, which is listed as having local significance.
- Item I403 – “Caerleon Park Homestead” located 1.2 km to the west, which is listed as having local significance.

There are no foreseeable constraints resulting from non-indigenous heritage items in the area, given the physical separation from the listed heritage items and the site, and therefore no further investigation is considered necessary.

There is no suggestion from information provided by MWRC that any of the physical elements of the STP are considered to constitute items of potential heritage value. No formal assessment of the site in this context has been carried out.

#### ***Aboriginal Heritage***

A basic search of the Office and Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) did not identify any sites, materials, isolated artefacts within or near to the site (within 200 m buffer) of Aboriginal heritage significance, refer to **Appendix D** for search results. The area of the site is highly disturbed, having been subject to considerable excavation and landfilling since at least the 1930s, if not before.

#### ***Mitigation***

Notwithstanding that preliminary searches of the site have not revealed any indications of heritage significance items on the site, identification of 'objects' or other heritage features during any works should result in ceasing of works in that area, to be cordoned off, and the NSW Office of Environment and Heritage and/or a suitably qualified heritage specialist be contacted to discuss how to proceed.

### **3.1.5 ZONING / PLANNING**

The former STP site is currently zoned RU 1 – Primary Production under the provisions of the Mid-Western Regional *Local Environmental Plan 2012* (LEP). The objectives of this zone are as follows:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values.
- To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.

By reference to the LEP land use table, a range of land uses are either permitted without consent, permitted with consent or prohibited, *inter alia*:

*2 Permitted without consent*

*Environmental protection works; Extensive agriculture; Home businesses; Home occupations; Intensive plant agriculture; Roads; Water reticulation systems*

*3 Permitted with consent*

*Building identification signs; Business identification signs; Cellar door premises; Dwelling houses; Extractive industries; Farm buildings; Home industries; Intensive livestock agriculture; Landscaping material supplies; Markets; Open cut mining; Plant nurseries; Restaurants or cafes; Roadside stalls; Any other development not specified in item 2 or 4*

*4 Prohibited*

*Amusement centres; Attached dwellings; Backpackers' accommodation; Boarding houses; Boat building and repair facilities; Car parks; Child care centres; Commercial premises; Correctional centres; Crematoria; Educational establishments; Exhibition homes; Exhibition villages; Freight transport facilities; Group homes; Health services facilities; Heavy industrial storage establishments; Hostels; Industrial retail outlets; Industries; Marinas; Mortuaries; Multi dwelling housing; Passenger transport facilities; Places of public worship; Public administration buildings; Pubs; Recreational facilities (indoor); Registered clubs; Residential flat buildings; Respite day care centres; Restricted premises; Semi-detached dwellings; Seniors housing; Service stations; Sex services premises; Shops; Shop top housing; Signage; Storage premises; Transport depots; Truck depots; Vehicle body repair workshops; Vehicle repair stations; Warehouse or distribution centres; Wholesale supplies*

It is noted that clause 3 of the land use table is an open clause, which allows development with consent of land use types that are not prohibited by clause 4. In the context of this assessment of the land uses considered likely / possible for this site, a number of specific land uses types are noted as permissible with consent by virtue of not being listed in clause 4. These include:

**waterbody (artificial) or artificial waterbody** means an artificial body of water, including any constructed waterway, canal, inlet, bay, channel, dam, pond, lake or artificial wetland, but does not include a dry detention basin or other stormwater management construction that is only intended to hold water intermittently.

**waterway** means the whole or any part of a watercourse, wetland, waterbody (artificial) or waterbody (natural).

**wetland** means:

(a) natural wetland, including marshes, mangroves, backwaters, billabongs, swamps, sedgeland, wet meadows or wet heathlands that form a shallow waterbody (up to 2 metres in depth) when inundated cyclically, intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities, or

(b) artificial wetland, including marshes, swamps, wet meadows, sedgeland or wet heathlands that form a shallow waterbody (up to 2 metres in depth) when inundated cyclically, intermittently or permanently with water, and are constructed and vegetated with wetland plant communities.

**recreation area** means a place used for outdoor recreation that is normally open to the public, and includes:

- (a) a children's playground, or
- (b) an area used for community sporting activities, or
- (c) a public park, reserve or garden or the like,

and any ancillary buildings, but does not include a recreation facility (indoor), recreation facility (major) or recreation facility (outdoor).

**recreation facility (outdoor)** means a building or place (other than a recreation area) used predominantly for outdoor recreation, whether or not operated for the purposes of gain, including a golf course, golf driving range, mini-golf centre, tennis court, paint-ball centre, lawn bowling green, outdoor swimming pool, equestrian centre, skate board ramp, go-kart track, rifle range, water-ski centre or any other building or place of a like character used for outdoor recreation (including any ancillary buildings), but does not include an entertainment facility or a recreation facility (major).

It is noted the current nature of the use of the site has essentially come about organically rather than via formal planning, due to the cessation of the use of the site as an STP and its evolution into the current wetland use. It will be necessary for Council to determine how the site is to be used in the future and consent to be gained for that use, subject to all necessary assessments and taking account of the matters raised in **Section 2 and Section 3.1**.

It is possible that potential recreational, commercial, industrial and/or recreational land uses may be considered to be in conflict with the above zone objectives or may represent a prohibited land use. Rezoning of the site may be necessary prior to consent being granted for the use of the land for these purposes.

It is noted from the a review of the LEP Minimum Lot Size (MLS) Map that no minimum lot size for the purposes of subdivision or dwelling development applies to the site.

Mapped or otherwise applicable constraints, including the relevant assessment requirements imposed by the LEP, have been discussed elsewhere in **Section 3.1**. These matters would need to be addressed in any development application proposing a change of use of the site.

**Table 3.3 Constraint assessment in respect of future Development Application**

Mapped constraint	LEP Clause Considerations
Preservation of trees or vegetation	Consideration of the provisions of LEP Clause 5.9, which states: <ol style="list-style-type: none"> <li>(1) <i>The objective of this clause is to preserve the amenity of the area, including biodiversity values, through the preservation of trees and other vegetation.</i></li> <li>(2) <i>This clause applies to species or kinds of trees or other vegetation that are prescribed for the purposes of this clause by a development control plan made by the Council.</i> <i>Note. A development control plan may prescribe the trees or other vegetation to which this clause applies by reference to species, size, location or other manner.</i></li> <li>(3) <i>A person must not ringbark, cut down, top, lop, remove, injure or wilfully destroy any tree or other vegetation to which any such development control plan applies without the authority conferred by:</i> <ol style="list-style-type: none"> <li>(a) <i>development consent, or</i></li> <li>(b) <i>a permit granted by the Council.</i></li> </ol> </li> <li>(4) <i>The refusal by the Council to grant a permit to a person who has duly applied for the grant of the permit is taken for the purposes of the Act to be a refusal by the Council to grant consent for the carrying out of the activity for which a permit was sought.</i></li> <li>(5) <i>This clause does not apply to a tree or other vegetation that the Council is satisfied is dying or dead and is not required as the habitat of native fauna.</i></li> <li>(6) <i>This clause does not apply to a tree or other vegetation that the Council is satisfied is a risk to human life or property.</i></li> </ol> <p style="text-align: center;">(cont'd)</p>

**Table 3.3 Constraint assessment in respect of future Development Application**

Mapped constraint	LEP Clause Considerations
	<p>(7) A permit under this clause cannot allow any ringbarking, cutting down, topping, lopping, removal, injuring or destruction of a tree or other vegetation:</p> <p>(a) that is or forms part of a heritage item or that is within a heritage conservation area, or</p> <p>(b) that is or forms part of an Aboriginal object or that is within an Aboriginal place of heritage significance,</p> <p>unless the Council is satisfied that the proposed activity:</p> <p>(c) is of a minor nature or is for the maintenance of the heritage item, Aboriginal object, Aboriginal place of heritage significance or heritage conservation area, and</p> <p>(d) would not adversely affect the heritage significance of the heritage item, Aboriginal object, Aboriginal place of heritage significance or heritage conservation area.</p> <p>Note. As a consequence of this subclause, the activities concerned will require development consent. The heritage provisions of clause 5.10 will be applicable to any such consent.</p> <p>(8) This clause does not apply to or in respect of:</p> <p>(a) the clearing of native vegetation:</p> <p>(i) that is authorised by a development consent or property vegetation plan under the Native Vegetation Act 2003, or</p> <p>(ii) that is otherwise permitted under Division 2 or 3 of Part 3 of that Act, or</p> <p>(b) the clearing of vegetation on State protected land (within the meaning of clause 4 of Schedule 3 to the Native Vegetation Act 2003) that is authorised by a development consent under the provisions of the Native Vegetation Conservation Act 1997 as continued in force by that clause, or</p> <p>(c) trees or other vegetation within a State forest, or land reserved from sale as a timber or forest reserve under the Forestry Act 1916, or</p> <p>(d) action required or authorised to be done by or under the Electricity Supply Act 1995, the Roads Act 1993 or the Surveying and Spatial Information Act 2002, or</p> <p>(e) plants declared to be noxious weeds under the Noxious Weeds Act 1993.</p> <p>Note. Permissibility may be a matter that is determined by or under any of these Acts.</p> <p>(9) Subclause (8) (a) (ii) does not apply in relation to land in Zone R5 Large Lot Residential, Zone E2 Environmental Conservation, Zone E3 Environmental Management or Zone E4 Environmental Living.</p>
Flood Planning Area	<p>Consideration of the provisions of LEP Clause 6.2, which states:</p> <p>(1) The objectives of this clause are as follows:</p> <p>(a) to minimise the flood risk to life and property associated with the use of land,</p> <p>(b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change,</p> <p>(c) to avoid significant adverse impacts on flood behaviour and the environment.</p> <p>(2) This clause applies to:</p> <p>(a) land identified as "Flood planning area" on the Flood Planning Map, and</p> <p>(b) other land at or below the flood planning level.</p> <p>(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:</p> <p>(a) is compatible with the flood hazard of the land, and</p> <p>(b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and</p> <p>(c) incorporates appropriate measures to manage risk to life from flood, and</p> <p>(d) is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and</p> <p>(e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.</p> <p>(4) A word or expression used in this clause has the same meaning as it has in the Floodplain Development Manual (ISBN 0 7347 5476 0) published by the NSW Government in April 2005, unless it is otherwise defined in this clause.</p> <p>(5) In this clause:</p> <p>flood planning area means the land shown as "Flood planning area" on the Flood Planning Map.</p> <p>flood planning level means the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard.</p>



**Table 3.3 Constraint assessment in respect of future Development Application**

Mapped constraint	LEP Clause Considerations
Groundwater Vulnerability	<p>Consideration of the provisions of LEP Clause 6.4, which states:</p> <p><i>(1) The objectives of this clause are as follows:</i></p> <p><i>(a) to maintain the hydrological functions of key groundwater systems,</i></p> <p><i>(b) to protect vulnerable groundwater resources from depletion and contamination as a result of development.</i></p> <p><i>(2) This clause applies to land identified as "Groundwater vulnerable" on the Groundwater Vulnerability Map.</i></p> <p><i>(3) Before determining a development application for development on land to which this clause applies, the consent authority must consider the following:</i></p> <p><i>(a) the likelihood of groundwater contamination from the development (including from any on-site storage or disposal of solid or liquid waste and chemicals),</i></p> <p><i>(b) any adverse impacts the development may have on groundwater dependent ecosystems,</i></p> <p><i>(c) the cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply),</i></p> <p><i>(d) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.</i></p> <p><i>(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:</i></p> <p><i>(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or</i></p> <p><i>(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or</i></p> <p><i>(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.</i></p>
Strategic Agricultural Land (SAL)	<p>Applies in respect of Part 4AA of the <i>State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007</i> in the event mining or petroleum development is proposed at the site. More broadly any assessment would need to consider the proposed land use in the context of the SAL status of the land. Given the historic non-agricultural use of the site, a future non-agricultural land use should be justifiable.</p>
Terrestrial Biodiversity	<p>Consideration of the provisions of LEP Clause 6.5 which states:</p> <p><i>(1) The objective of this clause is to maintain terrestrial biodiversity by:</i></p> <p><i>(a) protecting native fauna and flora, and</i></p> <p><i>(b) protecting the ecological processes necessary for their continued existence, and</i></p> <p><i>(c) encouraging the conservation and recovery of native fauna and flora and their habitats.</i></p> <p><i>(2) This clause applies to land identified as "Moderate Biodiversity Sensitivity" or "High Biodiversity Sensitivity" on the Sensitivity Biodiversity Map.</i></p> <p><i>(3) Before determining a development application for development on land to which this clause applies, the consent authority must consider:</i></p> <p><i>(a) whether the development is likely to have:</i></p> <p><i>(i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and</i></p> <p><i>(ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and</i></p> <p><i>(iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and</i></p> <p><i>(iv) any adverse impact on the habitat elements providing connectivity on the land, and</i></p> <p><i>(b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.</i></p> <p><i>(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:</i></p> <p><i>(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or</i></p> <p><i>(b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or</i></p> <p><i>(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.</i></p>

Source: Mid-Western Regional Local Environmental Plan 2012

## 3.2 DEVELOPMENT OPPORTUNITIES

The former Mudgee STP site presents a range of opportunities for future development, however constraints from past uses, including sewage treatment and landfilling, and surrounding land uses, including Mudgee Airport, require consideration. The majority of the area is not subject to serious constraints to passive recreational uses, including wetlands, and restrictions to Council utilising former STP operational area for material stockpiling would not be inhibitive.

A conceptual landform has been prepared and is discussed in **Section 3.3**, which indicates possible uses for each area of the site, based on identified constraints and the most beneficial potential end land use.

### **3.2.1 RECREATIONAL FACILITIES**

The majority of the landfill areas identified on **Figure 3.1** is considered to be suitable for passive recreational use. From a land use planning perspective, careful consideration of proposed land uses in the context of LEP definitions would be necessary, to determine permissibility. It is anticipated in the majority of scenarios that development consent would be required.

Tree planting in this area will add to the amenity and assist in rehabilitation of this area by acting as a phytocapping layer, minimising infiltration of moisture into the landfill and reducing potential for leachate generation.

Addition of a passive recreation reserve adjacent to the neighbouring Putta Bucca Wetlands will improve the amenity of both areas, acting as a 'green buffer zone' to the east of the established wetlands and its considerable biodiversity values.

### **3.2.2 SURFACE WATER MANAGEMENT & WETLANDS**

Pond D may, with consent, be developed into wetlands, extending the habitat resources of the adjacent Putta Bucca Wetlands, however this would not be tenable without increasing the water flow input. Capture of stormwater from the adjacent Putta Bucca Road would assist in achieving this outcome. Consideration of harvestable rights limits would need form part of the formal assessment and consultation with DPI (Water) is recommended.

The quality of water present within the treatment ponds (Ponds A, B and C) and the holding pond (Pond D) was not identified to be amenable to aquatic ecology, however this is likely attributable to evaporation and resulting increased concentration of dissolved contaminants. The quality of Pond D was identified to be the least impacted, and may be suitable for discharge to the neighbouring Putta Bucca Wetlands if the volume is increased (i.e. dilution) through augmented capture of rain and stormwater. Analytical testing of water samples following filling of Pond D to near-discharge levels would confirm suitability (or otherwise) for discharge to the adjacent Putta Bucca Wetlands.

Correspondence from the 'Friends of Putta Bucca Wetlands' community group (refer **Section 2**), as well as the draft *Plan of Management – Putta Bucca Wetlands* (K. Lindsay, Watershed Landcare Friends of Putta Bucca Wetlands, 2015), recommends rehabilitation of the ponds and surrounding banks using locally indigenous native wetland trees and shrubs.

Construction of waterbird and turtle refuge islands may assist in preservation of biodiversity, however the volume of water currently present in Pond D is not considered sufficient to act as an effective barrier to predators.

Establishing Pond D as an extension of the Putta Bucca Wetlands would also provide for biological filtering of runoff from upgradient areas prior to entering the Cudgegong River. The wetland would also have considerable aesthetic appeal for passive recreational land uses of the adjacent former landfill area.

The success of any wetland established would depend on the initial design of the wetland, the level of management of the area, and being able to maintain surface water flow to balance water loss through evaporation. The amount of water present in Pond D would fluctuate based on rainfall volumes and the amount of surface infiltration across the catchment. Rising and falling water levels will create an ephemeral zone and provide a habitat conducive for macrophytes and associated wetland species.

### 3.2.3 COUNCIL OPERATIONS

Minimal constraints have been identified that would preclude the former STP operational area as utilisation by MWRC as a stockpiling yard.

Ponds A, B and C are not considered to be suitable for incorporation into wetlands, and do not contribute to the amenity of the area given their location between the adjacent concrete batching plant and the former STP operational area. Macquarie Short-necked Turtles (*Emydura macquarii*) previously identified within Pond C have been confirmed by MWRC to no longer be present.

Filling, compacting and capping of these ponds would render the area, approximately 1.9 ha, suitable for activities ancillary to the proposed MWRC stockpiling yard, such as a hardstand for temporary storage of vehicles and/or plant.

Protection of the adjacent Pond D from surface water flows from this area has been considered in **Section 4.2.1**.

### 3.3 CONCEPTUAL LANDFORM

The conceptual landform for the site is attached as **Appendix E**, and considers the most beneficial land use for each area of the site. In summary:

- The former STP operational area can be adopted as a stockpiling area by MWRC.
- Ponds A, B and C are to be filled, compacted and capped to allow for land uses ancillary to the proposed MWRC stockpiling yard.
- Surface water from Putta Bucca Road can be captured through drainage infrastructure, and diverted to Pond D. Discharge rock falls can improve water quality by improving oxygenation.
- The habitat resources and biodiversity of Pond D may be improved by planting of vegetation.
- The former landfill area may be revegetated and established as passive recreation in conjunction with the adjacent expansion of the Putta Bucca Wetlands (to include Pond D).

Subdivision and rezoning of the site has been considered and the procedure had been discussed in **Section 4.1**.

# Rehabilitation Strategy

## 4.1 PLANNING PROCESS

### 4.1.1 SUBDIVISION

An application for subdivision of Lot 2 in DP 803206 to create three Torrens lots is recommended to segregate the proposed land uses and facilitate rezoning of the resulting lots (**Section 4.1.2**).

The largest of the proposed lots would incorporate Pond D and the former landfill area. This lot would also include the existing Putta Bucca Wetlands, which are extant on the current Lot 2 in DP 803206 whilst outside the current scope of this rehabilitation plan. This new lot, including the Putta Bucca Wetlands, would be approximately 21.3 ha in size.

The proposed MWRC stockpiling yard would be contained within a lot approximately 3.5 ha in size with frontage along Putta Bucca Road and incorporate the filled Ponds A, B and C.

The proposed subdivision alignment is illustrated on **Figure 4.1**



**Figure 4.1 Proposed Subdivision of Lot 2 DP 803206**

Geolyse notes that whilst no minimum lot size is applicable to Lot 2 in DP 803206, Section 4.1E of the Mid-Western Regional LEP (2012) specifies that:

*Development consent must not be granted for the subdivision of land in Zone RU1 Primary Production unless the consent authority is satisfied that:*

- a) *the subdivision will not adversely affect the use of the surrounding land for agriculture, and*
- b) *the subdivision is necessary for the ongoing operation of the permissible use, and*

- c) the subdivision will not increase rural land use conflict in the locality, and
- d) the subdivision is appropriate having regard to the natural and physical constraints affecting the land.

#### **4.1.2 REZONING**

As discussed in **Section 3.1.5**, potential recreational, industrial and/or recreational land uses may be in conflict with the current RU1 zone objectives. A Planning Proposal consistent with the NSW Department of Planning and Environment guidance documentation, including '*A Guide to Preparing Planning Proposals*' (NSW Department of Planning and Infrastructure, 2012) would be required to support an application by Council for a 'Gateway' rezoning of the land.

The planning component of the Planning Proposal would be required to consider, but not be limited to, the following elements:

- a) Consultations with NSW Department of Planning & Environment (DPE) and servicing agents;
- b) Site and Planning Proposal background, development intent;
- c) Statement of objectives;
- d) Review of Environmental Impacts; and
- e) Justification of the proposal.

The following reporting may be required in support of the Planning Proposal, however it is recommended their preparation be deferred until the rezoning has been considered by DPE and a Gateway decision made.

- a) Geotechnical assessment due to the likely unconsolidated nature of landfilling material;
- b) Ecological Assessment (flora and fauna) as required by the *Threatened Species Conservation Act 1995* and the *Environmental Planning and Assessment Act 1979*; and
- c) Aboriginal and Non-Aboriginal Heritage Due Diligence Assessment; and
- d) Stormwater Management Strategy to provide a concept design of stormwater management sufficient to satisfy Council and DPE requirements.

## **4.2 SITE REHABILITATION**

Rehabilitation of the site in accordance with the specified works described in this section will allow for new land-uses at the site, as described in **Section 3.2** and **3.3**, to be adopted without an increase in the risk to health or the environment from exposure to contamination.

### **4.2.1 REHABILITATION WORKS**

#### ***Treatment Ponds / Holding Pond***

Ponds A, B and C are to be filled, compacted and capped to allow for establishment of future land uses ancillary to MWRC stockpiling activities. Material used for filling and capping should be clean quarried material or material sourced from Council operations identified as virgin excavated natural material (VENM), as defined in the *Protection of the Environment Operations Act (1997)*, i.e. confirmed to not contain sulfidic ores or be contaminated with manufactured chemicals / residues as a result of industrial, commercial, mining or agricultural activities.

Re-use of sediment dredged from Pond D may be considered as an alternative to importation of quarried material, provided geotechnical requirements can be achieved. Reinstatement using dredged sediment may be managed by installation of a geofabric marker layer overlying the sediment, followed by capping with VENM to a minimum thickness of 1.0 m.

Reinstated Ponds A, B and C are to be graded towards a diversion drain aligned between the ponds and the adjacent former STP operational area. The diversion drain is to be lined with rock or gravel in accordance with Section 5.4.4 of Landcom (2004) *Managing Urban Stormwater: Soils and Construction*, specifically "...Where rocks are used, place them above a filter layer of suitable geotextile and, where necessary, properly graded layers of sand and gravel". Rock check dams constructed in accordance with 'Standard Drawing 5-4' in Landcom (2004) are to be installed to reduce flow velocity.

Surface water control and discharge infrastructure within Pond D, including rockfalls and flow distribution weirs, will improve water quality and provide conditions amenable to wetland flora and fauna.

Any dredging of sediments in Pond D to source material for reinstatement of Ponds A, B and C, is not to exceed depths greater than the base of the adjacent former quarry area, such that existing connectivity between groundwater and surface water is not significantly altered.

Correspondence from the 'Friends of Putta Bucca Wetlands' community group (refer **Section 2**), as well as the draft *Plan of Management – Putta Bucca Wetlands* (K. Lindsay, Watershed Landcare Friends of Putta Bucca Wetlands, 2015), suggests rehabilitation of the ponds and surrounding banks should only use locally indigenous native wetland trees and shrubs, including:

- Rough-Barked Apple, *Angophora floribunda*
- River Red Gum, *Eucalyptus camaldulensis*
- River Oak, *Casuarina cunninghamiana*
- Spiny Mat Rush, *Lomandra longifolia*
- River Bottlebrush, *Melaleuca paludicola*
- Tree Violet, *Meliccytus dentatus*

With consideration of the above suggestions (K. Lindsay, 2015), Geolyse has prepared a vegetation plan, as attached as **Appendix F**, to be adopted with regards to revegetation of Pond D.

Based on impacts present in the sediments of the holding pond (Pond D), successful revegetation would likely require rehabilitation (i.e. removal) of sediments impacted by heavy metals.

### **Former Landfill**

Assessment of the existing capping layer of the landfill area did not identify constraints related to contamination impacting potential revegetation (i.e. phytotoxicity), the predominant constraints are considered to result from thickness of the cap.

The draft *Plan of Management – Putta Bucca Wetlands* (K. Lindsay, 2015), suggests planting of native trees and shrubs "... known to occur locally to the box-gum woodlands of the floodplains of the Cuddegong River within 10 km of the Putta Bucca Wetlands Reserve". These species are summarised below:

**Table 4.2 Suggested Vegetation Plan – Trees and Shrubs**

<b>Trees</b>	<b>Setting</b>	<b>Shrubs</b>	<b>Setting</b>
Yellow Box - <i>Eucalyptus melliodora</i>	No restriction to planting setting identified	Western Silver Wattle - <i>Acacia decora</i>	No restriction to planting setting identified
Rough-barked Apple - <i>Angophora floribunda</i>	No restriction to planting setting identified	Mudgee Golden Wattle <i>Acacia spectabilis</i>	
Blakely's Red Gum - <i>Eucalyptus blakelyi</i>	Upper slopes	Ausfeld's Whipstick Wattle <i>Acacia ausfeldii</i>	
River Red Gum - <i>Eucalyptus camaldulensis</i>	Lower floodplain and drainage	Blackthorn <i>Bursaria spinosa</i>	
River Oak - <i>Casuarina cunninghamiana</i>	Lower floodplain and drainage	Sifton Bush <i>Cassinia arcuata</i>	

**Table 4.2 Suggested Vegetation Plan – Trees and Shrubs**

Trees	Setting	Shrubs	Setting
Kurrajong - <i>Brachychiton populneus</i>	No restriction to planting setting identified	Blueberry lily <i>Dianella revoluta</i>	
Hickory Wattle - <i>Acacia implexa</i>	No restriction to planting setting identified	Rough saw-sedge <i>Gahnia aspera</i>	
White Cypress - <i>Callitris glaucophylla</i>	Less fertile soils and slopes closer to the road	Happy Wanderer <i>Hardenbergia violacea</i>	
Black Cypress - <i>Callitris endlicheri</i>	Less fertile soils and slopes closer to the road		
- <i>Allocasuarina diminuta</i>	less fertile slopes and drier areas		
Casuarina gymnanthera - <i>Allocasuarina gymnanthera</i>	less fertile slopes and drier areas		

Source: Adapted from K. Lindsay, 2015

Establishment of native grass and herb cover is suggested to be managed through weed control and pasture management. Direct seeding may be required should native grasses and herbs fail to successfully establish passively. Such species may include *Chloris truncata*, *Austrodanthonia spp.*, *Austrostipa spp.*, *Digitaria spp.*, *Enneapogon spp.*, *Bothriochloa macra*, and *Whalenbergia spp* (K. Lindsay, 2015).

In order to facilitate establishment of the above vegetation, in particular the deep-rooted tree species (i.e. *Eucalyptus* genus), the capping layer should, in general, possess the optimal characteristics of a landfill phytocap, as described in the draft 'Environmental Guidelines Solid Waste Landfills' (NSW EPA, 2015 – 2nd Edition), including:

- *Soil(s) should:*
  - *be well structured and typically loamy in texture;*
  - *support plant growth;*
  - *have good water-holding capacity;*
  - *have low salinity;*
  - *have moderate to high organic content;*
  - *have a low to moderate hydraulic conductivity that will facilitate rainwater infiltration but not permit drainage through the cap (Note: soils at the base of the cap may have a low hydraulic conductivity, similar to that of a barrier cap, to limit drainage to the waste).*
- *The depth of the cap will typically need to be at least 1.5 m thick to provide sufficient soil water storage to limit percolation.*
- *The soil density should not affect the water storage capacity or impede root establishment and penetration.*

Source: Adapted from NSW EPA, 2015

In the event of the landfill capping layer not complying with these optimal specifications, planting of deep-rooted species should be limited to areas outside the known extent of historic filling activities.

### **Former Sewage Treatment Plant Operational Area**

The former STP operational area may be utilised by MWRC as a stockpiling yard provided adequate sedimentation controls are in place to prevent turbid runoff. Stockpile areas should be sufficiently bundled in accordance with specifications described in Landcom (2004) *Managing Urban Stormwater: Soils and Construction*.

The stockpiling yard is to be graded towards a diversion drain aligned between the yard and the adjacent reinstated Ponds A, B and C, discussed earlier in this section. The diversion drain will flow to an existing depression to the north of the former STP operational area which includes an inlet stormwater pit to Pond D. Adapting this depression as a sedimentation basin by installation of a rock-check dam prior to the stormwater inlet will allow for settlement of suspended particles in the stormwater flow. The volume of the sedimentation basin requires consideration in accordance with Section 6.3.3 to 6.3.5 of Landcom (2004) in the event of the surfaces of the stockpiling yard or reinstated Ponds A, B or C being unpaved and/or not permanently landscaped. The stormwater inlet is to be protected by installation of a geotextile filter in accordance with 'Standard Drawing 6-12' of Landcom (2004), and maintained / replaced as required. A rock-fall overflow may be constructed to allow discharge to Pond D in the event of elevated rainfall exceeding the capacity of the stormwater inlet.

Fragments of asbestos impacts are to be rehabilitated prior to development occurring. Microbial impacts were not identified at ground level, and impacts at depth (2.0 m at sample location 'Site 3') are not considered to present a constraint to the proposed stockpile land use provided no disturbance of this material is envisaged to occur.

#### **4.2.2 RESTRICTIONS**

Based on the proposed land uses and rehabilitation activities to occur at the site, the following restrictions are proposed to manage residual risks to human health or the environment.

##### ***Groundwater Bores***

Groundwater abstraction at the site should be prohibited until groundwater quality has been assessed and suitability for use(s) has been confirmed, based on historic uses of the site.

##### ***Public Signage***

Passive recreation areas proximal to the wetlands should display signage discouraging contact with sediment and surface water. Access to the ponds (i.e. boating, swimming) should be prohibited.

##### ***Discharge From Ponds to Putta Bucca Wetlands***

The water quality of Pond D should be assessed prior to discharge into the Putta Bucca Wetlands, to ensure the Putta Bucca Wetlands or Cudgegong River further downgradient are not adversely affected by identified impacts (pH, turbidity, copper, nickel, zinc, ammonia).

If the water quality of Pond D is assessed as unsuitable for discharge to the wetland, upstream catchment and channelling infrastructure should divert surface water flow away from the site until such point that the surface waters are considered suitable for discharge.

##### ***Structures***

No erection of structures should be permitted within 50 m of the known extent of historic filling activities at the former landfill area to mitigate risks associated with landfill gas accumulation.

Other structures in this area that would not require consideration of landfill gas accumulation (e.g. open picnic areas, information boards, etc.) should be constructed in such a manner that does not result in penetration of the capping layer.

##### ***Permissible Stockpiled Material***

Material to be stockpiled by MWRC at the former STP operational area should solely consist of virgin quarried material (e.g. sand and gravel) or material to be used as a product for Council civil works, such as for road-building or landscaping.

No stockpiling or storage of waste materials generated from off-site is permitted, and waste generated on-site should be stored in sealed bins to be collected for off-site disposal, as required.



### 4.2.3 ESTIMATED REHABILITATION COSTS

Geolyse has derived cost estimates for proposed site rehabilitation works and surface water infrastructure from the NSW Resources and Energy ESB26: *Rehabilitation Cost Calculation Tool* (Version 1.12) and Rawlinsons *Australian Construction Handbook* 2015. Estimated costs have been summarised in **Table 4.3**

**Table 4.3 Proposed Rehabilitation and Surface Water Infrastructure Cost Estimates**

Item	Unit	Quantity	Rate	Cost Estimate
Site Establishment, Sediment and Erosion Control	Lump Sum	1	\$35,000	\$35,000.00
Source, cart and spread suitable material to cap Ponds A, B and C (1.0 m)	m <sup>3</sup>	13900	\$47.00	\$653,300.00
Source, cart and spread topsoil atop Ponds A, B and C (0.3 m)	m <sup>2</sup>	13900	\$16.95	\$235,605.00
Spoil amelioration and supply and spread seed and fertiliser at reinstated Ponds A, B and C	ha	1.8	\$4,726.12	\$8,507.02
Re-establish vegetation commensurate with surrounding vegetation at landfill and surrounds	ha	10.6	\$2,682.39	\$28,433.33
Maintenance of revegetated areas (twice in 5 year period)	ha	10.6	\$830.26	\$8,800.76
Wetland Planting in Pond D	ha	2.7	\$28,818.44	\$77,809.79
<b>Subtotal</b>				<b>\$1,047,455.90</b>
Tender Preparation and Assessment	Lump Sum			\$6,386.65
Post closure environmental monitoring			5%	\$52,372.80
Project Management & Surveying			10%	\$104,745.60
<b>Total Rehabilitation</b>				<b>\$1,210,961.00</b>
Clear Vegetation & Topsoil (Putta Bucca Rd Table Drain)	m <sup>2</sup>	2730	\$1.70	\$4,641.00
Cut & Fill (clay) – From Putta Bucca Rd to reinstated ponds	m <sup>3</sup>	2047.5	\$12.45	\$25,491.38
Crushed Rock (Rockfalls)	m <sup>3</sup>	2	\$83.00	\$166.00
Crushed Rock (Distribution Weirs)	m <sup>3</sup>	13.75	\$83.00	\$1,141.25
Concrete Pipe 750 mm (below access roads)	m	10	\$370.00	\$3,700.00
Culvert and Drainage (access roads)	m	10	\$1,245.00	\$12,450.00
Project Management & Surveying			10%	\$4,758.96
<b>Total Stormwater</b>				<b>\$52,348.59</b>
<b>TOTAL</b>				<b>\$1,263,309.58</b>

Source: NSW Resources and Energy ESB26: *Rehabilitation Cost Calculation Tool* (Version 1.12) and Rawlinsons *Australian Construction Handbook* 2015

Cost estimates are provided exclusive of GST. Geolyse provides this opinion of cost on the terms that MWRC, or any other party, will not impose any liability whatsoever on Geolyse that may arise from the use of this opinion of cost.

## Recommendations and Conclusions

This investigation has considered possible constraints to redevelopment of the former Mudgee STP site. It is concluded that there are no insurmountable constraints to proposed uses of the land, nominated as an extension of the Putta Bucca Wetlands (Ponds D), passive recreation (former landfill area), Council stockpiling area (former STP operational area) and activities ancillary to the proposed MWRC stockpiling yard (Ponds A, B and C).

Various rehabilitation measures are required to render the site suitable for these proposed land uses. In summary, these are:

- The former STP operational area may be utilised by MWRC as a stockpiling yard provided adequate sedimentation controls are in place to prevent turbid runoff.
- Ponds A, B and C are to be filled, compacted and capped to allow for establishment of future land uses ancillary to MWRC stockpiling activities. Dredged sediment from Pond D may be used to reinstate Ponds A, B and/or C, however installation of a geofabric marker layer overlying the sediment, followed by capping with virgin excavated natural material (VENM) to a minimum thickness of 1.0 m is required.
- Surface water control and discharge infrastructure, including rockfalls and flow distribution weirs, will improve water quality and provide conditions amenable to wetland flora and fauna.
- Rehabilitation of the Pond D and surrounding banks should only use locally indigenous native wetland trees and shrubs.
- Rehabilitation of the landfill area should consist of planting of locally occurring native trees and shrubs.
- Establishment of native grass and herb cover is suggested to be managed through weed control and pasture management. Direct seeding may be required should native grasses and herbs fail to successfully establish passively.
- The capping layer of the landfill area should possess the optimal characteristics of a landfill phytocap, as described in the draft '*Environmental Guidelines Solid Waste Landfills*' (NSW EPA, 2015 – 2nd Edition).
- Fragments of asbestos impacts are to be rehabilitated prior to development occurring.

Further to the above recommended rehabilitation measures, the following restrictions are proposed to manage residual risks to human health or the environment:

- Groundwater abstraction at the site should be prohibited until groundwater quality has been assessed and suitability for use(s) has been confirmed, based on historic uses of the site.
- Passive recreation areas proximal to the wetlands should display signage discouraging contact with sediment and surface water. Access to the ponds (i.e. boating, swimming) should be prohibited.
- The water quality of Pond D should be assessed prior to discharge into the Putta Bucca Wetlands, to ensure the Putta Bucca Wetlands or Cudgegong River further downgradient are not adversely affected by identified impacts (pH, turbidity, copper, nickel, zinc, ammonia).
- If the water quality of Pond D is assessed as unsuitable for discharge to the wetland, upstream catchment and channelling infrastructure should divert surface water flow away from the site until such point that the surface waters are considered suitable for discharge.

- No erection of structures should be permitted within 50 m of the known extent of historic filling activities at the former landfill area to mitigate risks associated with landfill gas accumulation.
- Other possible structures in the former landfill area that would not require consideration of landfill gas accumulation (e.g. open picnic areas, information boards, etc.) should be constructed in such a manner that does not result in penetration of the capping layer.
- Material to be stockpiled by MWRC at the former STP operational area should solely consist of virgin quarried material (e.g. sand and gravel) or material to be used as a product for Council civil works, such as for road-building or landscaping.
- No stockpiling or storage of waste materials generated from off-site is permitted, and waste generated on-site should be stored in sealed bins to be collected for off-site disposal, as required.

This preliminary study does not replace full environmental assessment as required under the *Environmental Planning and Assessment Act 1979*. Future developers are required to undertake the necessary investigations, including flora and fauna assessments with respect to Section 5A of the *Environmental Planning and Assessment Act 1979* and (where relevant) the *Threatened Species Conservation Act 1995*.

## References

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**Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand 2000**, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*

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**Landcom 2004**, *Managing Urban Stormwater: Soils and Construction*

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**Lindsay K., Watershed Landcare Friends of Putta Bucca Wetlands, 2015**, *Plan of Management – Putta Bucca Wetlands, draft*

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**Mid-Western Regional Council, 2012**, *Local Environmental Plan*

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**National Environment Protection Council (NEPC), 1999 (amended 2013)**, *National Environment Protection (Assessment of Site Contamination) Measure*

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**NSW Environment Protection Authority (NSW EPA), 2000**, *Environmental Guidelines: Use and Disposal of Biosolids Products*

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**NSW Department of Planning and Infrastructure, 2012**, *'A Guide to Preparing Planning Proposals'*

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**NSW EPA, 2015**, *'Environmental Guidelines Solid Waste Landfills' DRAFT, 2nd Edition*

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**NSW Resources and Energy, ESB26: Rehabilitation Cost Calculation Tool, Version 1.12**

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**Rawlinsons 2015**, *Australian Construction Handbook*

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## Drawings



Project: 215129

Drawing 1 - Site Locality Map





### Legend

-  Site
-  MW Reg Cadastre

Project: 215129

Drawing 3 - Sample Locations (Site)



### Legend

#### Sample Points

- Sediment
- Soil
- Water
- ★ Sediment > Criteria
- ★ Soil > Criteria
- ★ Water > Criteria
- Site
- MW Reg Cadastre





Project: 215129  
Drawing 4 - Sample Locations (STP and Treatment Ponds)



### Legend

**Sample Points**

- Sediment
- Soil
- Water
- ★ Sediment > Criteria
- ★ Soil > Criteria
- ★ Water > Criteria
- Site
- MW Reg Cadastre

