



MOLINO STEWART

ENVIRONMENT & NATURAL HAZARDS

**Assyrian Schools Ltd
C/- PMDL**

**Saints Peter and Paul Assyrian
Primary School**

*Riparian Vegetation Management
Plan*



Saints Peter and Paul Assyrian Primary School

RIPARIAN VEGETATION MANAGEMENT PLAN

for

Assyrian Schools Ltd C/- PMDL

by

Molino Stewart Pty Ltd

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1 INTRODUCTION

1.1 LOCATION

The subject site is located at Kosovich Place off Wallgrove Road, Cecil Park, NSW (**Appendix A - Figure 1**). The school will be built on Lot 2320 DP 1201268 and Lot 2321 DP 1201268.

The property is within the Fairfield Local Government Area (LGA).

1.2 PROPOSED DEVELOPMENT

It is proposed to develop a new co-education primary school with library, administration and amenities buildings.

The development footprint consists of an existing cleared area of exotic grassland with pasture grass and weeds and very few native species. There are no mature native trees within the proposed development area. This Vegetation Management Plan (VMP) includes weed removal and revegetation of cleared areas on the western part of the site.

There is remnant riparian vegetation located along Ropes Creek, which is to the north of the subject site. This vegetation is not part of the development area or VMP.

1.3 PURPOSE OF THIS VMP

The VMP has been prepared to accompany a State Significant Development Application to Department of Planning and Environment (DPE) for a master plan development of the school. The VMP describes the objectives and actions that will be implemented to manage and enhance remnant riparian vegetation near the development site during construction and post construction for a three year maintenance period.

A Biodiversity Assessment (Molino Stewart 2018) has been prepared for the development proposal. The Biodiversity Assessment recommended the riparian corridor on the site be revegetated and enhanced. This VMP

outlines a program of works to improve the condition and habitat value of this riparian vegetation.

The VMP addresses the following as recommended in the Biodiversity Assessment:

- Specific measures for controlling weed spread during construction of the school.
- Specific measures to protect vegetation and ecological communities during construction works, such as fencing, inductions of personnel and pathogen controls.
- An indicative weed control program for the riparian area for a minimum three year maintenance period.
- Planting to be undertaken in riparian areas. This VMP recommends native locally occurring tree, mid-storey or groundcover planting species that would be suitable to plant in the riparian area. Specific location and densities would be subject to future detailed design.
- Specific “site based” habitat enhancement measures for the Cumberland Plain Land Snail in the riparian area.

A Landscape Master Plan detailing areas where vegetation would be planted within the development has been prepared (Arterra Design, 02/07/18). This VMP provides specific detail of planting to be undertaken in the riparian area, including specifications for revegetation with locally occurring indigenous species.

1.4 OBJECTIVES

The overall objective of this VMP is to provide for the long term protection and rehabilitation of riparian vegetation. More specific objectives are:

- Protect native trees and native vegetation;
- Ensure water quality control during construction and post-construction;



- Regenerate native vegetation through bush regeneration techniques, including weed control;
- Retain creek bank stability;
- Revegetate sections of the proposed 20 m vegetated riparian zone (VRZ) where there are cleared areas;
- Protection and augmentation of fauna habitat within the riparian corridor; and
- Minimise potential indirect impacts of development such as sedimentation and weed invasion.

1.5 RELEVANT LEGISLATION AND GUIDELINES

The Biodiversity Assessment Report (Molino Stewart 2018) includes a detailed analysis of legislation applicable to the development proposal. Summarised below is legislation and associated guidelines applicable to this VMP.

1.5.1 Biosecurity Act 2015

On 1st July 2017 the *Biosecurity Act 2015* was introduced. The *Biosecurity Act* combines 14 different pieces of legislation, including the previous *Noxious Weeds Act*. Under Part 3 of the *Biosecurity Act 2015*, all land owners or land managers have a “General Biosecurity Duty” to prevent, eliminate or minimise the Biosecurity Risk posed or likely to be posed by Priority Weeds. Priority weeds for Greater Sydney Area detected on the subject site are indicated in **Table 1**.

1.5.2 Water Management Act 2000

There are mapped waterways on the property. As the proposed development is within 40m of a waterway, it is subject to integrated approval from Department of Industry – Water (formerly the Department of Primary Industry (DPI) as a controlled activity under the *Water Management Act 2000* (WM Act).

The site is located within the Ropes Creek catchment. The waterway on the site that joins Ropes Creek to the north is highly modified and cleared, consisting of a dam connected to upstream and downstream by small drainage

channels. It would be classified as a second order stream under the Strahler System of ordering watercourses. The DPI Water “*Guidelines for riparian corridors on waterfront land*” require that for a second order stream, a Vegetated Riparian Zone (VRZ) of 20 metres width (on each side of waterway, from the top of bank) is required. This VRZ will be provided on the western part of the site (eastern side of creek only) as shown in **Appendix A – Figure 2**.

This VMP has been prepared in accordance with the DPI Water “*Guidelines for vegetation management plans on waterfront land*”

1.5.3 Fisheries Management Act 1994 (FM Act)

The FM Act aims to conserve fish stocks and key fish habitats; and conserve threatened species, populations and ecological communities of fish and marine vegetation.

Ropes Creek at the subject site is a small second-order stream. The tributary of Ropes Creek located to the west of the development area has been dammed. Only sections of Ropes Creek well downstream of the site are mapped as Key Fish Habitat by NSW DPI (undated b). The Fairfield Biodiversity Strategy (2012) states that there are no records of species listed as threatened under the FMA from the Fairfield LGA. Given the above factors, the site is not expected to provide habitat for any threatened aquatic species listed under the FM Act.

1.5.4 NSW Biodiversity and Threatened Species legislation

The *Biodiversity Conservation (BC) Act 2016* and *Regulation 2017* were enacted on 25 August 2017. The BC legislation replaces the *Threatened Species Conservation Act 1995* (TSC Act).

The area of vegetation along Ropes Creek to the north of the site would qualify as the Endangered Ecological Community (EEC) River-Flat Eucalypt Forest (RFEF) listed under the BC Act. This VMP aims to enhance the riparian area within the development site by replanting species characteristic of RFEF. This

VMP gives preference to use of local provenance seed in any revegetation in this area.

This VMP has been prepared in accordance with best practice guidelines for the management and restoration of bushland, including the DEC Guidelines *“Recovering bushland on the Cumberland Plain: best practice guidelines for the management and restoration of bushland”* (DEC, 2005).

2 SITE DESCRIPTION

2.1 LANDSCAPE CONTEXT

The site is located on the Cumberland Plain within the Sydney Basin Bioregion. It is within the highly urbanised area of Western Sydney.

2.2 GEOLOGY, SOILS AND TOPOGRAPHY

The topography of the site is undulating hills and flats with red podzolic soils. The ground is very hummocky with furrows running down the hill (opposite to contour ploughing) but on the flat the furrows were along the contour.

The mapped soil landscape on site is Luddenham (lu). This is an erosional soil landscape with undulating to rolling low hills on Wianamatta Group shales, and is often associated with Minchinbury Sandstone. Steeper slopes in local area are mapped as Picton (pn) soil landscape.

2.3 DRAINAGE AND RIPARIAN AREAS

The site is located within the Ropes Creek catchment. Ropes Creek is located to the north of Kosovich Place. It flows north-west to South Creek, and then into the Hawkesbury River. Detailed Riparian area mapping, including Fairfield LEP Riparian Lands and Waterways, is included in the Ecological Assessment (Molino Stewart, 2018)

The waterway on the site that joins Ropes Creek to the north is highly modified and cleared, consisting of a dam connected to upstream and downstream by small drainage channels. It would be classified as a second order stream under the Strahler System of ordering watercourses. The DPI Water “Guidelines for riparian corridors on waterfront land” require that for a second order stream, a Vegetated Riparian Zone (VRZ) of 20 metres width (on each side of waterway) is required. This VRZ will be provided on the site on the

eastern side of the waterway as shown in **Appendix A - Figure 2.**

The Fairfield Local Environmental Plan (LEP) mapping covers a larger area of the site than would be required as a 20 metre VRZ under the requirements of the WM Act. The area mapped on the site as riparian land by the LEP is mostly cleared and highly modified. A large part of this area will be revegetated under this VMP.

2.4 LAND USE

The majority of the site comprises cleared land, which was previously utilised as market gardens. A church and administration building is located at the cul-de-sac on the adjacent property.

2.5 VEGETATION COMMUNITIES

Native vegetation mapping for the Cumberland (NPWS 2002) did not map any native vegetation communities as occurring on the subject site.

Field survey found that the vegetation on the majority of the site consists of exotic grassland with pasture grass and weeds and very few native species. There are no mature native trees within the proposed development area.

The southern creek has been dammed and is dominated by *Typha latifolia* Bulrush, *Eichhornia crassipes* Water Hyacinth and *Salvinia molesta* Salvinia.

The vegetation along the creek on other properties to the north of Kosovich Place is regrowth RFEF.

In the paddock there are large tree logs from previous clearing.

2.5.1 Endangered Ecological Communities

The Critically Endangered Ecological Community (CEEC) Cumberland Plain Woodland is not present on the site.

The vegetation along Ropes Creek to the north of Kosovich Place is regrowth RFEF that would meet the below criteria specified in the NSW Scientific Committee Determination (NSW Scientific Committee, 2011) for the EEC “River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions”. The criteria include:

- The canopy vegetation is usually dominated by Forest Red Gum, Cabbage Gum and Rough-barked Apple or Broad-leaved Apple;
- The understorey comprises an open stratum of juveniles of any of the canopy trees, as well as *Acacia* sp. and *Melaleuca* sp. and may include *Bursaria spinosa* (Blackthorn), *Daviesia ulicifolia* (Gorse bitter-pea) and *Dillwynia sieberi*;
- A ground cover of native or exotic grasses and herbs depending on the level of disturbance affecting the community.
- The RFEF EEC occurs on river flat or terrace in an upper part of the Coastal Floodplain on silty, clayey or sandy loam soil with a lack of deep humic layers and has little or no saline (salt) influence

The extent of RFEF EEC to the north of the site is shown in **Appendix A – Figure 3**. There is no RFEF on the subject property. The creek line to the west of the proposed school site has been dammed and there is an absence of the tree and understorey species that would indicate the presence of RFEF EEC.

No clearing of vegetation or disturbance of the dam within the riparian areas is proposed. The proposed development does require earthworks to be undertaken upslope of the riparian area, which has potential to indirectly impact the RFEF EEC through hydrological changes and water quality impacts.

2.6 FLORA SURVEY RESULTS

A list of flora species recorded on the site and in the riparian area to the north of the Church is provided at **Table 1**. The majority are exotic species. The site is heavily disturbed and no flora species of conservation value were noted.

No threatened flora species or populations were recorded on the site during survey. An analysis of the potential for the site to provide

habitat for the locally recorded threatened species is shown in Appendix B. No threatened flora species or populations are expected to occur on the site.

2.7 FAUNA SURVEY RESULTS

A list of fauna species recorded on the site is provided in the Biodiversity Assessment. The list consists of common bird species, the introduced Black Rat and a number of microbat species. The bird species observed are typical of the disturbed vegetation and urban location.

The immediate local area consists mainly of cleared land with the exception of the narrow strips of riparian vegetation. The bushland area of Western Sydney Parklands is located less than one kilometre to the east and is a neighbour on the southern boundary of the site.

Within the proposed development area, the site is heavily disturbed and as a result provides limited potential fauna habitats. The remnant riparian vegetation to the north of Kosovich Place along Ropes Creek may provide some habitat for highly-mobile urban tolerant animals such as bats and birds. There are no hollow bearing trees present, although there are some hollow logs on the ground in the cleared areas of the site.

The ponds and waterways may provide some potential habitat for amphibians.

The best quality habitat consists of the remnant riparian vegetation along Ropes Creek on the adjacent site to the north. No clearing of trees or understorey is proposed in these areas.

The only threatened fauna species recorded on the site during survey were the following microbat species recorded via Anabat detection:

- *Mormopterus norfolkensis*, East Coast Freetail-bat (Vulnerable) Positive identification via Anabat. Abundant records across all survey nights.
- *Falsistrelle tasmaniensis*, Eastern False Pipistrelle (Vulnerable). Probable identification via Anabat.

- *Scoteanax ruepellii*, Greater Broad-nosed Bat (Vulnerable). Probable identification via Anabat.

Targeted searches were conducted for the Cumberland Plain Land Snail. This species prefers environments with areas of deep litter, often associated with riparian areas, to obtain its food resources. The development area is devoid of preferred habitat and no evidence of this species was found. Riparian areas located nearby may provide suitable habitat.

Due to the lack of habitats present within the proposed development area, the Biodiversity Assessment considered it unlikely that any other threatened fauna will be impacted by the works (Molino Stewart, 2018).

2.8 FISH HABITAT

Ropes Creek at the subject site is a small second-order stream that has been dammed. Only sections of Ropes Creek well downstream of the site are mapped as Key Fish Habitat by NSW DPI (undated b). The Fairfield Biodiversity Strategy (2012) states that there are no records of species listed as threatened under the FM Act from the Fairfield LGA. Given the above factors, the site is not expected to provide habitat for any threatened aquatic species listed under the FM Act.

2.9 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Under the EPBC Act, a person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). These matters are listed as:

- The world heritage values of a declared World Heritage property;
- The ecological character of a declared Ramsar wetland;
- A threatened species or endangered community listed under the Act;
- A migratory species listed under the Act; or

- The environment in a Commonwealth marine area or on Commonwealth land.

The EPBC Protected Matters report generated for the site lists five threatened ecological communities, 36 nationally listed threatened species and 15 migratory species that may occur within 5 km of the site. No EPBC listed ecological communities, flora, fauna or migratory species were detected on the site or considered likely to be impacted by the development based on habitat assessment.

2.10 WILDLIFE CONNECTIVITY AND CORRIDORS

The immediate local area consists mainly of cleared land with the exception of the narrow strips of riparian vegetation which provide fragmented connectivity for wildlife, mainly for mobile species such as birds and bats.

The bushland area of Western Sydney Parklands is located less than one kilometre east of the site.

Table 1 Flora species recorded on site

Family	Botanical name	Common Name	Exotic	Priority in Greater Sydney Strategic Weed Management Plan
<i>Apiaceae</i>	<i>Anethum graveolens</i> *	Dill Weed	Y	
<i>Asteraceae</i>	<i>Ageratina adenophora</i> *	Crofton Weed	Y	
	<i>Conyza bonariensis</i> *	Fleabane	Y	
	<i>Euchiton sphaericus</i> *	Cudweed	Y	
	<i>Hypochoeris radicata</i> *	Cats Ear	Y	
	<i>Onopordum acanthium</i> *	Scotch Thistle	Y	
	<i>Senecio madagascariensis</i> *	Fireweed	Y	Prohibition on dealings Must not be imported into the State or sold
	<i>Sonchus oleraceus</i> *	Sow Thistle	Y	
	<i>Taraxacum sp</i> *	Dandelion	Y	
<i>Chenopodiaceae</i>	<i>Einaidia polygonoides</i>			
<i>Convolvulaceae</i>	<i>Dichondra repens</i>	Kidney Weed		
<i>Cyperaceae</i>	<i>Cyperus congestus</i> *		Y	
	<i>Cyperus eragrostis</i> *	Umbrella Sedge	Y	
<i>Fabaceae</i>	<i>Glycine tabacina</i>	Glycine		
<i>Goodeniaceae</i>	<i>Scaevola albida</i>	Pale Fan-flower		
<i>Juncaceae</i>	<i>Juncus usitatus</i>	Common Rush		
<i>Malvaceae</i>	<i>Sida rhombifolia</i> *	Paddy's Lucerne	Y	
<i>Myrtaceae</i>	<i>Eucalyptus amplifolia</i>	Cabbage Gum		
	<i>Eucalyptus tereticornis</i>	Forest Red Gum		
<i>Myrsinaceae</i>	<i>Anagallis arvensis</i> *	Scarlet Pimpernel	Y	

<i>Oleaceae</i>	<i>Ligustrum lucidum</i> *	Large-leaved Privet	Y	
	<i>Ligustrum sinense</i> *	Small-leaved Privet	Y	
	<i>Olea erupaea</i> subsp. <i>cuspidate</i> *	African Olive	Y	An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Exclusion zone: The plant is eradicated from the land and the land kept free of the plant. Core infestation area: Land managers prevent spread from their land where feasible.
<i>Onagraceae</i>	<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	Water Primrose		
<i>Plantaginaceae</i>	<i>Plantago lanceolata</i> *	Ribwort	Y	
<i>Poaceae</i>	<i>Bromus catharticus</i> *	Prairie Grass	Y	
	<i>Chloris gayana</i> *	Rhodes Grass	Y	
	<i>Cynodon dactylon</i> *	Couch	Y	
	<i>Paspalum dilatatum</i> *	Paspalum	Y	
	<i>Pennisetum clandestinum</i> *	Kikuyu	Y	
	<i>Setaria gracillis</i> *	Slender Pigeon Grass	Y	
<i>Polygonaceae</i>	<i>Persicaria decipiens</i>	Slender Knotweed		
	<i>Rumex crispis</i> *	Curled Dock	Y	
<i>Pontederiaceae</i>	<i>Eichhornia crassipes</i> *	Water Hyacinth	Y	Regional Recommended Measure Land managers should mitigate spread from their land.
<i>Rosaceae</i>	<i>Rubus fruticosus</i> *	Blackberry	Y	Prohibition on dealings Must not be imported into the State or sold
<i>Salviniaceae</i>	<i>Salvinia molesta</i>	Salvinia		

<i>Solanaceae</i>	<i>Datura inoxia</i>	Downy Thornapple		
	<i>Solanum cinereum</i>	Narrawa Burr		
<i>Typhaceae</i>	<i>Typha latifolia</i> *	Bulrush		
<i>Verbenaceae</i>	<i>Verbena bonariensis</i> *	Purpletop	Y	

3 DEVELOPMENT SITE

This section outlines the control and mitigation measures to be implemented on the development site to protect native vegetation in the downstream riparian corridors.

3.1 PRIOR TO COMMENCEMENT OF EARTHWORKS, CLEARING AND CONSTRUCTION

The following actions will be undertaken on site prior to any earthworks, clearing or construction:

- Protective fencing of No-Go zones, including any areas of vegetation to be retained and waterways.
- Induction of personnel working on the site into the required mitigation measures and environmentally sensitive No-Go areas.
- Environmental personnel or a consultant Ecologist is to check puddles, logs and groundcover vegetation within the development area for fauna prior to works, and relocate to retained areas of vegetation where suitable.
- Carefully move logs from development area to edges of riparian areas to provide habitat, taking care not to damage any native vegetation.
- Installation of erosion and sediment controls, as detailed in Erosion and Sediment Control Plan and/or Soil and Water Management Plan.

3.2 CONSTRUCTION PHASE

3.2.1 Weed control

Initial weed removal on the development site will be undertaken as part of construction and earthworks on the site. Vegetation to be

cleared on the paddock areas of the site is highly weed infested. Care must be taken when clearing vegetation and undertaking earthworks not to spread weed propagules and to dispose of vegetation and soils appropriately. The following soil management and weed control and disposal measures are to be implemented:

- All weed plant material and topsoil containing weed plant material will be disposed of to an appropriate waste management facility.
- Weeds will be removed immediately onto suitable trucks and disposed of without stockpiling.
- Loads of weed-contaminated material will be securely covered to prevent weed plant material falling or blowing off vehicles.
- Topsoil recovered from areas of low weed infestation can be re-used onsite but is to be stockpiled.
- Weeds are to be separated from native vegetation if vegetation is to be used for mulch. Weeds are not to be used for mulch.

3.2.2 Pathogen controls

- Plant and equipment is to be washed down prior to mobilising to site.
- Pathogen and weed spread will be controlled via the adoption of hygiene and disinfection controls. Construction contractors will be required to ensure that all machinery, materials and personnel are clean of any weed seed and tyres, boots, cutting blades etc are disinfected using a benzalkonium chloride solution prior to entering or leaving the worksite. This is in accordance with the following Guidelines; *NSW Frog Hygiene Protocol* (DECC 2008a), *Keeping it Clean – A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens* (Allan and Gartenstein 2010) and *Myrtle Rust: Everyday Management* (Department of Primary Industries

2011b)

(<http://www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust>).

3.2.3 Pollution controls

- Implement the site specific Erosion and Sediment Control Plan and Soil and Water Management Plan. This is to include installation of Erosion and sediment controls prior to commencement of any clearing or earthworks on the site.
- The contractor to ensure that appropriate spill kits are located with machinery and plant.
- Refuelling of plant and equipment is only to be carried out in a bunded area at least 40 metres distant from any watercourse/wetland and all appropriate control measures and emergency spill kits in place.

4 RIPARIAN VEGETATION

This section outlines the management actions and targets for revegetation of the VRZ within the development site (Lot 2321 DP 1201268).

4.1 VEGETATION MANAGEMENT AREAS

The riparian area to be revegetated within the property will be managed as two different Vegetation Management Areas (VMAs);

- 1) Woodland area to be replanted with trees and shrubs; and
- 2) Dam area where aquatic weeds will be removed and replanting of eastern bank with groundcovers undertaken. As part of the dam is on the adjacent property, replanting is only required to take place on the sections within the subject property.

These VMAs are shown in **Appendix A – Figure 4**.

4.2 PRIORITIES

The overall approach to vegetation management on the site will follow the DEC Guidelines of “*Retain, protect and manage*” and is outlined below in order of priority:

1. Retain and protect remnant vegetation. Although there is no remnant vegetation on the development site, there is vegetation located on the site to the north.
2. Regenerate native vegetation where it is impacted by weeds or other low level disturbance.
3. Revegetate the site where there are cleared areas or where assisted regeneration techniques do not prove effective.

4.3 QUALIFICATIONS OF CONTRACTORS

Initial weed removal on the development site will be undertaken as part of construction and earthworks on that site.

The riparian vegetation along Ropes Creek downstream is an environmentally sensitive area. As a result, weed control, bush regeneration and planting works specified in this VMP are to be undertaken by qualified and experienced bush regenerators. Monitoring works would need to be undertaken by an Ecologist in consultation with the bush regeneration contractor.

4.4 WEED CONTROL

4.4.1 Guidelines and Timing

Weed control within the riparian area will be undertaken using a staged approach incorporating three levels of treatment:

- Primary weed clearance; followed by
- Secondary treatment or follow-up; and finally
- Maintenance weeding (National Trust of Australia 1999).

Primary weed clearance refers to the initial treatment of a weed infestation. The weeds on the development site will be removed during earthworks and construction. All primary weeding within riparian areas is to take place within the first six months of the bush regeneration contract.

Secondary treatment or follow-up works refers to the intensive weeding of areas that have already received primary weeding, removing the largest flush of second generation weeds that have germinated from soil stored seed and those that were not successfully killed during primary weeding. Native regeneration is also encouraged during this stage. Secondary weeding is to be undertaken in the first 12 months of the bush regeneration contract.

Once an area has been restored and preventive measures to stop weed recruitment on site have been implemented, the

maintenance weeding phase can begin. It is inevitable that weeds will re-establish due to dispersal and the soil seed bank will also be a continual source of new weed infestations. As such, regular maintenance works will be required for the three year period of the bush regeneration contract.

Timing of weed control works are outlined in **Table 2**.

4.4.1 Weed removal from dam

The artificial dam is dominated by *Typha latifolia* Bulrush, *Eichhornia crassipes* Water Hyacinth and *Salvinia molesta* Salvinia. All these weeds are to be removed as part of primary weeding, and follow up control undertaken. Revegetation of the dam area is detailed in Section 4.5 below.

4.4.2 Weed removal from woodland area

Initial weed removal from the woodland area will be undertaken as part of construction and earthworks on the site. Maintenance weeding will be needed to ensure that planted native species can establish.

4.4.3 Targets for weed cover

To reduce weed cover to less than 10% cover within Year 1 and 5% by end of Year 2.

4.5 REVEGETATION

4.5.1 Guidelines

As outlined in the DEC Cumberland Plain Restoration Guidelines (DEC, 2005), replanting of deep-rooted native species indigenous to the area can help stabilise and protect riverbanks. Good management of riparian land will also decrease the amount of soil and nutrients lost from the land during heavy rainfall. A combination of natural vegetation and grassy filter strips can be used to trap any sediment and nutrients moving from upslope. For filter strips, grass or sedges

with heights that exceed 10 cm should be used.

4.5.2 Suitable Native Plant Species

Plants to be used in revegetation of the woodland area are to be characteristic of River-Flat Eucalypt Forest within Fairfield LGA. Plants to be used in the dam area will need to be species more characteristic of Freshwater Wetlands that adjoin River-Flat Eucalypt Forest. Native species listed below are locally occurring tree, mid-storey or groundcover planting species that would be suitable to plant in the riparian area. The species recommended are based on those species already present near the site as well as other native species suitable to the particular vegetation community. In selecting species, consideration has been given to the need to stabilise soils, given it is a riparian zone. The below list could be expanded to include other native species characteristic of River-Flat Eucalypt Forest within Fairfield LGA, depending on availability of tubestock. Specific location and densities of species would be subject to future detailed design.

a) Tree

- *Eucalyptus amplifolia* Cabbage Gum
- *Eucalyptus tereticornis* Forest Red Gum
- *Angophora floribunda* Rough Barked Apple

b) Shrub

- *Acacia parramattensis*
- *Bursaria spinosa*
- *Melaleuca decora*
- *Melaleuca linariifolia*
- *Melaleuca styphelioides*

c) Macrophytes – Dam VMA

Planting along the edges of the dam should comprise wet-dry tolerant sedges including:

- *Baumea rubiginosa* Soft Twig-sedge
Height: 0.7 - 1.1 m

- *Carex appressa* Tall Sedge 1 m
- *Eleocharis acuta* Small Spike Rush 0.4 m
- *Juncus usitatus* Common Rush 0.8 m
- *Schoenoplectus mucronatus* Star Club Rush 0.5 - 1 m

It is also advisable that a seed mix of suitable species from the below list of woodland ground covers be spread on the dam banks to encourage further ground cover growth in more elevated areas.

d) Groundcovers – Woodland VMA

- *Lomandra longifolia*
- *Microlaena stipoides*
- *Oplismenus aemulus*
- *Themeda australis*

4.5.1 Source of planting stock

Preference is to be given to locally sourced seed stock. All plants should be sourced from local native plant nurseries such as the Fairfield Community Nursery. Where suitable plants are not commercially available, seed should be collected from the local area in accordance with seed collection guidelines and propagated on-site before transplanting into prepared areas.

4.5.2 Planting methods

All plants should be either tubestock (groundcover plants) or minimum 10cm pot-sized for the shrubs and small trees.

An area surrounding the planting site should be completely removed of all exotic plants and mulched to a depth of 10 cm. Mulch should not be placed around the stems of any plants.

All plants should be watered at the time of the planting. Follow up watering is only required if a dry period is experienced after the initial planting.

Installation of guards surrounding the shrubs and small trees with provide protection and improve likelihood of establishment.

4.5.3 Post-planting management

Plantings will need to be monitored and maintained for a minimum three year maintenance period.

Weed monitoring and removal is to be on a monthly basis for the first six months and then every two months from six to 12 months to ensure competition with the native plants is minimised.

4.5.4 Timing

After primary weed control, replanting is to be undertaken within the first four (4) months of the bush regeneration contract.

4.5.5 Targets for native vegetation cover

An 80% survival rate is the target for tube stock planted. Replacement planting is required if this target is not met.

To determine success of native vegetation regeneration, the following targets for native vegetation cover apply to the riparian area:

- 40% native veg cover in ground layer at end of two years.
- 20% native veg cover in shrub layer at end of two years.

If at the end of two years these native vegetation regeneration targets are not met, further planting of tubestock would be required to maintain adequate vegetation coverage. Species selection should be determined based on the success of the initial planting; as well as including those species growing successfully in the local area.

4.6 CUMBERLAND PLAIN LAND SNAIL HABITAT ENHANCEMENT

The OEH “Action Toolbox” for the Cumberland Plain Land Snail (OEH undated c) “site based” recovery actions for this species that will be implemented in the riparian area including:

- Carefully move the logs from development area to the edges of riparian areas to provide habitat, taking care not to damage any native vegetation.
- Retain large woody debris and other material (stones) on the ground that provides habitat. Ensure it is dispersed across occupied sites to allow movement of individuals.
- Manage weed presence, density and diversity, maintaining low density of weeds that are identified as habitat engineers (e.g. dense shrubs) or otherwise strongly affect structure and composition of the grassy woodland habitat. Where possible, also manage adjacent source areas for weed seeds and propagules.
- Reduce or exclude slashing from areas that may be occupied by snails such as around woody debris and near the trunks of trees to ensure habitat and cover are retained.

4.7 MONITORING PROGRAM

Table 2 below outlines the timing of required monitoring and reporting program for the riparian vegetation works.

The objectives of the monitoring program are to evaluate the effectiveness of the weed management program, to determine if adequate natural regeneration is occurring and monitor the success of plantings. There will be a three (3) year monitoring and maintenance period for plantings and weed control works.

Prior to commencement of weed control and bush regeneration works, at least two monitoring points are to be established in the riparian zone. These points are to be marked with a stake and the GPS location recorded. It is suggested that 10 m by 10 m quadrats be used to determine percent cover and abundance of native plants and weeds. Each quadrat is to include photographic monitoring from pre-determined photo points, including baseline photographs.

The previous sections outline specific targets for tubestock survival, weed cover and native vegetation cover.

If monitoring determines that the weed eradication techniques are ineffective or not meeting targets, then the techniques and effort being used are to be altered to more effectively control the weeds.

If natural regeneration native vegetation percent cover targets or tubestock survival targets have not been met at the end of two (2) years then corrective measures will need to be implemented, including planting of additional tube stock.

4.8 REPORTING PROGRAM

Table 2 outlines the reporting program, including six (6) monthly reports to the relevant authority as determined by DPE for the first two years, followed by a final report at the end of three years. The final report should list:

- The number and species of all plants used in revegetation;
- Results of percent cover monitoring for weeds and native species;
- The extent of weed management required and treatments applied;
- Photographs taken from the reference points to document the changes in the condition and structure of the rehabilitation works; and
- Any issues associated with the rehabilitation works that may affect the future survival of the vegetation

Table 2 Program of Works

Aspect of VMP	0-2 months	2-6 months	6-12 months	1-2 years	2-3 years	Responsibility
Weed control	Primary weeding in dam and woodland VMAs	Primary and Secondary weeding	Secondary weeding	Secondary weeding	Maintenance weeding	Bush regeneration contractor
Initial Revegetation		Planting of tubestock. Monitoring monthly for first 6 months and replacement of tubestock if required.	Monitoring and replacement of tubestock if required.	Monitoring and replacement of tubestock if required.	Monitoring and replacement of tubestock if required.	Bush regeneration contractor
Additional Planting					Additional planting of tubestock if required. Monitoring and replacement of tubestock plantings every six months if required.	Bush regeneration contractor
Monitoring	Prior to commencement of weed control and revegetation, establish at least two monitoring points in the riparian zone as per Section 4.6 above.	Monitoring bi-monthly for first 6 months against targets for weed control and survival of tubestock.	Monitoring bi-monthly until 12 months against targets for weed control, survival of tubestock and native vegetation cover.	Monitoring of weeds and native regeneration at 18 months and 24 months against targets for weed control, survival of tubestock and native vegetation cover. Determine whether any additional tubestock plantings required.	If additional tubestock planted, monthly monitoring of survival of tubestock for 6 months from date of planting. Annual monitoring against targets for weed control, survival of tubestock and native vegetation regeneration until 3 years.	Ecologist in consultation with Bush regeneration contractor
Reporting to regulatory authority		Monitoring report at 6 months.	Monitoring report at 12 months.	Monitoring report at end of 2 years. Include recommendation on whether any additional tubestock plantings required.	Annual report at end of 3 years	Ecologist, using information from Bush Regeneration Contractor

5 REFERENCES

Department of Environment and Conservation (NSW) (DEC) (2005) *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland*. Department of Environment and Conservation (NSW), Sydney.

Fairfield City Council (2012), *Fairfield Biodiversity Strategy 2010*.

Greater Sydney Local Land Services (2017) *Greater Sydney Regional Strategic Weed Management Plan 2017-2022*, June 2017. NSW Department of Primary Industries (DPI) (Water) *Guidelines for riparian corridors on waterfront land*.

NSW Department of Primary Industries (DPI) (Water) *Guidelines for vegetation management plans on waterfront land*.

NSW NPWS (2002) Native vegetation of the Cumberland Plain, NSW NPWS, Sydney, October 2012.

Office of Environment and Heritage (OEH) (undated a) Threatened Species Profiles for threatened species, endangered populations, endangered ecological communities and key threatening processes listed under the NSW Threatened Species Conservation Act 1995. Office of Environment & Heritage NSW (OEH), Sydney, Australia. Online profiles found at http://threatenedspecies.environment.nsw.gov.au/tsprofile/browse_allspecies.aspx)

Office of Environment and Heritage (OEH) (undated b) Saving Our Species program information at http://www.environment.nsw.gov.au/saving_ourspecies/about.htm

Office of Environment and Heritage (OEH) (undated c) Saving Our Species - "Action Toolbox" for The Cumberland Plain Land Snail, accessed online http://www.environment.nsw.gov.au/saving_ourspeciesapp/project.aspx?ProfileID=1052
6.

APPENDIX A – FIGURES

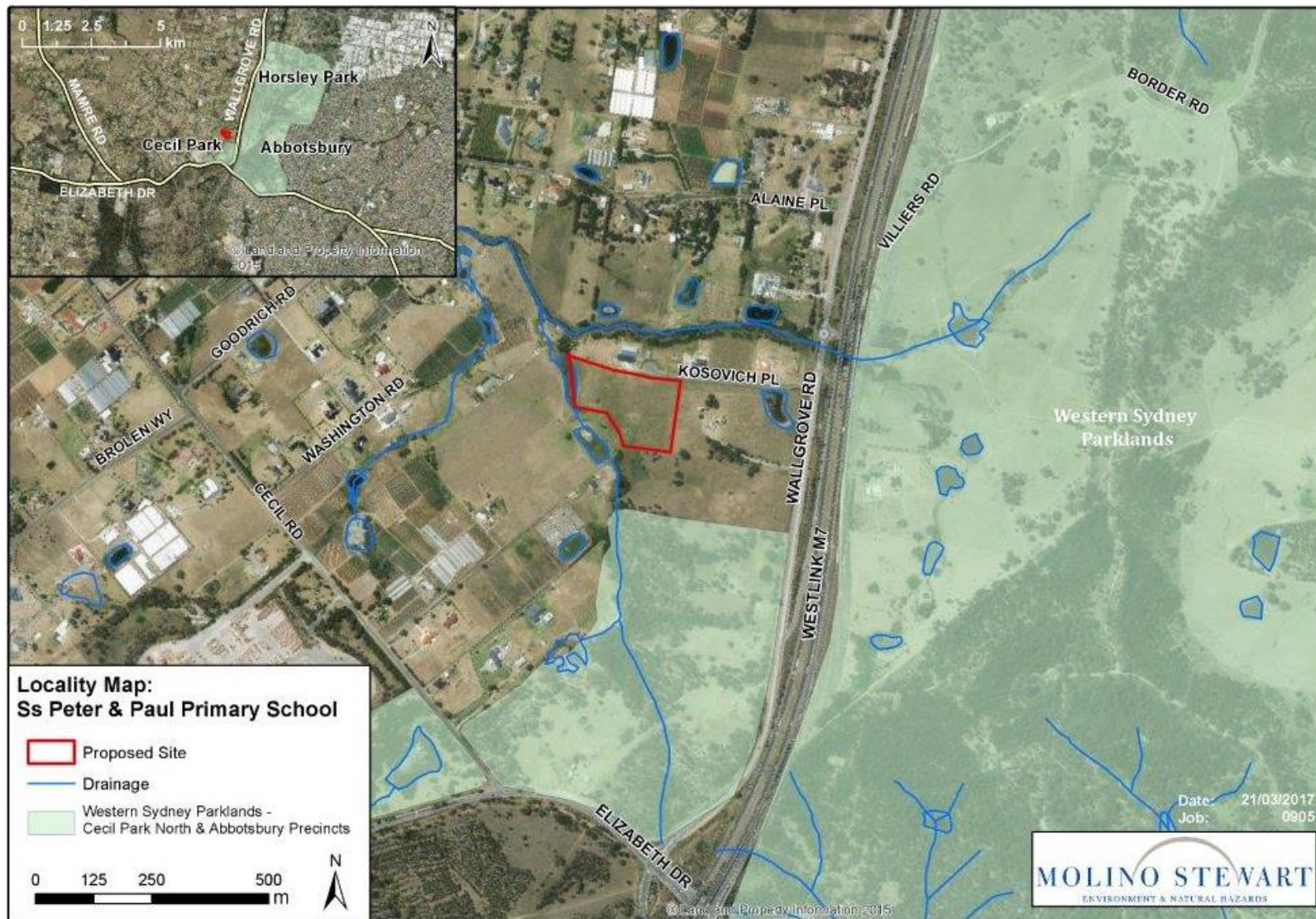


Figure 1 Locality

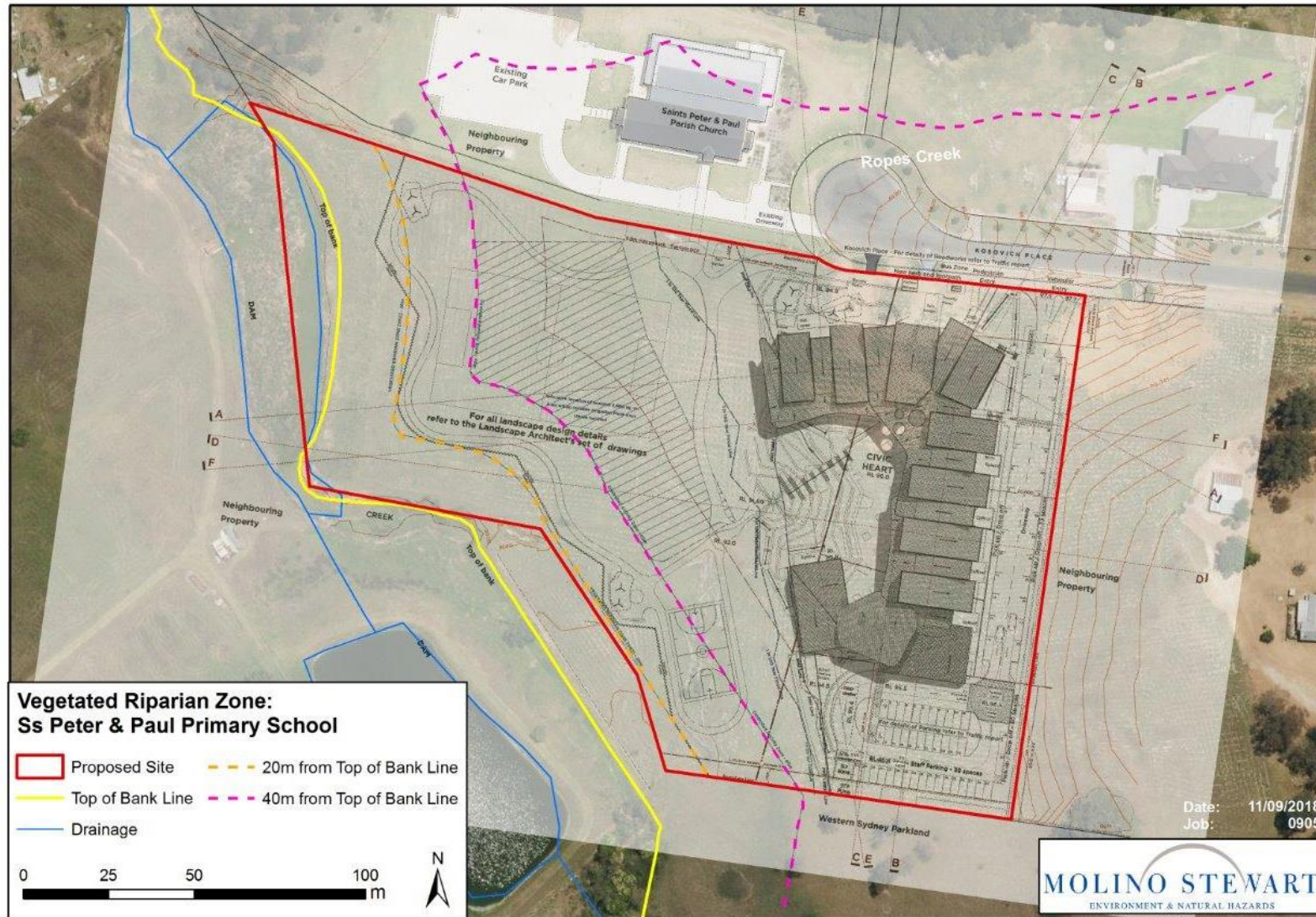


Figure 2 Vegetated Riparian Zone

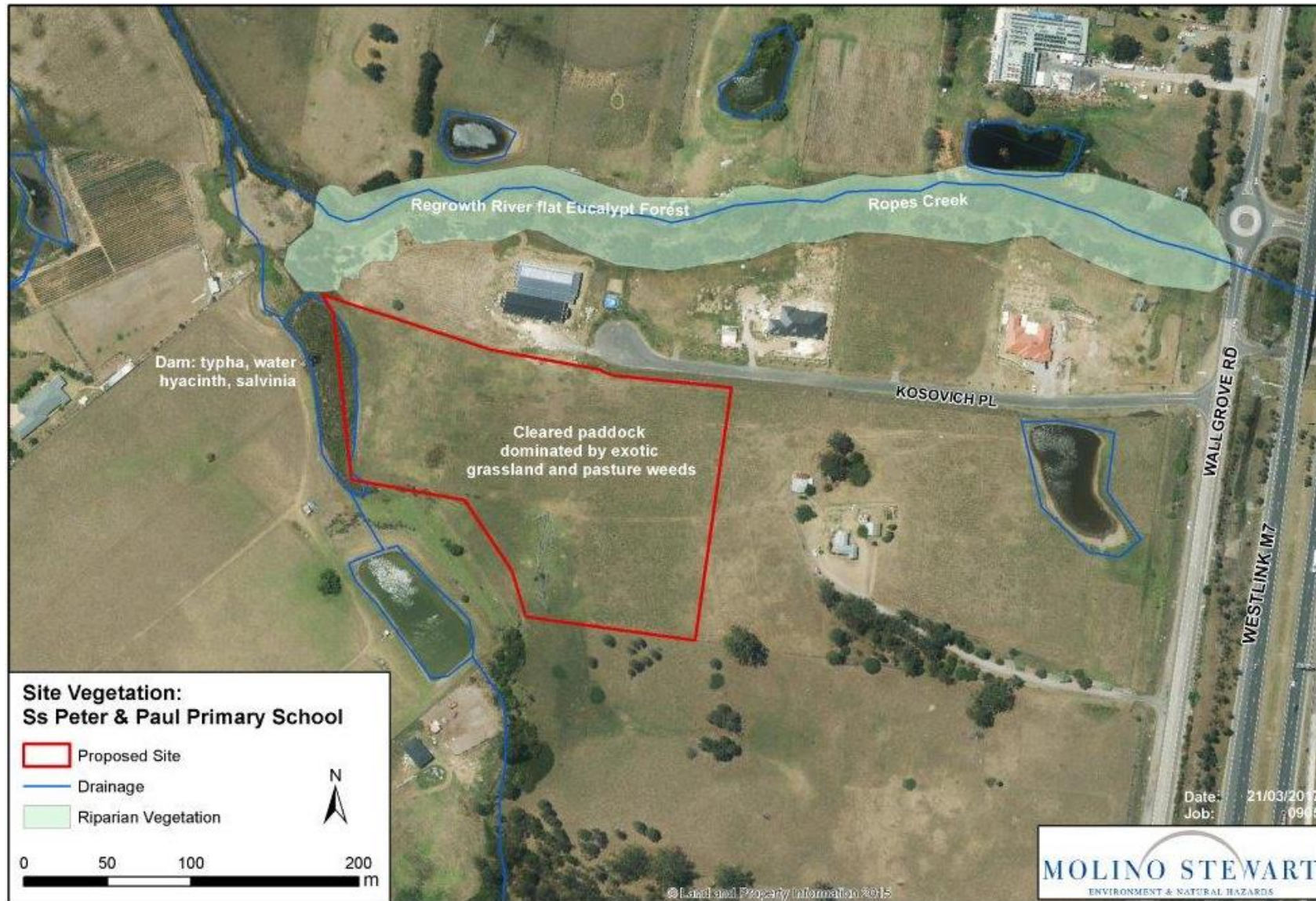


Figure 3 Vegetation

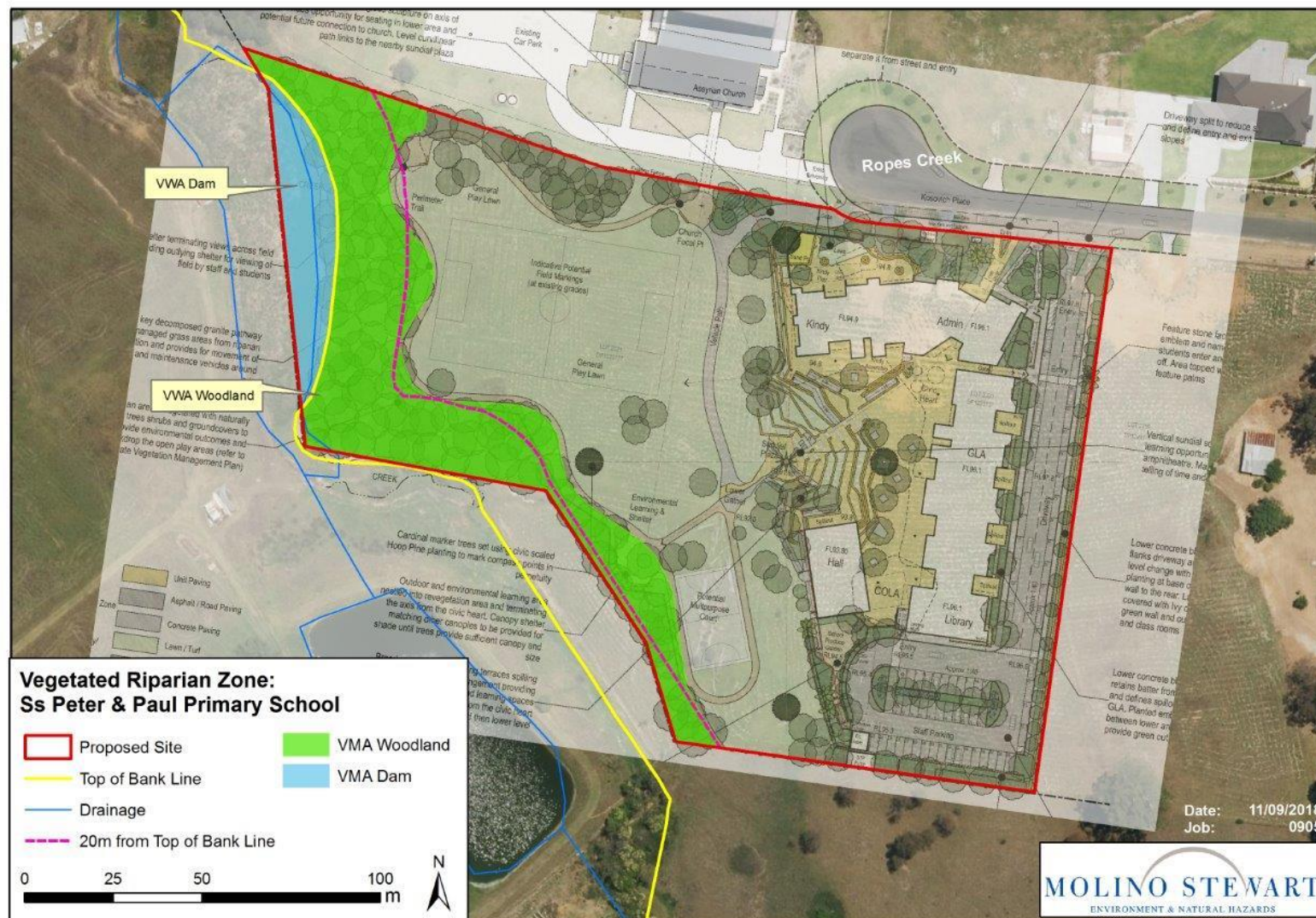


Figure 4 Vegetation management areas