Travers

bushfire & ecology

Watercourse Assessment

Proposed Memorial Park
Wallacia

October 2017
(REF: A17162W)

WATERCOURSE ASSESSMENT

Proposed Cemetery
Lot 2 DP 1108408
13 Park Road, Wallacia

OCTOBER 2017

Report Authors:	Michael Sheather-Reid B. Nat. Res. (Hons.) – General Manager (Senior Ecologist)
Plans prepared:	Sandy Cardow Kelly Tucker Dip. SIS.; B.Sc.
Checked by:	Michael Sheather-Reid B. Nat. Res. (Hons.) – General Manager (Senior Ecologist)
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Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be interpreted without reference to the entire report.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

ABN 64 083 086 677
PO Box 7138
Kariong NSW 2250

38A The Avenue
Mt Penang Parklands
Central Coast Highway
Kariong NSW 2250

t: 02 4340 5331
e: info@traversecology.com.au
www.traversecology.com.au

Executive Summary

This watercourse assessment report has been prepared by *Travers bushfire & ecology* to verify the existing watercourses onsite and to identify riparian buffer constraints in accordance the NSW Office of Water *Controlled activities on waterfront land - Guidelines for Riparian Corridors on Waterfront Land,* July 2012).

Based on ground truthing, this report identifies that watercourses do affect Lot 2 DP1108408, 13 Park Road, Wallacia.

In accordance with the NSW Controlled Activity Guidelines, the following riparian protection zones apply within this site:

- first order streams – 10m from top of bank
- second order streams – 20m from top of bank
- third order streams – 30m from top of bank
- Fourth order stream – 40m from top of bank

The riparian zone widths for the mapped watercourses in accordance with the NSW Office of *Water Controlled Activity Guidelines (2012)* are:

- CATCHMENT A (619ha) contains the western located watercourses WC1 & WC2 – fifth and fourth order streams respectively retained as is and subject to a vegetation management plan.
- CATCHMENT B (123ha) contains the northern located watercourses WC3 to WC15– first to fourth order streams – WC11 is declassified to a drainage line, WC12, WC13 and WC15 area proposed to be replaced by bio-retention swales. Loss of riparian zone has been offset.

In accordance with the NSW Office of Water Controlled activities on waterfront land - Guidelines for Riparian Corridors on Waterfront Land (2012), non-riparian uses are allowed within the outer 50% of the vegetated riparian zone, as long as offsets are provided in accordance with the averaging rule.

The riparian corridor offsetting provision has been used to offset the loss of any portions of the riparian corridor impacted by proposed works within the riparian corridor. An equivalent area riparian corridor offset can be provided for any losses of riparian protection zone.

The placement of buildings and any other non-riparian corridor uses are to be in accordance with the Table 3 - Riparian corridor matrix and the ‘Averaging Rule’ of the NSW Controlled Activity Guidelines (2012).

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Introduction 1

This watercourse assessment report has been prepared by *Travers bushfire & ecology* to verify the existing watercourses onsite and to identify riparian buffer constraints in accordance the NSW Office of Water *Controlled activities on waterfront land - Guidelines for Riparian Corridors on Waterfront Land,* July 2012).

Based on ground truthing, this report identifies that watercourses do affect lands at No. 13 Park Road, Wallacia for proposed memorial development. The 'study area' referred to throughout this report incorporates Lot 2 DP 1108408 and Lot 512 DP 1079728.

This report identifies whether this site is affected by watercourses as defined under the *Water Management Act* 2000, assess the condition of the watercourse, presence of any sensitive riparian habitat, confirm the extent of watercourses, their classification and to assess the level of riparian corridor protection required in accordance with the Controlled Activity Guidelines for watercourses as issued by the *Office of Water - NSW DPI.*

Figure 1 – Study Area

The proposed development requires the removal of several first order streams for bio-retention swales. Riparian offsets area however provided as part of the proposed use of the site including revegetation of now cleared riparian lands.

1.1 Proposed Subdivision Development

The proposed development involves the construction of the following built facilities on site:

- A multipurpose chapel (with crematorium below);
- A administration office;
- Reuse of existing building as function room; and
- Reuse of existing workshop building.

A road network has been designed to allow access to each of these facilities and access to the various burial and memorial sites throughout the development. Pathways are also provided. Please refer to Figure 2 for an illustration of the proposed road network and built facilities.

Aerial photography and mapping obtained from the NSW Land and Property Management Authority's (LPMA) *Spatial Information Exchange* (*SIX Viewer*) and *Near Maps* indicates that there are a number of dams and streams located within, and in the vicinity of, the site (refer Figure 3). Where required, measures need to be taken to provide appropriate riparian protection for any future development to maintain water quality and to conserve riparian vegetation and associated faunal habitat.

The basis of the following report was a detailed ground-truthing investigation in order to verify the presence and environmental value of any streams and to provide recommendations on riparian protection zones.

1.2 Background Details

Table 1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1 – Site features

Location	13 Park Road, Wallacia
Size	Approx. 44 hectares
Local government area	Wollondilly
Grid reference	282400E 6250300N
Topography	The majority of slopes are gentle although there are some moderately steep short rises near to drainage lines.
Geology and soils	Bringelly Shale Formation covers most of the site except around Jerrys Creek which bisects the site near the western end. This geological unit Quaternary Alluvium. The south-western tip around the club house is located on the Blacktown Soil Landscape. Jerrys Creek and immediate surrounds is located on the Richmond Soil Landscape. The remainder of the site is located on the Luddenham Soil Landscape.
Catchment and drainage	Jerrys Creek bisects the site in the western portion. A tributary of Jerrys Creek runs close to the northern boundary of the site. Jerrys Creek joins onto the Nepean River approximately 500m to the west, but it meanders for approximately 1500m.
Vegetation	Natural remnant vegetation on site is shale or alluvium derived. Shale derived vegetation is Cumberland Plain Woodland, and alluvium derived is River-flat Eucalypt Forest on Coastal Floodplains.
Existing land use	Golf course.
Clearing	>90% of the natural vegetation has been cleared from the site.

Figure 2 – Proposed site layout plan

Mapped Watercourses 2

Electronic aerial photography from *Near Maps* and *Spatial Information Exchange* were viewed. Topographic mapping for the site (Figure 2) was also viewed as the key trigger of a nominated watercourse for assessment purposes.

2.1 Mapped Watercourses

Two Main catchments cover the site consisting of Jerrys Creek Catchment areas. Mapped watercourses and their stream order is shown on Figure 3 including:-

- CATCHMENT A (619ha) contains the western located watercourses WC1 & WC2 – fifth and fourth order streams respectively retained as is and subject to a vegetation management plan.
- CATCHMENT B (123ha) contains the northern located watercourses WC3 to WC15– first to fourth order streams – WC11 is declassified to a drainage line, WC12, WC13 and WC15 area proposed to be replaced by bio-retention swales. Loss of riparian zone has been offset.

Catchment A (Jerry's Creek) supports a catchment area of approximately 619ha. It contains the well-defined watercourses 1 & 2 includes of Jerry's Creek reflecting the larger catchment size. Within the site, watercourses 1 & 2 are subject to flooding and are mapped as fourth order streams. Vegetation within the watercourses 1 & 2 has been mostly cleared and is severely weed infested or managed as part of the golf course lands. The existing banks are mostly stable except in the northern portions.

Catchment B (not named) supports a catchment area of approximately 123ha. It contains several mapped watercourses WC3 to WC15. The main channel along the northern boundary of the site consists of WC 3 to WC5. WC6, WC7, WC8 and WC9 have been highly modified and cleared of any native vegetation. WC 6 & 7 have been piped through current fairways.

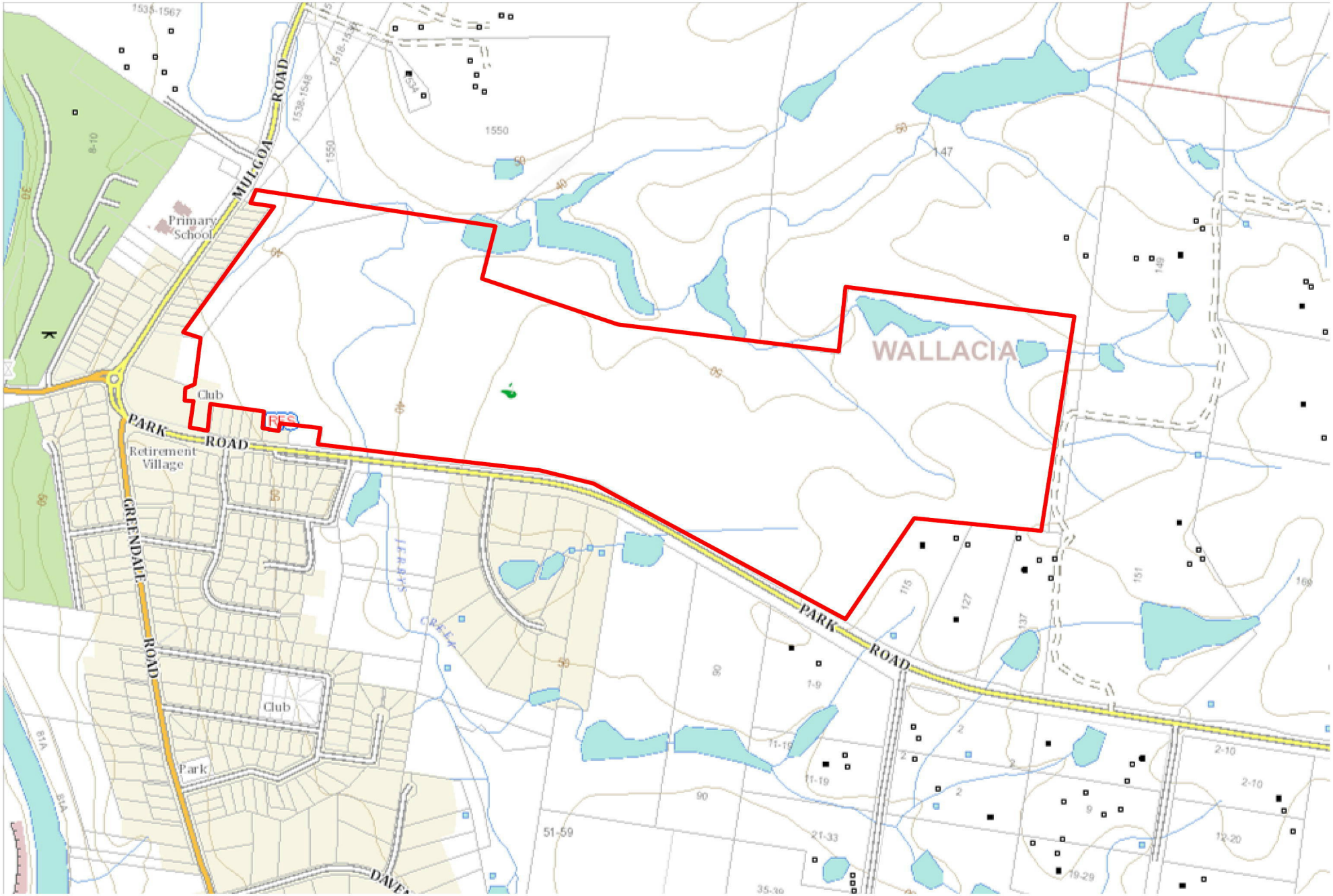


Figure 2 – Watercourses as mapped on SIX MAPS

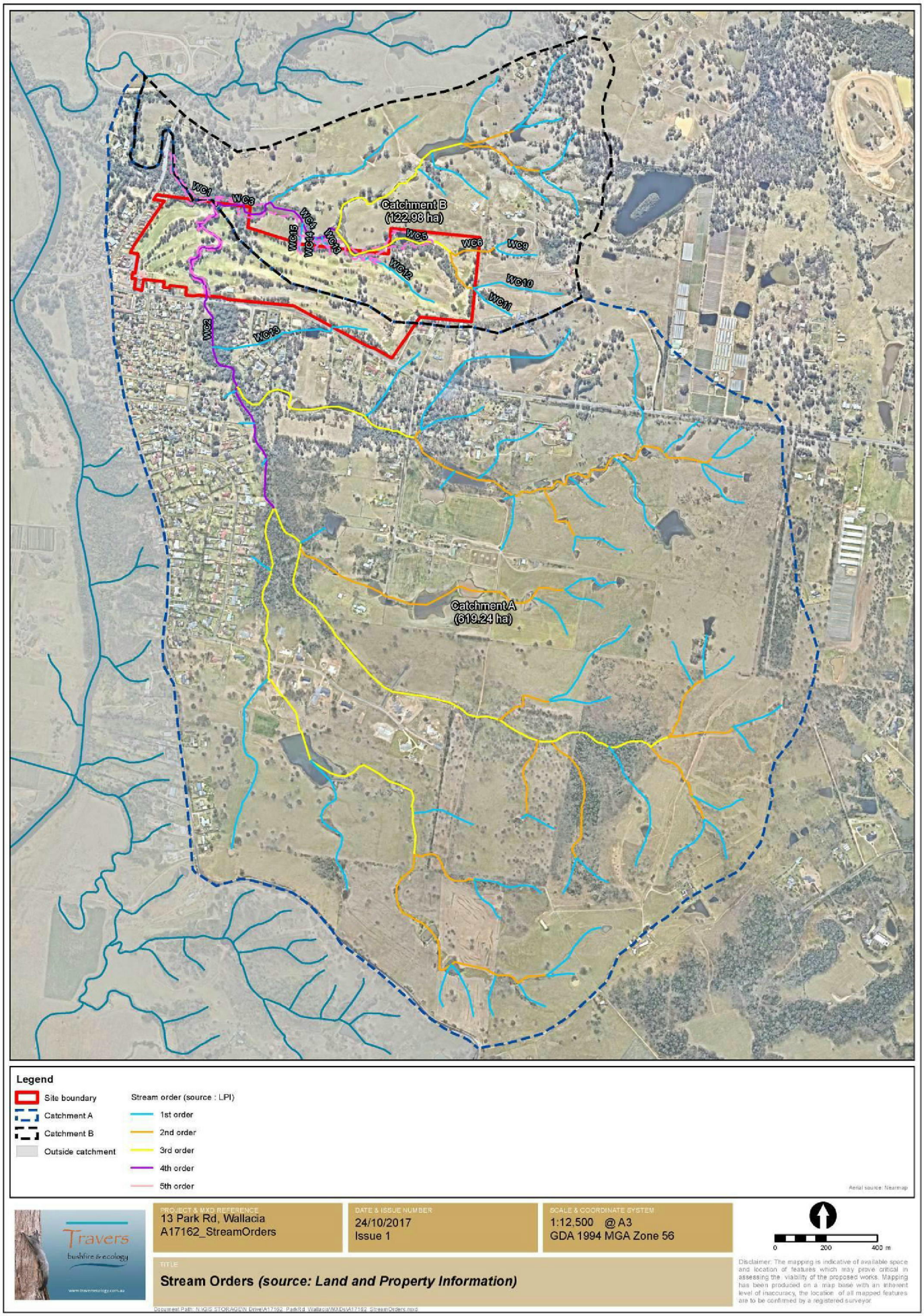


Figure 3 – Stream order mapping

2.2 Stream Orders

In accordance with the Strahler method and the current NSW DPI Office of Water *Controlled Activity Guidelines (2012)*, the following streams orders applies to each mapped watercourse (Figure 3).

- Watercourse 1 – stream order 4
- Watercourse 2 – stream order 4
- Watercourse 3 – stream order 4
- Watercourse 4 – stream order 4
- Watercourse 5 – stream order 3
- Watercourse 6 – stream order 2
- Watercourse 7 – stream order 2
- Watercourse 8 – stream order 1
- Watercourse 9 – stream order 1
- Watercourse 10 – stream order 1
- Watercourse 11 – stream order 1
- Watercourse 12 – stream order 1
- Watercourse 13 – stream order 1
- Watercourse 14 – stream order 1
- Watercourse 15 – stream order 1
- Watercourse 16 – stream order 1

Validation of Watercourses 3

An inspection of the site and its watercourses was undertaken on 1st November 2010 to identify the presence or absence of watercourse features.

For each water course present, the following features were assessed:

- the presence of a defined channel (*either intermittent or continuous*) along the alignment of the watercourse;
- the extent of riparian vegetation, specifically:
- the presence of vegetation with environmental value, such as native species
- the presence of noxious weeds and degree of weed infestation
- the presence of any ponded water;
- the presence of flow along the stream and the associated flow velocity;
- the presence of any aquatic or terrestrial fauna; and
- the potential connectivity between any riparian vegetation and upstream or downstream riparian.

As identified on Figure 3, the site contains two catchments as follows:

- Catchment A – 619ha – Jerry's Creek
- Catchment B - 123 ha – Sub-catchment of Jerry's Creek

The extent of each validated watercourse is also illustrated on Figure 4 which also identifies riparian protection zones as per the stream order. Drainage lines 1 & 2, that are not watercourses are also shown.

3.1 Catchment A – Water Course 1 & 2

The inspection identified the following watercourse features:

- Presence of a defined channel which was flowing at the time of inspection and unlikely to cease to flow in dry conditions;
- Dense and heavily weed infested riparian vegetation mostly cleared to the top of bank.
- There were a large range of environmental weed species;
- Ponding of water and was flowing at a low velocity at the time of inspection;
- Disconnected vegetation connectivity but extensive vegetation upstream and downstream to the south and north.
- Evident floodplain within golf course.

Physical evidence supports the presence of a high order stream with natural channel but heavily disturbed and managed riparian vegetation that is capable of providing a long term vegetative link to the north and south, which is moderate to high ecological value.

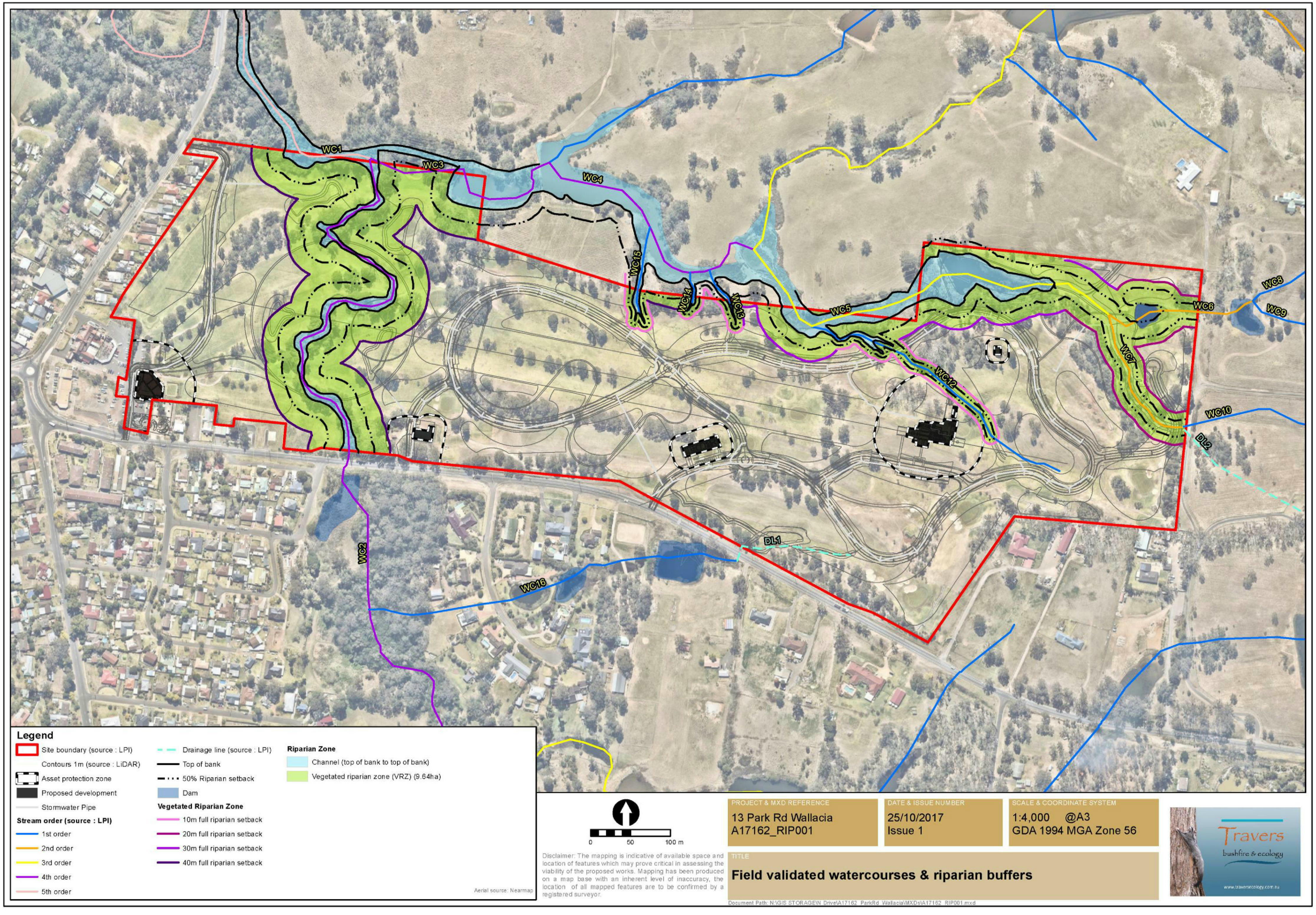


Figure 4 – Validated water courses & riparian corridors

3.1.1 Recommended Management

Due to the degraded riparian vegetation and banks, it is recommended that riparian vegetation is established to a minimum 50% riparian offset line (i.e. 20m from top of bank) All weeds are to be targeted and removed to allow the revegetation fo a fully structured riparian vegetation to 20m from top of bank. As the site is a floodplain the outer 20m of the riparian corridor is to be kept free of understorey vegetation so as to not slow passage of water. Selected tree planting could also be undertaken in the outer 20m of the riparian corridor

Existing stormwater pipes within the creek are in a poor condition and should be removed to allow the creek to be restored. Proposed water quality treatment devices are to be planted with native sedge species and to revegetate the embankments adjoining the riparian corridor to provide habitat connectivity.

Existing crossings should be re-examined

3.1.2 Watercourse Photos

***Photo 1** – Watercourse 2 – Within floodplain immediately upstream of confluence with WC1*

Photo 2 *- Watercourse 2 – looking upstream channel showing highly managed edges*

Photo 3 – *Watercourse 2 – looking downstream of photo 2 - partially aquatic macrophytes within channel portions with no canopy*

Photo 4 – *Watercourse 2 – Upstream vegetated portion at the southernmost cart crossing (very limited riparian vegetation)*

3.2 Catchment B - Water Course 3 & 4

Watercourses 3 & 4 are offsite adjacent to the northern boundary. Photographs were note taken but the inspection identified the following watercourse features:

- Presence of a defined channel with evidence of constraint flows from ground seepage;
- WC3 vegetation in the downstream reach
- Scattered remnant native trees hugging the defined channel only in the lower reaches within a pasture;
- WC4 mostly impounded water
- Low levels of weeds as the creek and embankments are managed as pasture blackberry evident in locations;
- Ponding within each dam;

Physical evidence supports the presence of a highly modified watercourse with substantive open water habitat.

3.2.1 Recommended Management

No Management required

3.3 Catchment B - Water Course 5

Watercourses 5 is a mostly vegetated channel partially within the site. Photographs were note taken but the inspection identified the following watercourse features:

- Presence of a defined channel with evidence of constraint flows from ground seepage;
- Scattered remnant native trees , regenerating native vegetation some of which is likely to be planted;
- blackberry evident in locations;
- Ponding within each dam;

Physical evidence supports the presence of a modified watercourse with substantive open water habitat.

3.3.1 Recommended Management

WC5 is the receiving waters of flows from the site. Improve riparian protection where watercourse 5 is within the site. Provide a 30m VRZ from top of bank and revegetate within locally occurring riparian vegetation.

3.3.2 Watercourse Photo

***Photo 5** – WC5 downstream of northern most dam showing regrowth and existing native vegetation*

Photo 6 *– Main dam on WC5 looking downstream from WC 6&7*

3.4 Catchment B - Water Course 6 & 7

Watercourses 6 & 7 are within the site adjacent to the northern boundary but have been piped. Seepage is evident on the surface with a damp and spongy soil surface.

Physical evidence supports the presence of a former watercourse which has been highly modified and is now completely artificial.

3.4.1 Recommended Management

Reinstatement of an open channel and restoration riparian vegetation as a riparian offset for the loss of riparian corridors within the site.

3.4.2 Watercourse Photos

***Photo 7** – Watercourse 5 leading into the junction of WC 6& 7 – stormwater pits evident in photo*

***Photo 8** – Watercourse 7 showing approximate alignment of the pipeline*

Photo 9 – *Watercourse 7 showing existing modified channel upstream of the pipe section*

3.5 Catchment B - Water Course 8, 9, 10 & 11

Watercourses 8, 9, 10 & 11 are offsite adjoining the eastern boundary. All are within managed pasture with limited native vegetation. An existing raised access road on an embankment runs along the eastern boundary containing medium to large culverts to allow water t pass downstream in to the golf course

Physical evidence supports the presence of a former watercourse which has been highly modified and is now completely artificial.

Water course 11 shows no watercourse attributes and has been classified as a drainage line for the purposes of this report.

3.5.1 Recommended Management

No Management required as they are offsite.

3.5.2 Watercourse Photos

Photo 10 *– Watercourse 8 –swale in existing pasture within lands adjoining the eastern boundary of the site*

Photo 11 *– Watercourse 11 – no channel present (not a watercourse) with a very small catchment area*

3.6 Catchment B - Water Course 12, 13, 14, 15 & 16

Watercourses 12, 13, 14 and 15 are within the site and drain to the north, Watercourse 16 drains to the south but has no channel formation and has been classified for the purposes of this report as not a water course.

All watercourses are within managed fairways or roughs with limited native vegetation. Physical evidence supports watercourse 12 as a managed by incised watercourse which has been highly modified for the purpose of the existing fairways. Watercourse 12 is suitable for the proposed bio-retention swale with a riparian offset. Watercourses 13, 14 and 15 are watercourses based on the presence of defined channels but are all short runs. Whilst they will carry water they are suitable for the proposed bio-retention swales with a riparian offset.

3.6.1 Recommended Management

Removal and reinstatement as bio-retention swales is appropriate to enhance water quality protection to the receiving waters adjacent to the northern boundary (Watercourse 4 & 5).

3.6.2 Watercourse Photos

Photo 12 *– Watercourse 15 within fairway and rough – presents as a drainage swale - short run channel immediately behind photographer*

Photo 13 *– Watercourse 14 within rough – short run channel evident under native grass – suitable for revegetation of CPW.*

Photo 14 *– Watercourse 13 within rough at downstream extent – continues 250m through fairway within evidence of partial channel formation – Photographer standing within flat adjoining watercourse 5 suitable for restoration for wetland species.*

Photo 15 *– Middle section of watercourse 13 within rough – continues for another 100m through fairway within evidence of partial channel formation- proposed as a bioretention swale.*

Photo 16 *–Watercourse 16 within rough – not a watercourse presents as a swale and classified as a drainage line - no channel formation and all water flows controlled by dam on the southern side of Park Road, Wallacia.*

Riparian Buffers & Controls

4

4.1 Objectives for riparian corridor management

The overarching objective of the controlled activities provisions of the *WM Act* is to establish and preserve the integrity of riparian corridors (NSW Office of Water *Controlled activities on waterfront land - Guidelines for Riparian Corridors on Waterfront Land* 2012). Ideally, the environmental functions of riparian corridors should be maintained or rehabilitated by applying the following principles:

- Identify whether or not there is a watercourse present and determine its order in accordance with the Strahler System.
- If a watercourse is present, define the riparian corridor / vegetated riparian zone on a map in accordance with Table 1.
- Seek to maintain or rehabilitate a riparian corridor / vegetated riparian zone with fully structured native vegetation in accordance with Table 1.
- Seek to minimise disturbance and harm to the recommended riparian corridor / vegetated riparian zone.
- Minimise the number of creek crossings and provide perimeter road separating development from the riparian corridor / vegetated riparian zone.
- Locate services and infrastructure outside of the riparian corridor / vegetated riparian zone. Within the riparian corridor / vegetated riparian zone, provide multiple service easements and / or utilise road crossings where possible.
- Treat stormwater run-off before discharging into the riparian corridor / vegetated riparian zone.

The NSW Office of Water however, does allow for a range of works and activities on waterfront land and in riparian corridors to better meet the needs of the community, providing that they cause minimal harm, as outlined in the riparian corridor matrix below.

4.2 Riparian corridors

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000 (WM Act).* The NSW Office of Water administers the *WM Act* and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity.

Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40m of the highest bank of the river, lake or estuary. It is noted the Endangered Protected Wetlands as listed under the Biodiversity Conservation Act 2016 are a ‘wetland’ which is defined under the definition of a ‘lake’ under the Water Management Act 2000. This means that any ‘wetlands’ are defined as waterfront land and a controlled activity approval must be obtained from the Office of Water before commencing the controlled activity.

The NSW Office of Water has developed *Controlled Activity Guidelines* (2012) to assist applicants who are considering carrying out a controlled activity on waterfront land. On 1st July 2012 new rules commenced regarding controlled activities within riparian corridors. The new rules amend the riparian corridor widths that apply to watercourses, providing more flexibility in how riparian corridors can be used and making it easier for applicants to determine the Office of Water controlled activity approval requirements. Key aspects of the changes include:

- Provision of greater flexibility in the allowable uses and works permitted within riparian corridors.
- The core riparian zone and vegetated buffer have been combined into a single vegetated riparian zone.
- The width of the vegetated riparian zone within the riparian corridor has been pre-determined and standardised for first, second, third and fourth order and greater watercourses.
- Where suitable, applicants may undertake non-riparian corridor works or development within the outer 50% of a vegetated riparian zone, as long as they offset this activity by connecting an equivalent area to the riparian corridor within the development site, and
- The riparian corridors matrix enables applicants to determine what activities can be considered in riparian corridors.

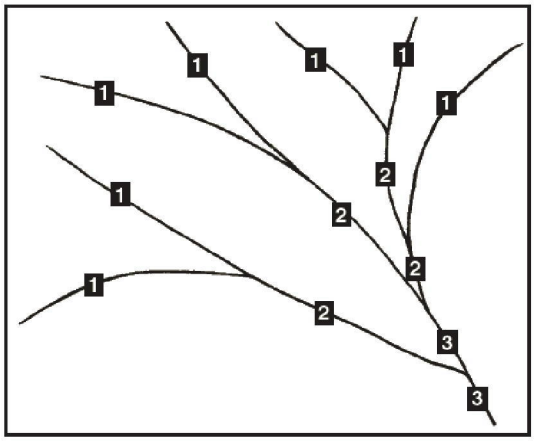
As stated in the controlled activity guidelines for the preparation of vegetation management plans (NSW Office of Water 2012), a riparian corridor forms a transition zone between the land, also known as the terrestrial environment, and the river or watercourse or aquatic environment. Riparian corridors perform a range of important environmental functions such as:

- Providing bed and bank stability and reducing bank and channel erosion.
- Protecting water quality by trapping sediment, nutrients and other contaminants.
- Providing diversity of habitat for terrestrial, riparian and aquatic plants (flora) and animals (fauna).
- Providing connectivity between wildlife habitats.
- Conveying flood flows and controlling the direction of flood flows.
- Providing an interface or buffer between developments and waterways, and
- Providing passive recreational uses.
- The protection, restoration or rehabilitation of vegetated riparian corridors is important for maintaining or improving the shape, stability (or geomorphic form) and ecological functions of a watercourse (NSW Office of Water 2012).
- The proposed management of the riparian corridors can accommodate all these functions without compromising the bushfire safety of the proposed development areas.

4.3 Riparian corridors widths

The NSW Officer of Water recommends a vegetation riparian zone width based on watercourse order as classified under the Strahler System of ordering watercourses and using current 1:25 000 topographic maps (see Figure 5 and Table 2). The width of the VRZ should be measured from the top of the highest bank on both sides of the watercourse (NSW Office of Water *Controlled activities on waterfront land - Guidelines for Riparian Corridors on Waterfront Land* 2012).

Table 2 - Recommended riparian corridor widths



Watercourse type	VRZ width (each side of watercourse) (metres)	Total RC width (metres)
First order	10	20 + channel width
second order	20	40 + channel width
third order	30	60 + channel width
fourth order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40	80 + channel width

Figure 5 - The Strahler System

Stream order: The watercourse order as classified under the Strahler System based on 1:25,000, 1:50,000 or 1:100,000 topographic maps, whichever is the smallest scale available. A full list is provided at Part 2, Schedule 2 of the *Water Management (General) Regulation 2011.*

The adherence to the NSW Office of Water Controlled Activity Guidelines is subject to the approval by the NSW Office of Water and the development consent authority. Consequently alternative solutions are assessed by the NSW Office of Water based on their performance in terms of achieving riparian management objectives. Where a watercourse does not exhibit the features of a defined channel with bed and banks, the NSW Office of Water may determine that the watercourse is not waterfront land for the purposes of the *WM Act.*

In accordance with the NSW Office of Water *Controlled Activity Guidelines (2012)* the following watercourse types have been given to the existing watercourses onsite:-

- Watercourses 8, 9, 10, 12, 14, 15 – first order streams.
- Watercourses 6 & 7 – second order streams.
- Watercourse 5 – third order stream.
- Watercourse 1, 2, 3 & 4 - fourth order streams.

Watercourses 11 & 13 within the site are not showing any strong channel formation or riparian characteristics and have been declassified as a watercourse but retain a status of a drainage line for catchment protection purposes.

The vegetated riparian zone widths In accordance with the NSW Office of Water *Controlled Activity Guidelines (2012)* are: The riparian zone widths in accordance with the NSW Office of *Water Controlled Activity Guidelines (2012)* are:

- Watercourses 8, 9, 10, 12, 14, 15 – VRZ is 10m from top of bank.
- Watercourses 6 & 7 –VRZ is 20m from top of bank
- Watercourse 5 – VRZ is 30m from top of bank.

- Watercourses 1, 2, 3 & 4 – VRZ is 40m from top of bank.

The proposed riparian setbacks are consistent with the NSW Office of Water Guidelines for Controlled Activities (2012) with the exceptions to watercourses 12, 13 and 15 which are proposed to be used as bio-retention swales which have been offset within the north-western portions of the site to recreate the vegetated riparian corridors removed for fairways.

A preparation of a vegetation management plan for the riparian corridors is recommended to accurately define the planting densities, spacings and species to be used within each riparian corridor and to integrate with any other vegetation management works or landscaping within the site.

4.4 Permissible works and activities within riparian corridors

The following riparian corridor matrix enables applicants to identify certain works and activities that can occur on waterfront land and in riparian corridors. Applicants should note that the matrix relates to controlled activity approvals under the *WM Act* only. They are still required to comply with other relevant government legislation, such as threatened species, flood planning levels and fisheries guidelines.

Table 3 - Riparian corridor matrix

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

4.4.1 Riparian corridor off-setting for non-riparian corridor uses

In accordance with the NSW Office of Water *Controlled Activities on Waterfront Land - Guidelines for Riparian Corridors* (2012), non-riparian uses, such as APZs are allowed within the outer 50% of the vegetated riparian zone, so long as offsets are provided in accordance with the averaging rule.

The current proposal indicates that the existing riparian corridors will be partly impacted by a proposed stormwater detention and water quality treatment devices and asset protection zones. Riparian offsetting has been provided for the impacted riparian corridors and revegetation works are to be undertaken. The proposed internal road also impacts within the 50% offset line for top of bank adjoining the northern most dam. This is not considered to significantly affect the riparian zone. Other proposed activities such as cycleways, paths, detention basins, stormwater outlet structures and essential services and stream realignment are permissible in accordance with the NSW Office of Water *Controlled activities on waterfront land - Guidelines for Riparian Corridors on Waterfront Land* (2012).

Figure 6 shows the required riparian corridors, riparian loss due to proposed works and proposed riparian offsets.

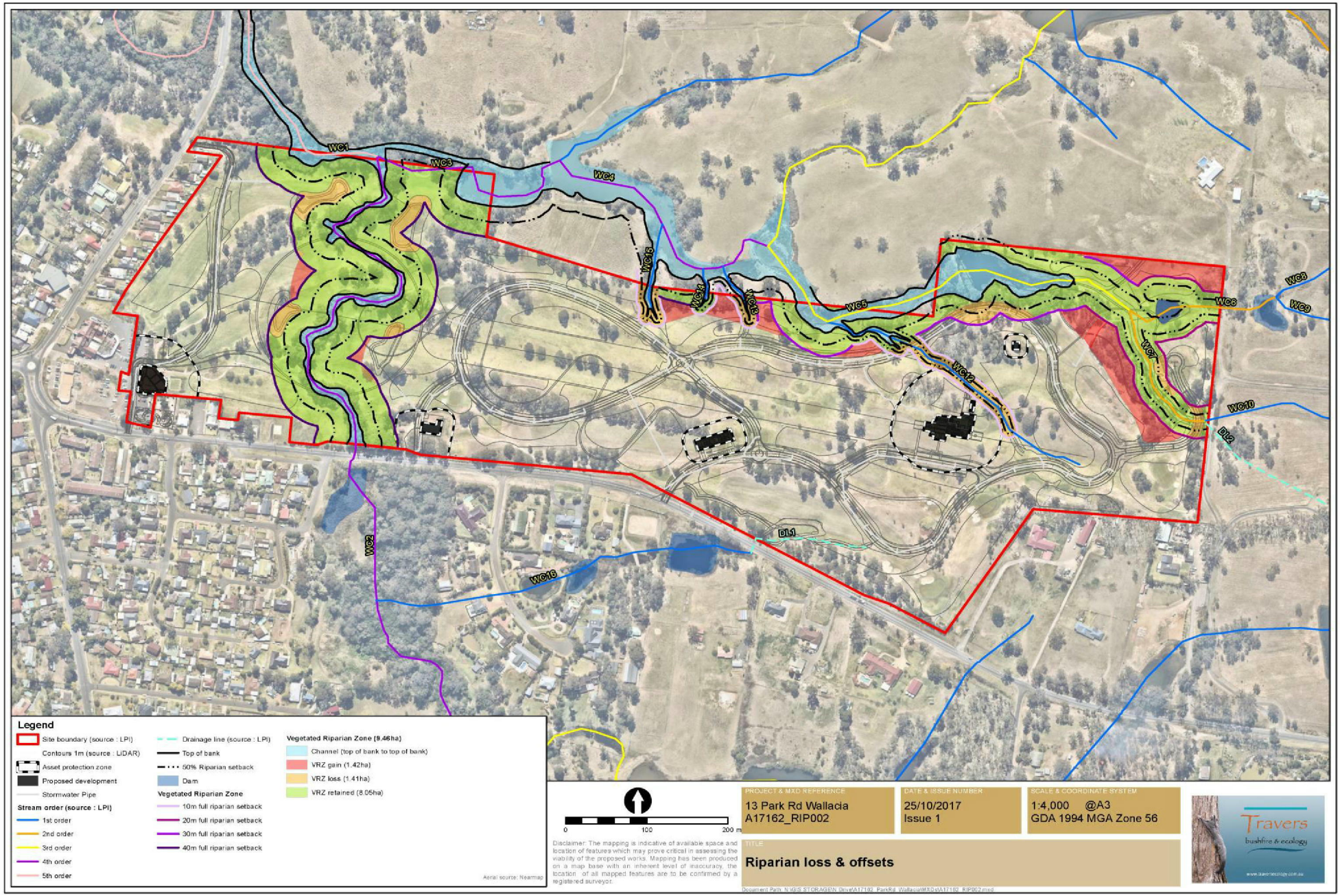


Figure 6 - Proposed riparian loss and offsets

Conclusions and Recommendations 5

The classification of field validated watercourses is illustrated on Figure 6.

The riparian zone widths in accordance with the NSW Office of *Water Controlled Activity Guidelines (2012)* are:

- Watercourses 8, 9, 10, 12, 14, 15 – VRZ is 10m from top of bank.
- Watercourses 6 & 7 –VRZ is 20m from top of bank
- Watercourse 5 – VRZ is 30m from top of bank.
- Watercourses 1, 2, 3 & 4 – VRZ is 40m from top of bank.

No other watercourses are present onsite – watercourse 11 and 13 are recommended to be declassified as watercourses to drainage lines requiring no riparian protection.

Alternative solutions for highly degraded watercourses are appropriate for this site and approvable under a Controlled Activity Approval from the NSW Office of Water in accordance with the requirements of the *Water Management Act 2000.*

Ongoing management of the site's riparian zones will generally be in accordance with the *Controlled Activity Guidelines for Riparian Corridors* as issued by the NSW Office of Water and the issued General Terms of Approval.

This will require the preparation of a vegetation management plan for all retained watercourses to accurately define planning densities, spacing and plant species to be used. However, this report proposes alternative outcomes to effectively integrate and maintain the functions of riparian lands.

Riparian vegetation will be established, maintained and existing vegetation will be retained and strategically enhanced to improve riparian protection. All watercourses except that of Jerry's Creek will be restored to the required vegetation riparian zone. Partial revegetation of the Jerry's Creek riparian corridor will be revegetated (inner 50% of the riparian corridor) to improve ecological connectivity and to stabilise all existing banks but the outer flood conveyance zones within the land will be retained as open space.

NSW Office of Water Controlled Activity Guidelines 2012

A1

Department of Primary Industries
Office of Water

CONTROLLED ACTIVITIES ON WATERFRONT LAND

Guidelines for riparian corridors on waterfront land

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). The NSW Office of Water administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity.

Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

This means that a controlled activity approval must be obtained from the Office of Water before commencing the controlled activity.

What is a riparian corridor?

A riparian corridor (RC) forms a transition zone between the land, also known as the terrestrial environment, and the river or watercourse or aquatic environment. Riparian corridors perform a range of important environmental functions such as:

- providing bed and bank stability and reducing bank and channel erosion
- protecting water quality by trapping sediment, nutrients and other contaminants
- providing diversity of habitat for terrestrial, riparian and aquatic plants (flora) and animals (fauna)
- providing connectivity between wildlife habitats
- conveying flood flows and controlling the direction of flood flows
- providing an interface or buffer between developments and waterways
- providing passive recreational uses.

The protection, restoration or rehabilitation of vegetated riparian corridors is important for maintaining or improving the shape, stability (or geomorphic form) and ecological functions of a watercourse.

Changes to controlled activities within riparian corridors

On 1 July 2012 new rules commenced regarding controlled activities within riparian corridors. The new rules amend the riparian corridor widths that apply to watercourses, providing more flexibility in how riparian corridors can be used and making it easier for applicants to determine the Office of Water controlled activity approval requirements. Key aspects of the changes include:

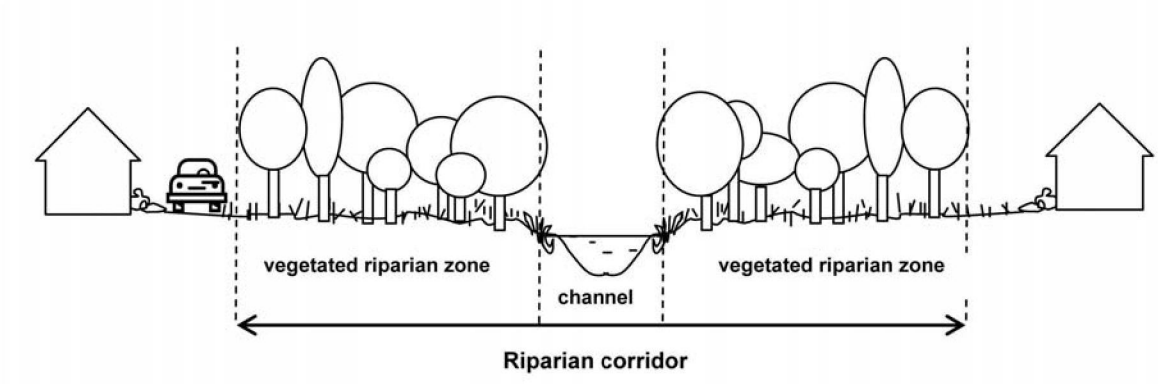
- Provision of greater flexibility in the allowable uses and works permitted within riparian corridors.
- The core riparian zone and vegetated buffer have been combined into a single vegetated riparian zone (VRZ).
- The width of the VRZ within the riparian corridor has been pre-determined and standardised for first, second, third and fourth order and greater watercourses.
- Where suitable, applicants may undertake non-riparian corridor works or development within the outer 50 per cent of a VRZ, as long as they offset this activity by connecting an equivalent area to the RC within the development site.
- A new ‘riparian corridors matrix’ enables applicants to determine what activities can be considered in riparian corridors.

These changes will simplify the controlled activities application and assessment process, provide greater flexibility, help make more land available for housing, support floodplain, stormwater and bush fire management, and allow riparian corridors to be used for public amenity whilst continuing to deliver environmental outcomes required under the WM Act.

The riparian corridor consists of:

- the channel which comprises the bed and banks of the watercourse (to the highest bank) and
- the vegetated riparian zone (VRZ) adjoining the channel.

Figure 1. The riparian corridor



Riparian corridor widths

The Officer of Water recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses and using current 1:25 000 topographic maps (see Figure 2 and Table 1). The width of the VRZ should be measured from the top of the highest bank on both sides of the watercourse.

Figure 2. The Strahler System

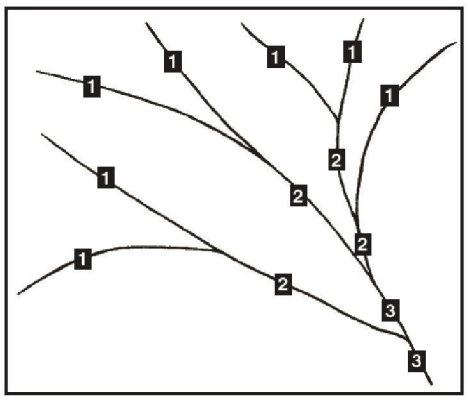


Table 1. Recommended riparian corridor (RC) widths

Watercourse type	**VRZ width** (each side of watercourse)	**Total RC width**
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Note: where a watercourse does not exhibit the features of a defined channel with bed and banks, the Office of Water may determine that the watercourse is not waterfront land for the purposes of the WM Act

Objectives for riparian corridor management

The overarching objective of the controlled activities provisions of the WM Act is to establish and preserve the integrity of riparian corridors.

Ideally the environmental functions of riparian corridors should be maintained or rehabilitated by applying the following principles:

- Identify whether or not there is a watercourse present and determine its order in accordance with the Strahler System.
- If a watercourse is present, define the RC/VRZ on a map in accordance with Table 1.
- Seek to maintain or rehabilitate a RC/VRZ with fully structured native vegetation in accordance with Table 1.
- Seek to minimise disturbance and harm to the recommended RC/VRZ.
- Minimise the number of creek crossings and provide perimeter road separating development from the RC/VRZ.
- Locate services and infrastructure outside of the RC/VRZ. Within the RC/VRZ provide multiple service easements and/or utilise road crossings where possible.
- Treat stormwater run-off before discharging into the RC/VRZ.

The Office of Water however, does allow for a range of works and activities on waterfront land and in riparian corridors to better meet the needs of the community, so long as they cause minimal harm as outlined in the riparian corridor matrix below.

Riparian corridor matrix

The riparian corridor matrix enables applicants to identify certain works and activities that can occur on waterfront land and in riparian corridors. Applicants should note that the matrix relates to controlled activity approvals under the WM Act only. They are still required to comply with other relevant government legislation, such as threatened species, flood planning levels and fisheries guidelines.

Table 2. Riparian corridor matrix

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	●	●	●	●	●	●	●		
2nd	20m	●	●	●	●	●		●		
3rd	30m	●	●	●		●			●	●
4th +	40m	●	●	●		●			●	●

Key

Stream order: The watercourse order as classified under the Strahler System based on 1:25,000, 1:50,000 or 1:100,000 topographic maps whichever is the smallest scale available. A full list is provided at Part 2, Schedule 2 of the Water Management (General) Regulation 2011.

Vegetated riparian zone (VRZ): The required width of the VRZ measured from the top of the high bank on each side of the watercourse.

Riparian corridor (RC) off-setting for non RC uses: Non-riparian uses, such as Asset Protection Zones are allowed within the outer 50 per cent of the VRZ, so long as offsets are provided in accordance with the averaging rule as seen in Figure 3.

Cycleways and paths: Cycleways or paths no wider than four metres total disturbance footprint can be built in the outer 50 per cent of the VRZ.

Detention basins: Detention basins can be built in the outer 50 per cent of the VRZ or online where indicated. Refer to the Office of Water's *Controlled activities. Guidelines for outlet structures* and *Controlled activities. Guidelines for instream works*. Online basins must:

- be dry and vegetated
- be for temporary flood detention only with no permanent water holding
- have an equivalent VRZ for the corresponding watercourse order
- not be used for water quality treatment purposes.

Stormwater outlet structures and essential services: Stormwater outlets or essential services are allowed in the RC. Works for essential services on a fourth order or greater stream are to be undertaken by directional drilling or tied to existing crossings. Refer to the Office of Water's *Controlled activities. Guidelines for laying pipes and cables in watercourses* and *Controlled activities. Guidelines for outlet structures.*

Stream realignment: Indicates that a watercourse may be realigned. Refer to the Office of Water's *Controlled activities. Guidelines for instream works.*

Road crossings: Indicates permitted road crossing methods. Refer to the Office of Water's *Controlled activities. Guidelines for watercourse crossings* and NSW DPI policy and guidelines for fish friendly waterway crossings for Class 1 and 2 waterways.

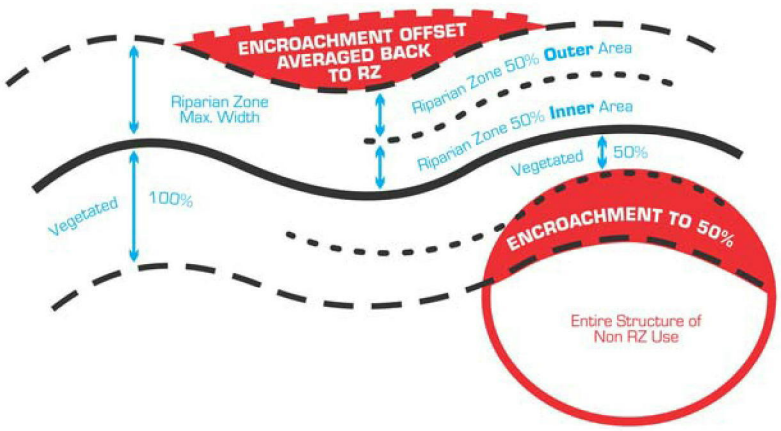
What is the averaging rule?

Non riparian corridor works and activities can be authorised within the outer riparian corridor, so long as the average width of the vegetated riparian zone can be achieved over the length of the watercourse within the development site. That is, where appropriate 50 per cent of the outer vegetated riparian zone width may be used for non-riparian uses including asset protection zones, recreational areas, roads, development lots and infrastructure. However, an equivalent area connected to the riparian corridor must be offset on the site (see Figure 3) and the inner 50 per cent of the vegetated riparian zone must be fully protected and vegetated with native endemic riparian plant species.

Bridges, cycleways, paths, stormwater oulets and other essential services do not need to be offset, but must comply with the requirements set out in the riparian corridor matrix (Table 2) and other relevant Office of Water controlled activities guidelines. Offline detention basins do not need to be offset so long as there is an equivalent VRZ for the corresponding watercourse and they are built in compliance with the Office of Water's *Controlled activities: Guidelines for watercourse crossings* and *Controlled activities: Guidelines for in-stream works*. If a proposed basin will not have an equivalent VRZ for the corresponding watercourse, it may still be built in the outer 50 per cent of the VRZ but must be offset.

The averaging rule should generally be applied to cleared waterfront land. Development proposals involving waterfront lands that contain existing native vegetation should seek to preserve that riparian vegetation in accordance with the minimum riparian corridor requirements outlined in Table 1.

Figure 3. Averaging rule



Applications for controlled activity approvals

Applications for controlled activities approvals should be informed by the riparian corridor matrix shown in Table 2 and prepared using the *Application for a Controlled Activity Approval for works on waterfront land* form and the *Guideline for completing an application for a Controlled Activity Approval*.

Other controlled activity guidelines are available on the Office of Water website and outline relevant considerations for applicants when proposing activities and works on waterfront lands.

Streamlined assessment

Where applications are presented in accordance with the riparian corridor matrix (Table 2) and other Office of Water controlled activity guidelines, they will be assessed under a streamlined process. This may decrease the amount of time it takes the Office of Water to make a determination, saving applicants time and money.

Applications that do not conform to the matrix and/or relevant Office of Water controlled activity guidelines will continue to be subject to merit assessment to ensure that the proposals meet the requirements of the WM Act. All applications will still need to demonstrate that minimal harm will occur to waterfront land before a controlled activity approval will be issued.

Where do I go for additional information?

Find out more about controlled activities at the Office of Water website www.water.nsw.gov.au.

Contact us

Contact a water regulatory officer as listed on the Office of Water website www.water.nsw.gov.au, free call the licensing information on 1800 353 104 or email information@water.nsw.gov.au.

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