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## 200 Aldington Road Industrial Estate - Riparian Assessment

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**Fife Kemps Creek Trust**

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Template 2.8.1

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## Abbreviations

Abbreviation	Description
CBD	Central Business District
CEMP	Construction Environmental Management Plan
ELA	Eco Logical Australia Pty Ltd
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
FM Act	<i>Fisheries Management Act 1994</i>
GFA	Gross Floor Area
Hawkesbury Nepean SREP	<i>Sydney Regional Environmental Plan No. 20 – Hawkesbury Nepean River</i>
NRAR	Natural Resources Access Regulator
Penrith LEP	<i>Penrith Local Environmental Plan 2010</i>
RC	Riparian corridor
SEARs	Secretary's Environmental Assessment Requirements
SEPP WSEA	<i>State Environmental Planning Policy (Western Sydney Employment Area) 2009</i>
SSDA	State Significant Development Application
ToB	Top of Bank
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone
WM Act	<i>Water Management Act 2000</i>

## Executive Summary

This Riparian Assessment is required to support a State Significant Development Application (SSDA) for Aldington Road Industrial Estate, located at 106-228 Aldington Road, Kemps Creek. This report determines potential impacts on the riparian and aquatic ecology from the proposed development and makes recommendations to mitigate those impacts.

This Riparian Assessment has been prepared to assess the development's impact on the mapped watercourses and riparian corridors on site, as per the Secretary's Environmental Assessment Requirements (SEARs) issued in July 2020 which require *'an assessment of the development's impacts on the riparian corridor and wetland on site, including detailed interface management measures'*.

Two mapped watercourses are located in the development area. The site survey identified that the 1<sup>st</sup> order watercourse at the south of the site did not meet the definition of a 'river' under the *Water Management Act 2000* (WM Act). The 1<sup>st</sup> order watercourse in the north east of the site was likely to meet the definition of a 'river' under the WM Act due to the defined nature of the watercourse upstream of the study area, however the flow path does not follow that of the mapped hydroline.

There were 11 farm dams identified within and adjacent to the study area. Most of these had limited aquatic habitat and eight are to be removed as part of the proposed development. The dam in the northern-most section of the site had moderate levels of aquatic habitat and was representative of a wetland environment. This dam will be retained after development, and the surrounding vegetation managed to maintain habitat values.

# 1. Introduction

## 1.1 Background / context

This Riparian Assessment forms a Request for Additional Information for the proposed Concept State Significant Development Application for a new industrial estate on land at 106 – 228 Aldington Road, Kemps Creek.

The EIS for the project was placed on public exhibition between 18 November 2020 and 15 December 2020. During this period, a total of 18 submissions were received. These submissions were addressed and subsequent amendments to the project were made, as outlined in the Response to Submissions Report (dated 23 March 2021) prepared by Ethos Urban.

In written correspondence dated 28 April 2021, it was requested that FKC provide a further response to additional commentary raised by DPE, as well as additional comments raised by public authorities in their review of the first Response to Submissions Report. This was responded to via a second a Response to Submissions Report outlined by Ethos Urban (dated 22 September 2021).

Additional correspondence was received from DPE dated 15 November 2021 which has necessitated updates and additional information, as contained within this report.

## 1.2 Summary of the project for which development consent is now sought

Consent is sought for the following development. It represents minor amendments and does not represent a significant material change to what was previously proposed under the second RTS Report (22 September 2021).

- A concept masterplan with an indicative total building area of 342,865 sqm, comprising:
  - 325,865 sqm of warehouse gross floor area (GFA);
  - 17,010 sqm of ancillary office GFA;
  - 13 individual development lots for warehouse buildings with associated hardstand areas and two lots for water management infrastructure purposes (each including a bio-retention basin);
  - Roads, including:
    - Internal road layouts;
    - Southern road connection to Aldington Road;
    - Northern boundary road (half road corridor) connecting to Aldington Road;
    - Road connections to adjoining landholdings to the north and east;
  - Provision for 1,517 car parking spaces; and
  - Associated concept site landscaping.
- Detailed consent for progressive delivery of site preparation, earthworks and infrastructure works (i.e., Stage 1 works) on the site, including:
  - Demolition and clearing of all existing built form structures;
  - Drainage and infill of existing farm dams and any ground dewatering;

- Clearing of existing vegetation;
- Subdivision of the site into 15 individual lots;
- Construction of a warehouse building with a total of 50,300 sqm of GFA, including:
  - 47,800 sqm of warehouse GFA;
  - 2,500 sqm of ancillary office GFA; and
  - 222 car parking spaces.
- Bulk earthworks including 'cut and fill' to create level development platforms for the warehouse buildings, and site stabilisation works (if required);
- Roadworks and access infrastructure, including an interim access road and a temporary junction with Aldington Road;
- Stormwater works including stormwater basins, diversion of stormwater;
- Utilities services including sewer and potable water reticulation
- Road and boundary retaining walls.





Figure 1: Location map with hydroline and Strahler stream order

## 2. Legislative Context

The specific riparian and aquatic regulatory requirements and policies were reviewed to determine their application to the proposed development.

- *Fisheries Management Act 1994*
- Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (Fairfull, 2013)
- NSW *Water Management Act 2000* (WM Act) and Guidelines for controlled activities on waterfront land – Riparian corridors (NRAR, 2018)
- *Water Management Act 2000*
- *Water Management (General) Regulation 2018*
- *State Environmental Planning Policy (Western Sydney Employment Area) 2009*.

### 2.1 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) governs the management of fish and their habitat in NSW. The FM Act applies to waterways defined as ‘key fish habitat’ and threatened fish species, and therefore requires a separate assessment from the NSW *Biodiversity Conservation Act 2016* (BC Act). The objectives of the FM Act are to conserve fish stocks and key fish habitats, conserve threatened species, populations and ecological communities of fish and marine vegetation and to promote ecologically sustainable development. The FM Act also regulates activities involving dredging and / or reclamation of aquatic habitats, obstruction of fish passage, harming marine vegetation and use of explosives within a waterway.

In accordance with Part 4, Division 1.7, Section 4.41 (b) of the EP&A Act, applications for separate permits under Sections 201, 205 or 219 of the FM Act are not required for SSD, but the offset policy relating to loss of key fish habitat still applies under the FM Act. In order to inform a comparative and acceptable assessment of impacts to aquatic habitat, the regulatory framework of the FM Act and associated guidelines have been adopted for this assessment.

### 2.2 Policy and guidelines for fish habitat conservation and management

The Policy and guidelines for fish habitat conservation and management (Fairfull, 2013) (herein referred to as the ‘Policy’) is a supplementary document that outlines the requirements and obligations under the FM Act and the *Fisheries Management (General) Regulation 2010* and was developed to maintain and enhance fish habitat and assist in the protection of threatened species. The Policy provides a definition of key fish habitat (KFH) and guidance for assigning a classification of waterways for fish passage (Table 1). It also guides sensitivity ratings of the KFH types present, which determines the potential disturbance and offsetting required for development (Table 2) and informs the types of crossing infrastructure suitable for the creek line (Table 3).

The Policy classifies waterways into three types of key fish habitat. While the tributary of Ropes Creek within the SSD area is likely to be considered a Type 3 KFH habitat using the descriptions outlined in Table 3, the guidelines note that 1<sup>st</sup> and 2<sup>nd</sup> order streams on gaining streams are not considered key



fish habitat unless they are known habitat for threatened aquatic species. The main drainage line of Ropes Creek, approximately 270 m downstream of the site, is mapped as key fish habitat.

**Table 1: Key Fish Habitat and associated sensitivity classification scheme (Fairfull, 2013)**

Key fish habitat and associated sensitivity classification scheme (for assessing potential impacts of certain activities and developments on key fish habitat types)	
TYPE 1 – Highly sensitive key fish habitat:	TYPE 2 – Moderately sensitive key fish habitat:
<i>Posidonia australis</i> (strapweed)	<i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds <5 m <sup>2</sup> in area
<i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds >5 m <sup>2</sup> in area	Mangroves
Coastal saltmarsh >5 m <sup>2</sup> in area	Coastal saltmarsh <5 m <sup>2</sup> in area
Coral communities	Marine macroalgae such as <i>Ecklonia</i> and <i>Sargassum</i> species
Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings)	Estuarine and marine rocky reefs
Marine park, an aquatic reserve or intertidal protected area	Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management program)
SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia	Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area
Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants	Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna
Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act	Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1
Mound springs	Weir pools and dams up to full supply level where the weir or dam is across a natural waterway
	<b>TYPE 3 – Minimally sensitive key fish habitat may include:</b>
	Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna
	Coastal and freshwater habitats not included in TYPES 1 or 2
	Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation

Table 2 Classifications and characteristics of waterway class

Classification	Characteristics of waterway class
<b>CLASS 1</b> Major key fish habitat	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.
<b>CLASS 2</b> Moderate key fish habitat	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pool or in connected wetland areas. Freshwater aquatic vegetation is present. TYPE 1 and 2 habitats present.
<b>CLASS 3</b> Minimal key fish habitat	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other CLASS 1-3 fish habitats.
<b>CLASS 4</b> Unlikely key fish habitat	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present).

Table 3: Watercourse crossings (Fairfull, 2013).

Preferred waterway crossing type in relation to waterway class				
Waterway classification	Minimum	Recommended	Crossing	Additional Design Information
<b>CLASS 1</b> Major key fish habitat	Bridge, arch structure or tunnel			Bridges are preferred to arch structures.
<b>CLASS 2</b> Moderate key fish habitat	Bridge, arch structure, culvert <sup>1</sup> or ford			Bridges are preferred to arch structures, box culverts and fords (in that order).
<b>CLASS 3</b> Minimal key fish habitat	Culvert <sup>2</sup> or ford			Box culverts are preferred to fords and pipe culverts (in that order).
<b>CLASS 4</b> Unlikely key fish habitat	Culvert <sup>3</sup> , causeway or ford			Culverts and fords are preferred to causeways (in that order).

<sup>1</sup> High priority given to the 'High Flow Design' procedures presented for the design of these culverts—refer to the "Design Considerations" section of Fairfull and Witheridge (2003).

<sup>2</sup> Minimum culvert design using the 'Low Flow Design' procedures; however, 'High Flow Design' and 'Medium Flow Design' should be given priority where affordable—refer to the "Design Considerations" section of Fairfull and Witheridge (2003).

<sup>3</sup> Fish friendly waterway crossing designs possibly unwarranted. Fish passage requirements should be confirmed with NSW DPI.

## 2.3 Water Management Act 2000

The main objective of the WM Act is to manage NSW water in a sustainable and integrated manner that will benefit current generations without compromising future generations' ability to meet their needs. The WM Act is administered by the Natural Resources Access Regulator (NRAR) and establishes an approval regime for activities within waterfront land, defined as the land 40 m from the highest bank of a river, lake or estuary.

The WM Act defines a river as:

- a. any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and*
- b. any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and*
- c. anything declared by the regulations to be a river.*

For the purposes of paragraph (c) of the definition of 'river' in the Dictionary to the Act, the following are declared to be a river as per the *Water Management (General) Regulation 2018* (WM Regulation):

*any watercourse, whether perennial or intermittent, comprising an artificial channel that has changed the course of the watercourse, any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows.*

In accordance with Part 4, Division 1.7, Section 4.41 (g) of the EP&A Act, a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the WM Act is not required for SSD.

However, in order to inform a comparative and acceptable assessment of riparian impacts, the regulatory framework of the WM Act and associated guidelines have been adopted for this assessment.

NRAR's *Guidelines for Controlled Activities on waterfront land—Riparian corridors* (NRAR, 2018) outline the need for a Vegetated Riparian Zone (VRZ) adjacent to the channel to provide a transition zone between the terrestrial environment and watercourse. This vegetated zone helps maintain and improve the ecological functions of a watercourse whilst providing habitat for terrestrial flora and fauna. The VRZ plus the channel (bed and banks of the watercourse to the highest bank) constitute the 'riparian corridor' (Figure 2). NRAR recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses and using Hydroline Spatial Data which is published on the department's website (Table 4).

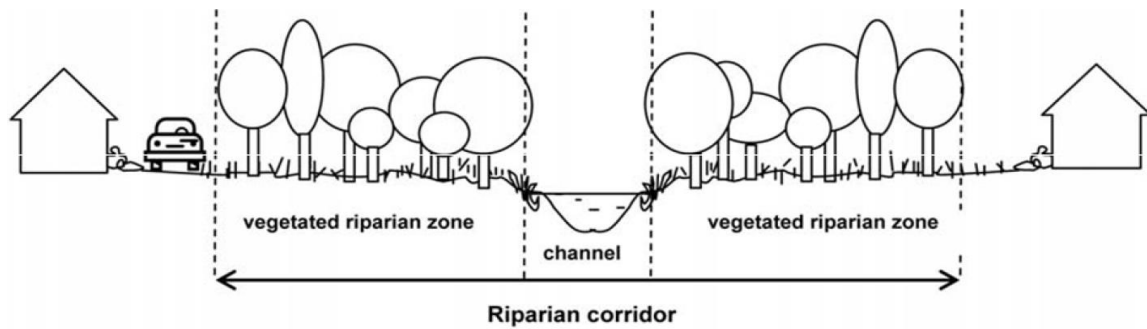


Figure 2: Vegetated Riparian Zone and watercourse channel comprising the riparian corridor (NRAR, 2018).

Table 4: Recommended riparian corridor widths relative to Strahler Order (NRAR 2018)

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

Certain works are permissible within the riparian zone (Table 5). Non-riparian uses are consistent with NRAR's guidelines in the outer 50% of the VRZ as long as compensation (1:1 offset) is achieved within the site. The outer VRZ that is impacted must be offset elsewhere on site using the 'averaging rule' (Figure 3).

Table 5: Riparian corridor (RC) matrix of permissible use (NRAR 2018)

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
1 <sup>st</sup>	10m	•	•	•	•	•	•	•		
2 <sup>nd</sup>	20m	•	•	•	•	•		•		
3 <sup>rd</sup>	30m	•	•	•		•			•	•
4 <sup>th</sup> +	40m	•	•	•		•			•	•

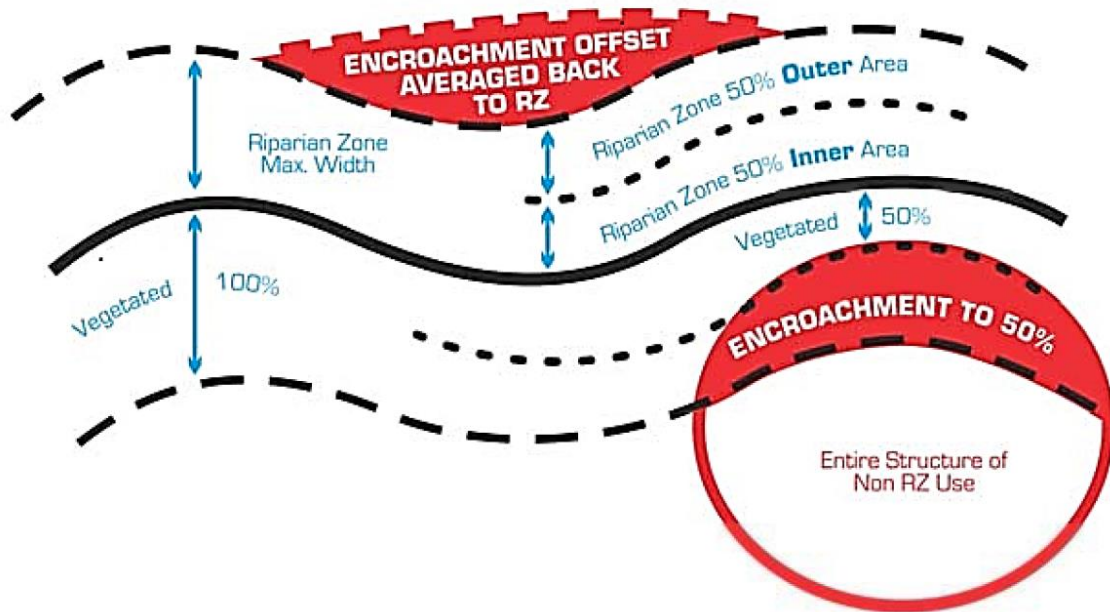


Figure 3: Riparian 'averaging rule' for offsetting encroachment into the outer 50% of the VRZ (NRAR 2018).

Furthermore, NRAR's *Guidelines for Controlled Activities on waterfront land—Riparian corridors* (NRAR 2018) provides for a streamlined assessment for development that meets pre-determined criteria.

## 2.4 NSW Wetlands Policy

The NSW Wetlands Policy (DECCW, 2010) aims to provide for the protection, ecologically sustainable use and management of NSW wetlands. Wetlands include lakes, lagoons, estuaries, rivers, floodplains, swamps, bogs, billabongs, marshes, coral reefs and seagrass beds. For the sustainable management of wetlands, the NSW Government adopts 12 principles to guide decision-making. The themes of these 12 principles include:

- Catchment scale
- Water regimes
- Floodplain connectivity
- Wetlands of significance
- Land management practices
- Cultural values
- Rehabilitation
- Climate change
- Research
- Protection and offsetting
- Cooperation and incentives
- Monitoring and reporting.

Mitigation measures outlined in Section 5.2 of this impact assessment are in line with the policy's guiding principles.

## 2.5 State Environmental Planning Policy (Western Sydney Employment Area) 2009

The *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (SEPP WSEA) was amended following the adoption of the Mamre Road Precinct Plan. A number of clauses within the SEPP WSEA are applicable to the proposed development of the Aldington Road development, including Part 6 Clauses 33H, 33I and 33L.

The impacts of the proposed development relevant to these clauses of the SEPP WSEA are discussed in Section 5.3.4.

## 2.6 Mamre Road Development Control Plan

The DCP contains controls specific to riparian zone protection and management. An assessment of the consistency of the proposed development with the DCP is provided in chapter 5.



## 3. Methods

### 3.1 Literature and data reviews

The following literature and data sources were reviewed prior to undertaking the field survey:

- BioNet/Atlas of NSW Wildlife database search for a 10 km radius (DPIE, 2020)
- EPBC Act Protected Matters Search Tool 5 km database search (DAWE 2020)
- The Native Vegetation of the Sydney Metropolitan Area v.3 (OEH 2016)
- Aerial mapping (SIXMaps)
- Water Management (General) Regulation 2018 hydroline spatial data 1.0
- Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (Fairfull 2013)
- Guidelines for controlled activities on waterfront land – Riparian corridors (NRAR, 2018).

### 3.2 Field survey methods

The Strahler stream order classification was extracted from the DPI Hydroline Spatial Data. A field survey was conducted by ELA Aquatic Ecologist Claire Wheeler on 20 July 2020 to determine if the watercourses on site met the definition of a 'river' under the WM Act and determine the current condition and extent of riparian and aquatic habitat:

**1. Definition of a 'river' under the WM Act** – Waterways within the SSDA boundary were assessed to determine if they met the definition of a 'river' using definitions outlined in section 2.3 of this report.

**2. Riparian habitat assessment** - An assessment of riparian condition and recovery potential was conducted for the waterways. This assessment considered native vegetation cover, connectivity and quality, bed and bank stability and habitat diversity.

**3. Aquatic habitat assessment** - The quality of aquatic habitat was examined, including vegetation structure and regeneration, weed infestation, woody debris, fish habitat, patch size and connectivity potential.

## 4. Existing Environmental Conditions

Within and adjacent to the development area were eleven farm dams, most of which had limited riparian and/or fringing vegetation surrounding them and poor aquatic habitat values. These dams have been numbered in Figure 4 and are described in Table 6. Dams 9 and 10 are connected following heavy rain and high flow, however are two separate dams in low flow and dry conditions. Examination of aerial photos and overland flow paths identified that these two dams are quite likely fed by two different catchments – Dam 9 from flow to the south east of the study area and Dam 10 from overland flow from the west within the study area. It is important to note that this environment is highly modified and the waterbodies and watercourses in the north east of the site are not representative of their original flow paths.

The study area had been the subject of significant disturbance in the past, with a number of small irrigation channels constructed across various lots to service the market gardens within the properties.

DPI mapping showed two unnamed watercourses within the study area (Figure 1); a 1<sup>st</sup> order tributary of Kemps Creek in the south of the site and a 1<sup>st</sup> order tributary of Ropes Creek in the north east of the site.

The 1<sup>st</sup> order watercourse mapped within the south of the development area had no indicative features of a waterway (such as defined bed and banks or geomorphic features such as erosion and deposition) observed along the length of this mapped watercourse within the SSD boundary.

The mapped 1<sup>st</sup> order watercourse in the north east corner originated upstream of the development area and flowed in a roughly northerly direction.



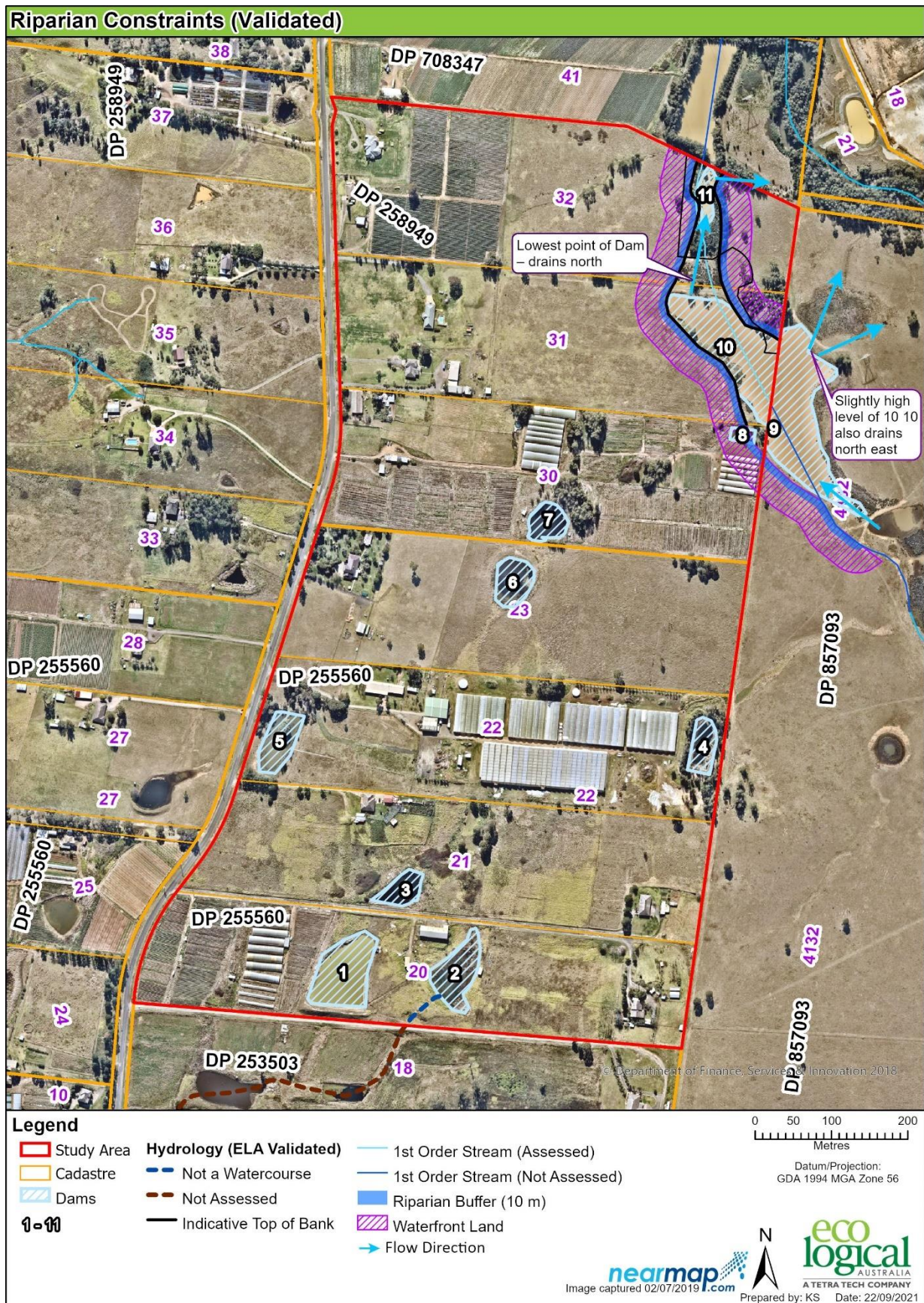









Figure 4: Validated watercourses within study area





Table 6: Dams within and adjacent to study area

Dam number	Description	Aquatic fauna observed	Aquatic flora observed	Representative photo
1	Dam 1 covered an area of approximately 5,600 m <sup>2</sup> and was surrounded by pasture grasses. There was no fringing vegetation surrounding the dam and the banks of the dam was relatively steep.	No aquatic fauna observed.	Floating macrophytes ( <i>Azolla pinnata</i> ).	
2	Dam 2 covered an area of approximately 2,300 m <sup>2</sup> . No grease, oil or sheen was observed on the water's surface. On the northern and southern sides of the dam, it was fringed with dense <i>Typha orientalis</i> (Cumbungi).	No aquatic fauna observed.	Emergent <i>Typha orientalis</i> plus submerged macrophytes.	
3	Dam 3 covered an area of approximately 1,700 m <sup>2</sup> . Two thirds of the edge of the dam were covered in dense <i>Typha orientalis</i> with exotic species such as <i>Rubus fruticosus</i> (Blackberry), <i>Cestrum parqui</i> (Green Cestrum) and pasture grasses growing alongside the remaining edge of the dam	No aquatic fauna observed.	<i>Typha orientalis</i> .	

Dam number	Description	Aquatic fauna observed	Aquatic flora observed	Representative photo
4	Dam 4 covered an area of approximately 1,800 m <sup>2</sup> and was actively used for irrigation of nearby vegetable crops. The dam was surrounded on all sides by <i>Casuarina</i> sp. and had some areas of dense <i>Typha orientalis</i> on the southern side of the dam.	No fauna observed.	Emergent macrophytes including <i>Ludwigia peploides</i> (Water Primrose) and <i>Persicaria decipiens</i> (Knotweed) and floating <i>Azolla pinnata</i> .	
5	Dam 5 covered an area of approximately 1,700 m <sup>2</sup> and was partially surrounded by <i>Casuarina</i> sp. Evidence of soil pugging by stock was seen on the northern side of the dam.	No fauna observed.	Submerged macrophytes in the form of <i>Vallisneria australis</i> (Ribbonweed).	
6	Dam 6 covered an area of approximately 875 m <sup>2</sup> and on the southern side of the dam there was a large area of <i>Juncus</i> sp. where it appeared that the area was constantly damp and supported the growth of these species.	Eurasian Coots and frogs could be heard calling.	<i>Ludwigia peploides</i> and <i>Eleocharis sphacelata</i> within the dam.	

Dam number	Description	Aquatic fauna observed	Aquatic flora observed	Representative photo
7	Dam 7 covered an area of approximately 1,700 m <sup>2</sup> . The dam was located approximately 100 m downstream of dam 6, however there was no defined channel observed between these two dams.	Frogs heard calling.	<i>Persicaria decipiens</i> .	
8	Dam 8 covered an area of approximately 650 m <sup>2</sup> . There were a few <i>Eucalyptus</i> sp. on the edge of the dam however it was predominantly surrounded by exotic vegetation including <i>Rubus fruticosus</i> , <i>Senecio madagascariensis</i> and pasture grasses.	Pied cormorant.	No aquatic flora observed.	
9	Dam 9 was on the adjacent lot outside of the study area but is in the flow path of the mapped 1 <sup>st</sup> order watercourse. This dam is connected to dam 10 when full.	No aquatic fauna observed.	No aquatic flora observed.	Not available

Dam number	Description	Aquatic fauna observed	Aquatic flora observed	Representative photo
10	Dam 10 covered an area of approximately 7,800 m <sup>2</sup> . Erosion was observed on some parts of the bank of the north western side of the dam and there was little shrub or canopy vegetation surrounding the dam that would provide bank stability.	No aquatic fauna observed	<i>Typha orientalis</i> , <i>Lemna</i> sp. and <i>Ludwigia peploides</i> on the edges of the dam.	
11	Dam 11 covered an area of approximately 3,750 m <sup>2</sup> . The dam was surrounded by a narrow-vegetated buffer of <i>Casuarina</i> sp., with <i>Juncus acutus</i> and <i>Typha orientalis</i> . Woody debris within the waterbody was present and some of the <i>Casuarina</i> sp. on the edge of the waterbody had roots exposed above the water level and undercut in some areas, which would provide good refuge for aquatic fauna.	Long finned eel.	<i>Typha orientalis</i> in the middle of the dam	



## 4.1 Mapped watercourses

### 4.1.1 Kemps Creek tributary

DPI mapping showed an unnamed first order tributary of Kemps Creek within the study area at the southern boundary of Lot 20 DP 255560.

The site inspection identified that there was no defined channel downstream of Dam 2 in the location where a watercourse was mapped on the hydroline dataset. There was an overland flow path that had been channelled towards Dam 1 through a section of concrete pipe. Downstream of the dam there was dense pasture grasses but no defined bed or bank or evidence of geomorphic processes such as erosion and deposition (Figure 5 to Figure 8). A pipe was observed at the southern boundary of the SSD area (Figure 8) to channel the flow into the property to the south. The mapped watercourse within the south of the site does not meet the definition of a 'river' under the WM Act.



**Figure 5: Upstream extent of mapped Kemps Creek tributary, looking north east**



**Figure 6: Upstream extent of mapped Kemps Creek tributary, looking south west**



**Figure 7: Downstream extent of mapped Kemps Creek tributary, looking north east**



**Figure 8: Downstream extent of mapped Kemps Creek tributary, looking south west.**

### 4.1.2 Ropes Creek tributary

The mapped watercourse within the north east area of the site is located through Dams 10 and 11. Although this is a highly modified system, water flowing out of Dam 10 would flow to Dam 11. This area is shown in Figure 9 to Figure 15.





**Figure 9: Dam 10, looking south east**



**Figure 10: Dam 10, looking south**



**Figure 11: Boundary fence in between Dams 9 and 10, looking south east**



**Figure 12: Top of dam wall on northern side of Dam 10, looking west.**



**Figure 13: No defined channel between Dam 9 and 10, looking north.**

On the downstream side of Dam 11, it was evident that a channel had been blocked at some point to create a dam, however the dam now resembled a wetland environment. There is unlikely to be any low flows moving through this section of watercourse other than in high flow events. Immediately upstream of Dam 11 was a damp area that would be inundated following heavy rain. There were small isolated

pools of water within this area in amongst the dense *Juncus acutus* (Figure 14 and Figure 15) and evidence of pugging from cattle.



**Figure 14:** Area between upstream of Dam 11 and northern side of Dam 10, looking north



**Figure 15:** Isolated pools of water between Dams 10 and Dam 11, looking south

## 5. Impact assessment

The proposed development at Aldington Road will involve the establishment of an industrial precinct, including two on-site detention and water quality improvement basins. The FKC Estate Master Plan (SBA Architects, 1/9/2021, Issue N (Appendix A)) has been used to identify potential impacts to the riparian and aquatic habitat and water quality as a result of the proposed development. The development will require removal of Dams 1-8, construction of two water quality basins and the establishment of a managed vegetated zone to maintain aquatic and terrestrial habitat within the north east corner of the site (see Figure 16).

This section describes:

- potential impacts.
- mitigation measures to ensure potential impacts are avoided or minimised.
- Consistency with legislation and policy.



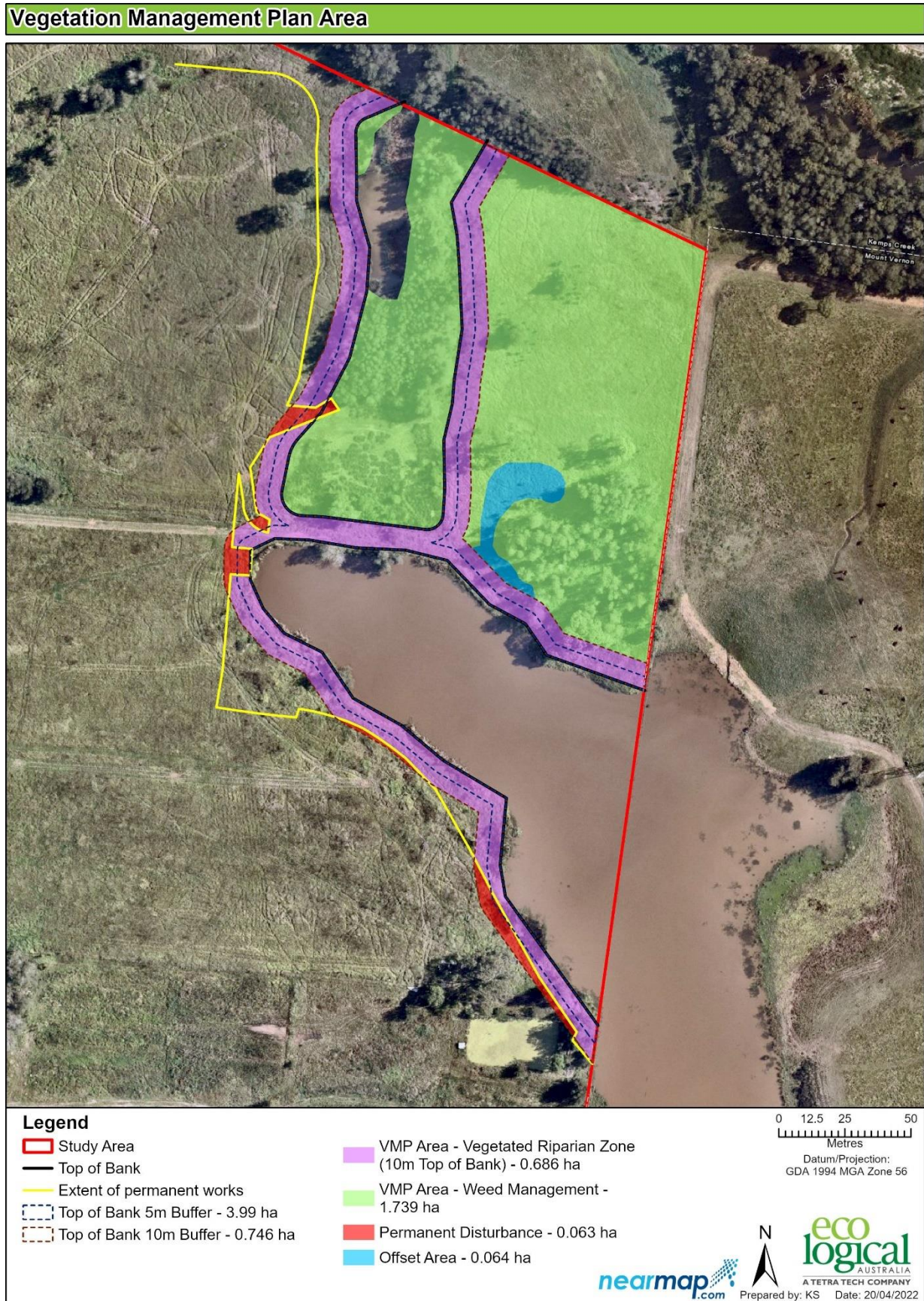


Figure 16: Proposed development extent in relation to riparian zone

## 5.1 Potential Impacts

### 5.1.1 Removal of farm dams

As outlined in section 4 of this report, Dams 1 -8 are not connected to any watercourses that meet the definition of a 'river' under the WM Act, nor do they appear to be providing good habitat for aquatic fauna due to the lack of instream and fringing vegetation and woody debris. Mitigation measures provided in section 5.2 of this report outline the process for decommissioning these dams to ensure that there is little, if any, impact to aquatic fauna currently residing in these dams.

Dams 9, 10 and 11 are all retained as part of the proposed development (Figure 16).

### 5.1.2 Surface erosion and sedimentation

Any clearing of vegetation or earthworks within the existing riparian zone of the 1<sup>st</sup> order tributary of Ropes Creek could result in lack of soil stability. This may cause surface erosion (sheet and gully erosion) and transportation of sediment overland into the downstream waterway of Ropes Creek. Impacts may include increased water turbidity, which could harm fish, and disrupt light penetration through the water column and impact on primary (plant) production, with flow on effects through the food web. Increased sediment loads may settle in downstream pools, causing a loss of deep habitat, promotion of dense reeds and changes to hydrologic connectivity. Sediment could also smother naturally rocky areas, resulting in a loss of habitat where macroinvertebrates shelter in the spaces between rocks.

### 5.1.3 Weed Invasion

Where disturbance from construction associated with the proposed development results in bare ground or increased sunlight penetration into currently-vegetated riparian areas, there is the potential for invasion of exotic flora species. The movement of construction vehicles in and around the riparian area can also act as a vector for weed propagules. Impacts include introduction of new weeds to the area and extended penetration of weeds into native plant communities. This may result in a loss of biodiversity and habitat value, smothering of native juvenile plants, harbouring of feral animals and alteration of vegetation structure and riparian function.

### 5.1.4 Increase velocity of surface water runoff

The construction and ongoing use of impervious surfaces can impact on the velocity of water entering the creekline where impermeable surfaces are constructed over existing vegetation (e.g. proposed car parks). Impacts may include changes to instream flow velocity which can change the aquatic habitat for macroinvertebrates and other small aquatic fauna (e.g. some macroinvertebrates and macrophytes prefer slow water), increased bank erosion from fast discharge resulting in bed and bank erosion, loss of riparian vegetation, loss of edge habitat and sedimentation of downstream environments.

## 5.2 Mitigation measures

### 5.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared to minimise impacts on the environment. This CEMP includes an Erosion and Sediment Control Plan, prepared in accordance with *The Blue Book – Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) and will be implemented prior to works, with the aim of achieving an outcome of 'no visible turbid plumes migrating



through the waterway'. The Plan must include, as a minimum, the locations and type of erosion and sediment controls to be erected.

### 5.2.2 Vegetation Management Plan

A Vegetation Management Plan (VMP) has been prepared and includes methods for establishment and maintenance of the Vegetation Management Area. Initial weed control would be required to limit the impact of the widespread weed species that are currently growing onsite. The revegetated areas will then require ongoing maintenance to ensure areas remain relatively weed free.

The VMP is to specify high-density planting to provide bank stabilisation following construction of the batters around the basins.

The VMP is to provide for management actions over an initial 5 years with review and evaluation to inform management of the subsequent five years. Annual reports are to be prepared for the first five years and submitted to the consent authority.

The proposed VMP area is shown in Figure 16. And is consistent with the NRAR Guidelines.

### 5.2.3 Dam Dewatering Plan

A Dam Dewatering Plan (DDP) has been prepared. Implementation of the Dam Dewatering Plan is to minimise harm to native aquatic fauna during decommissioning of the farm dams. The DDP will specify how different species likely to be encountered will be handled and where native species are to be relocated to. To ensure aquatic species are protected during the dam decommissioning process, the aquatic ecologist in charge of fauna relocation should possess the following licenses/permits:

- Section 37 *Fisheries Management Act 1994* (for fish), issued by NSW Department of Primary Industries - Fisheries
- Animal Research Authority (for the welfare of all animals), issued by the Secretary's Animal Care & Ethics Committee. This Authority describes permitted euthanasia techniques (e.g. for Redfin Perch and sick or diseased fauna).

The aquatic ecologist is to notify NSW Fisheries of the activity 48 hours prior to fish relocation (unless an agreement is in place), including locations of dewatered and relocation sites.

The dewatering schedule should allow time for fish rescue, especially during the final 0.3 m water depth (to be advised by Aquatic Ecologist). Fauna should be captured in one day, so pumps need to be of adequate size and placed in an area free from mud and debris (e.g. inside excavator bucket or screened sump pit).

Native fish healthy enough for relocation are to be contained and transported in an aerated tub/bucket/tank to an appropriate dam/lake/waterhole/creek. It is recommended that native species are relocated to a nearby dam or creekline with landholder's permission. NSW Fisheries advise that the host location should be large enough to accommodate additional fish, especially predatory eels. If a large number of predatory fish such as *Anguilla reinhardtii* are captured during the aquatic fauna relocation process, an additional release point may be required.

## 5.3 Consistency with planning framework

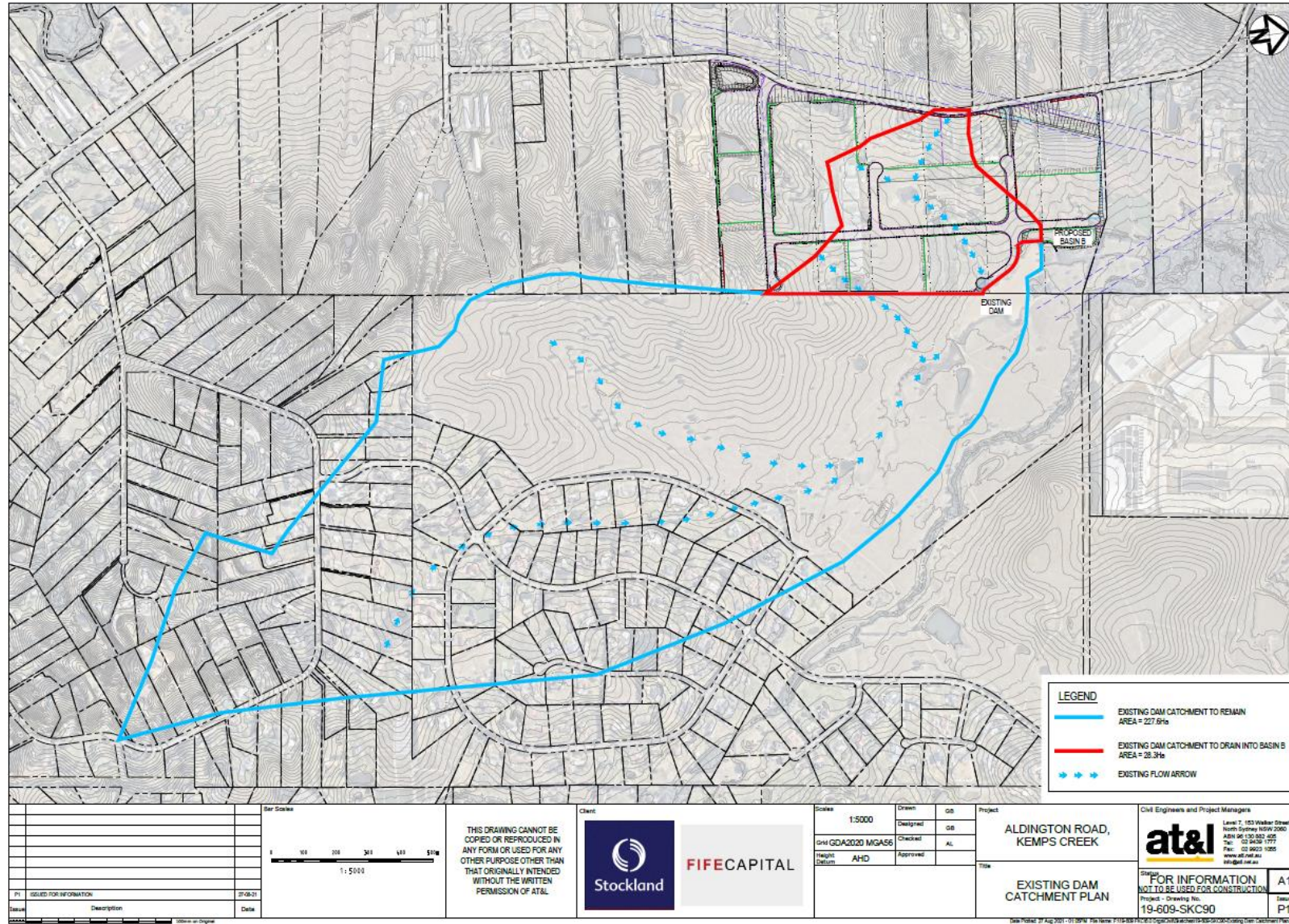
### 5.3.1 Water Management Act 2000

The principle legislation relevant to watercourses and riparian corridors discussed in Section 2.3 is the WM Act, which has the objective to provide sustainable and integrated management of the waterways of the state. The field visit concluded that the southern-most first order watercourse did not meet the definition of a 'river' under the WM Act, as there was no defined channel, evidence of bed and banks or geomorphic processes.

The mapped watercourse within the north of the site is considered a river for the purposes of the WM Act due to connected nature of Dam 9 to upstream waterbodies, however this is a highly modified environment.

The revised design maintains the existing watercourse through the north east corner of the site. The existing unvegetated 'riparian zone' has an area of 0.74 ha. A minor incursion of 0.063 ha will occur but will be offset through the rehabilitation of 0.064 ha of vegetation and in addition to the revegetation of 0.68 ha of riparian zone and weed management over 1.73 ha.

As shown in Figure 17, a portion of Dam 10's catchment will re-directed to Stormwater Basin B and then into Dam 11. The total catchment area of Dam 10 is currently around 255.9 ha and the area of the catchment to be redirected is 28.3 ha. This equates to approximately 11% of the total catchment area of Dam 10. It is not anticipated that this will have a significant impact on downstream environments and both dams eventually drain to Ropes Creek.



**Figure 17: Portion of Dam 10 catchment (red outline) that will be directed through Dam 11 prior to draining to Ropes Creek.**



### 5.3.2 Fisheries Management Act 1994

A review of the NSW Fisheries Spatial Portal found that there was no Freshwater Fish Community Status assigned to the tributary of Ropes Creek within the site, however the main reach of Ropes Creek adjacent and downstream of the development site was rated as 'fair'.

A search of the Commonwealth Protected Matters database, Department of Planning, Industry and Environment (DPIE) BioNet database, NSW Department of Primary Industries Primefacts and Fisheries Threatened Species distribution maps (Riches et al, 2016) identified three species of aquatic fauna with potential to be found within the study area (Table 7). As there are no records within the Ropes Creek catchment and a lack of suitable habitat on site, it is unlikely that these species would be found within the proposed development area.

**Table 7: Likelihood of occurrence table for aquatic species**

Scientific Name	Common Name	FM Act	EPBC Act	Habitat Associations	Records within 5 km and catchment	Likelihood of occurrence
<i>Archaeophya adamsi</i>	Adams Emerald Dragonfly	E		Adam's Emerald Dragonfly larvae have been found in narrow, shaded riffle zones with moss and abundant riparian vegetation (often closed canopy) in small to moderate sized creeks with gravel or sandy bottoms.  Adult dragonflies generally fly away from the water to mature before returning to breed. Males fly actively at breeding sites and often guard a territory. Females probably lay their eggs into the water.	0	No, no suitable habitat within development area.
<i>Maccullochella peellii</i>	Murray Cod		V	The Murray Cod occurs naturally in waterways of Murray-Darling Basin in warm water habitats from clear, rocky streams to slow flowing turbid rivers and billabongs. They prefer habitats with submerged woody debris that provide protected spawning areas.	0	No, no suitable habitat and no records within 5 km of site.
<i>Macquaria australasica</i>	Macquarie Perch	E	E	Habitat for this species is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie Perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	0	No, no suitable habitat and no records within 5 km of site.
<i>Prototroctes maraena</i>	Australian Grayling	E	V	Historically, this species inhabited coastal streams from the Grose River southwards through NSW, VIC and TAS. On the mainland, this species has been recorded from rivers flowing east and south of the main dividing range. This species spends only part of its	0	No, no suitable habitat and no records within 5 km of site.

Scientific Name	Common Name	FM Act	EPBC Act	Habitat Associations	Records within 5 km and catchment	Likelihood of occurrence
				lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous species (migratory between fresh and saltwaters).		

Note: E = Endangered, V= Vulnerable.

### 5.3.3 Environment Protection and Biodiversity Conservation Act 1999

The Protected Matters search (DAWE, 2020) identified that there are no Wetlands of International Importance or Nationally Important Wetlands within 5 km of the study area.

### 5.3.4 Mamre Road DCP – Riparian Provisions

The following table describes the consistency of the proposed development with the riparian corridor provisions of the Mamre Road Precinct DCP.

**Table 8: Mamre Road DCP Consistency**

Control	Proposed Plan
Mapped Riparian Corridors (Field-Validated)	
1) Within a mapped riparian corridor (field-validated), as identified in Figure 2, existing native vegetation is to be retained, rehabilitated and managed in accordance with the controls below, except where clearing is required for essential infrastructure e.g. roads.	Design retains the watercourse and riparian zone of watercourses shown in Figure 2 of the DCP.
Avoiding Modifications to Natural Waterbodies	
2) Modifications to a natural (or historic) waterbody and waterfront land requires the approval of Natural Resources and Assessment Regulator (NRAR), including the enhancement of the ecological outcomes of the watercourse, hydrological benefits and ensure the long-term geomorphic stability of the watercourse.	There are no natural watercourses on site as all have been highly modified. Historic waterbodies (ie farm dams) in the north east have been retained in their current form. Other farm dams are proposed to be removed.
Protection and Enhancement of Riparian Corridors	
3) Waterways of Strahler Order 2 and higher will be maintained in a natural state, including the maintenance and restoration of riparian area and habitat, such as fallen debris.	There are no Strahler 2 watercourses on site.
4) Where a development is associated with or will affect a waterway of Strahler Order 2 or higher, rehabilitation will occur to return that waterway to a natural state.	There are no Strahler 2 watercourses on site.

Control	Proposed Plan
5) Waterway crossings such as bridges are to be maintained to retain ecological connectivity and water quality.	No new waterway crossings are proposed.
6) Road crossings across a waterway of Strahler Order 2 or higher are to be designed to minimise impacts to vegetated riparian area and species movements in accordance with NSW Department of Primary Industries- Fisheries requirements to maintain fish passage	No new waterway crossings are proposed. An existing dam wall controls flow from Dam 10 to Dam 11. This dam wall is retained as it provides access to the north east corner of the property.
7) Where development is unavoidable within riparian areas or waterfront lands, the development application shall demonstrate that potential impacts on water quality, aquatic habitat, and riparian vegetation will be negligible or offset in accordance with the vegetated riparian zone and offsetting requirements as specified NRAR Guidelines for Controlled activities on waterfront land - riparian corridors (May 2018).	Development is avoided within riparian corridors other than some very minor incursions into the vegetated riparian zone. The incursion has been more than adequately offset via implementation of a VMP in the north east corner of the site.
8) All riparian corridors should comprise a vegetated riparian zone along each side of the watercourse/channel.	A VMP provides for this outcome.
9) The vegetated riparian zone shall be vegetated with fully structured native vegetation (trees, shrubs and groundcover species).	The VMP provides for the structure of vegetation in the riparian zone.
10) Riparian areas along Kemps Creek and Ropes Creek shall retain Proteaceae shrubs providing habitat and connectivity for the Eastern Pygmy Possum <i>Cercartetus nanus</i> .	The VMP provides for the structure of vegetation in the riparian zone.
11) Activities within the vegetated riparian zone, such as cycleways and paths, detention basins, stormwater management devices and essential services, must comply with the 'riparian corridor matrix' in the NRAR Guidelines.	The proposed stormwater basin B adjoins a first order watercourse, but is not on-line. This is allowable under the NRAR Guidelines.
12) The number of vehicular and pedestrian watercourse crossings should be minimised and designed in accordance with the NRAR Guidelines.	No new crossings are proposed.
13) Private and public fencing should avoid intersecting across riparian corridors.	No fences are proposed across the waterway.
14) Bushfire asset protection zones should be located outside the vegetated riparian zones.	Yes. See Bushfire Assessment.
15) Appropriate widths for vegetated riparian zones are dependent on the stream order in accordance with the Strahler methodology. Stream width shall be measured either in accordance with the 'Waterfront Land Tool' as developed by the NRAR, or from the top of the highest bank on both sides of the channel/watercourse. Enhancement of riparian corridors should: <ul style="list-style-type: none"> <li>Respond to the hydrological regime of the drainage area for watercourse treatments;</li> </ul>	The proposed VMP will provide a VRZ of 10m measured from the top of bank. Where works extend into the 10m VRZ, riparian offsets are provided as per NRAR Guidelines.

Control	Proposed Plan
<ul style="list-style-type: none"> <li>○ Replicate the natural watercourse through creation of a meandering channel;</li> <li>○ Simulate natural stream bank and bed substrate having regard to riparian requirements and flow velocities to sustain vegetation groupings;</li> <li>○ Minimise ongoing maintenance through channel and stream bed design;</li> <li>○ Establish functional riparian zones and natural stream channels;</li> <li>○ Maintain or create a full assemblage of local indigenous vegetation with natural in-stream obstructions;</li> <li>○ Minimise damage to channel banks and vegetation from storm flow events; and</li> </ul> <p>Ensure that the channel has the capacity to support flood flows having regard to the steepness of the catchment and stream channel morphology.</p>	
16) Where a development proposal would significantly affect Key Fish Habitat and/or threatened fish, applicants must include an Aquatic Ecological Environmental Assessment in accordance with the Fisheries Management Act 1994.	No Key Fish Habitat will be impacted.
17) Water holding structures (e.g. farm dams) more than 0.1ha in area or 3ML in volume within 3km of the approach boundary to Western Sydney Airport, are to be avoided unless appropriate wildlife strike assessment and design/maintenance controls are implemented, to ensure there is no attraction for water-favouring fowl.	See Stormwater Assessment
18) Dams proposed for retention must be subject to a geotechnical investigation to determine the safety of the structure with respect to surrounding land uses.	See Stormwater Assessment
Development Adjacent Riparian Corridors	
19) Where development immediately abuts a riparian corridor, development shall be located and designed to minimise environmental impact to the riparian corridor. Consideration must be given to issues such as surveillance, built form and design, landscaping, opportunity for public interfaces, where appropriate, and protection from bushfire threat	See Landscape Plan



## 6. Conclusions

This Riparian Assessment has been prepared to assess the development's impact on the mapped watercourses and riparian corridors on site, as per the Secretary's Environmental Assessment Requirements (SEARs) issued in July 2020 which require *'an assessment of the development's impacts on the riparian corridor and wetland on site, including detailed interface management measures'*.

Following re-design of the development in the north eastern corner of the site, existing farm dams and the watercourse identified in the Mamre Road DCP are being retained and will have vegetated riparian zones in accordance with a proposed Vegetation Management Plan. The redesign ensures the riparian outcomes of the development are consistent with the structure plan in the DCP and the Precinct Plan.

Eight farm dams will be removed in accordance with a proposed Dam Dewatering Plan to be prepared prior to commencement of construction.

## 7. References

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## Appendix A Master Plan

