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Aldington Road Kemps Creek Riparian Assessment

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 200 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 1st 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 1st 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 nine 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

Eco Logical Australia (ELA) was engaged by Fife Kemps Creek Trust to prepare a Riparian Assessment for the proposed State Significant Development (SSD-10479) at Stockland Fife Industrial Estate, 106-228 Aldington Road, Kemps Creek. The site is in the Penrith Local Government Area (LGA) and covers approximately 81 ha.

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'*.

Within the State Significant Development Application (SSDA) boundary, there are two mapped watercourses, a first order tributary of Ropes Creek in the north of the site and a first order tributary of Kemps Creek in the south of the site (Figure 1).

1.1 State Significant Development project description

The site is part of the Broader Western Sydney Employment Area and is zoned land under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (SEPP WSEA). The majority of the site is zoned as IN1 General Industrial, with the north-western corner zoned as RE2 Private Recreation and a very small area as E2 Environmental Conservation.

The SSDA seeks approval for the concept masterplan for proposed future development lots and building footprints, including:

- 357,355 m² of warehouse gross floor area (GFA)
- 18,200 m² of ancillary office GFA
- 200 m² of café GFA
- 13 individual development lots for warehouse buildings with associated hardstand areas
- Internal road layouts and road connections to Aldington Road
- Provision for 1700 car parking spaces
- Associated site landscaping.

Detailed consent for Stage 1 works is sought for Stage 1 works including:

- Demolition and clearing of all existing built form structures
- Drainage and infill of existing farm dams and any ground dewatering
- Clearing of all existing vegetation
- Construction of a warehouse building with a total of 50,930 m² of GFA, including:
 - 48,430 m² of warehouse GFA
 - 2,500 m² of ancillary office GFA
 - 231 car parking spaces
 - associated landscaping.
- Bulk earthworks including 'cut and fill' to create flat development platforms for the warehouse buildings, and topsoiling and grassing / site stabilisation works

- Roadworks, access infrastructure and associated landscaping
- Stormwater and drainage works, including stormwater basins, diversion of stormwater lines, gross pollutant traps and associated swale works
- Sewer and potable water reticulation;
- Inter-allotment, 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 1st and 2nd 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 ² in area
<i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds >5 m ² in area	Mangroves
Coastal saltmarsh >5 m ² in area	Coastal saltmarsh <5 m ² 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
	TYPE 3 – Minimally sensitive key fish habitat may include:
	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
CLASS 1 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'.
CLASS 2 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.
CLASS 3 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.
CLASS 4 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
CLASS 1 Major key fish habitat	Bridge, arch structure or tunnel			Bridges are preferred to arch structures.
CLASS 2 Moderate key fish habitat	Bridge, arch structure, culvert ¹ or ford			Bridges are preferred to arch structures, box culverts and fords (in that order).
CLASS 3 Minimal key fish habitat	Culvert ² or ford			Box culverts are preferred to fords and pipe culverts (in that order).
CLASS 4 Unlikely key fish habitat	Culvert ³ , causeway or ford			Culverts and fords are preferred to causeways (in that order).

¹ 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).

² 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).

³ 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).

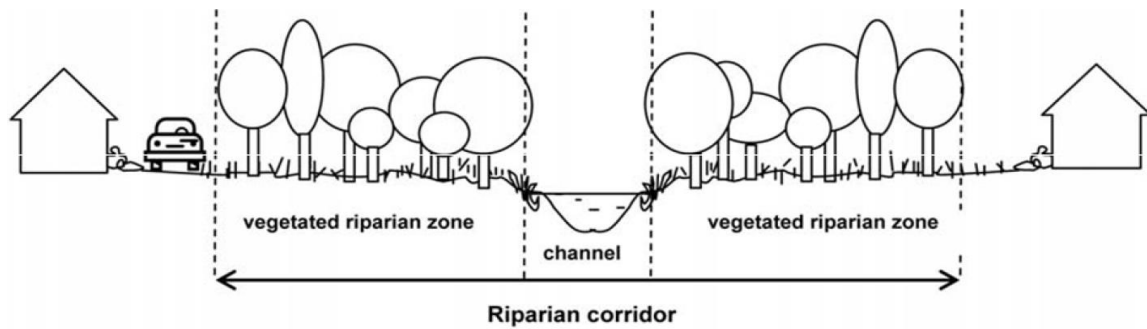


Figure 2: Vegetated Riparian Zone and watercourse channel comprising the riparian corridor (NRAR, 2018).

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 st order	10 m	20 m + channel width
2 nd order	20 m	40 m + channel width
3 rd order	30 m	60 m + channel width
4 th 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 st	10m	•	•	•	•	•	•	•		
2 nd	20m	•	•	•	•	•		•		
3 rd	30m	•	•	•		•			•	•
4 th +	40m	•	•	•		•			•	•

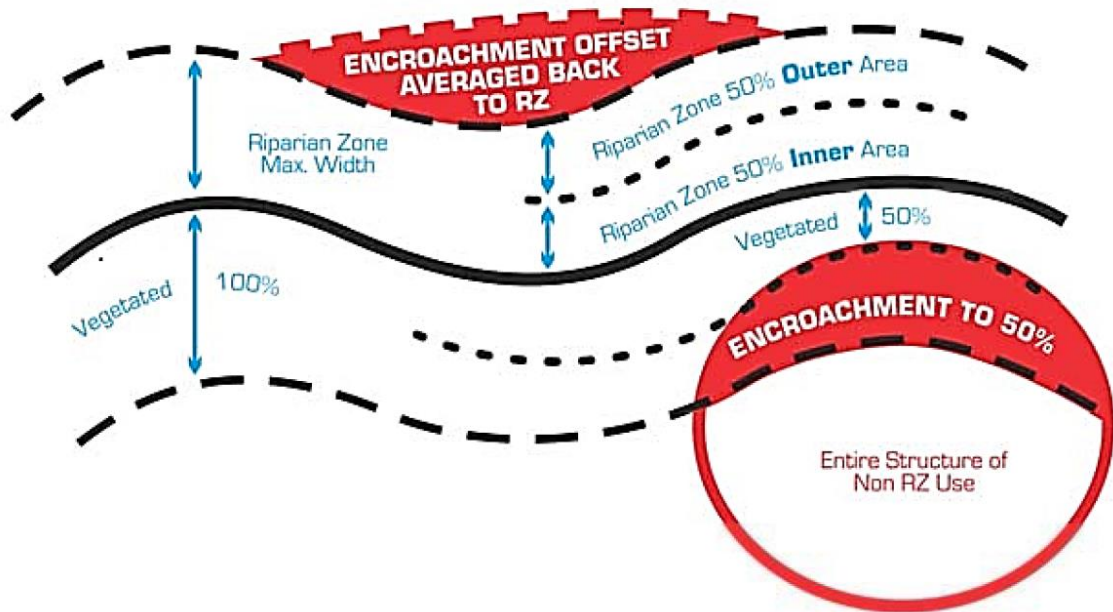


Figure 3: Riparian 'averaging rule' for offsetting encroachment into the outer 50% of the VRZ (NRAR 2018).

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 6 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 6.5.

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 1st order tributary of Kemps Creek in the south of the site and a 1st order tributary of Ropes Creek in the north east of the site.

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

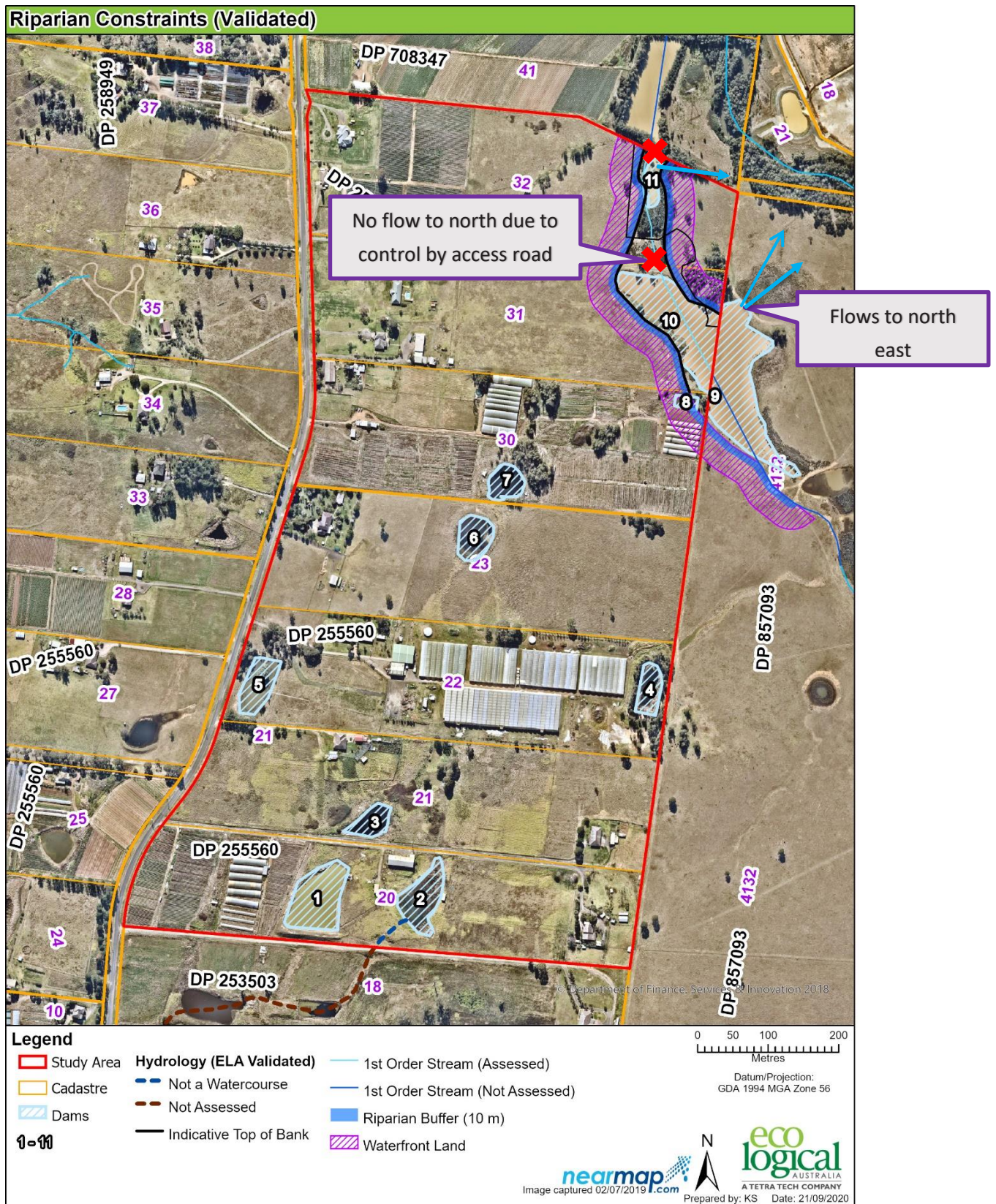












Figure 4: Validated watercourses within study area

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 ² 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 ² . 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 ² . 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 ² 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 ² 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 ² 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 ² . 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 ² . 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 st order watercourse.	No aquatic fauna observed.	No aquatic flora observed.	Not available
10	Dam 10 covered an area of approximately 7,800 m ² . 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.	

Dam number	Description	Aquatic fauna observed	Aquatic flora observed	Representative photo
11	Dam 11 covered an area of approximately 3,750 m ² . 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. Along the extent of the mapped watercourse within the site, there was little evidence of an area that

would meet the definition of a ‘river’ under the WM Act, with no defined channels in between Dams 10 and 11 (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.

Whilst there was no evidence of a 'river' within the study area, examination of aerial photos of upstream areas along this mapped watercourse indicate that there is likely a defined bed and bank in the upstream reaches of this watercourse.



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, 14/9/2020, Issue A (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 and 10, 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:

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

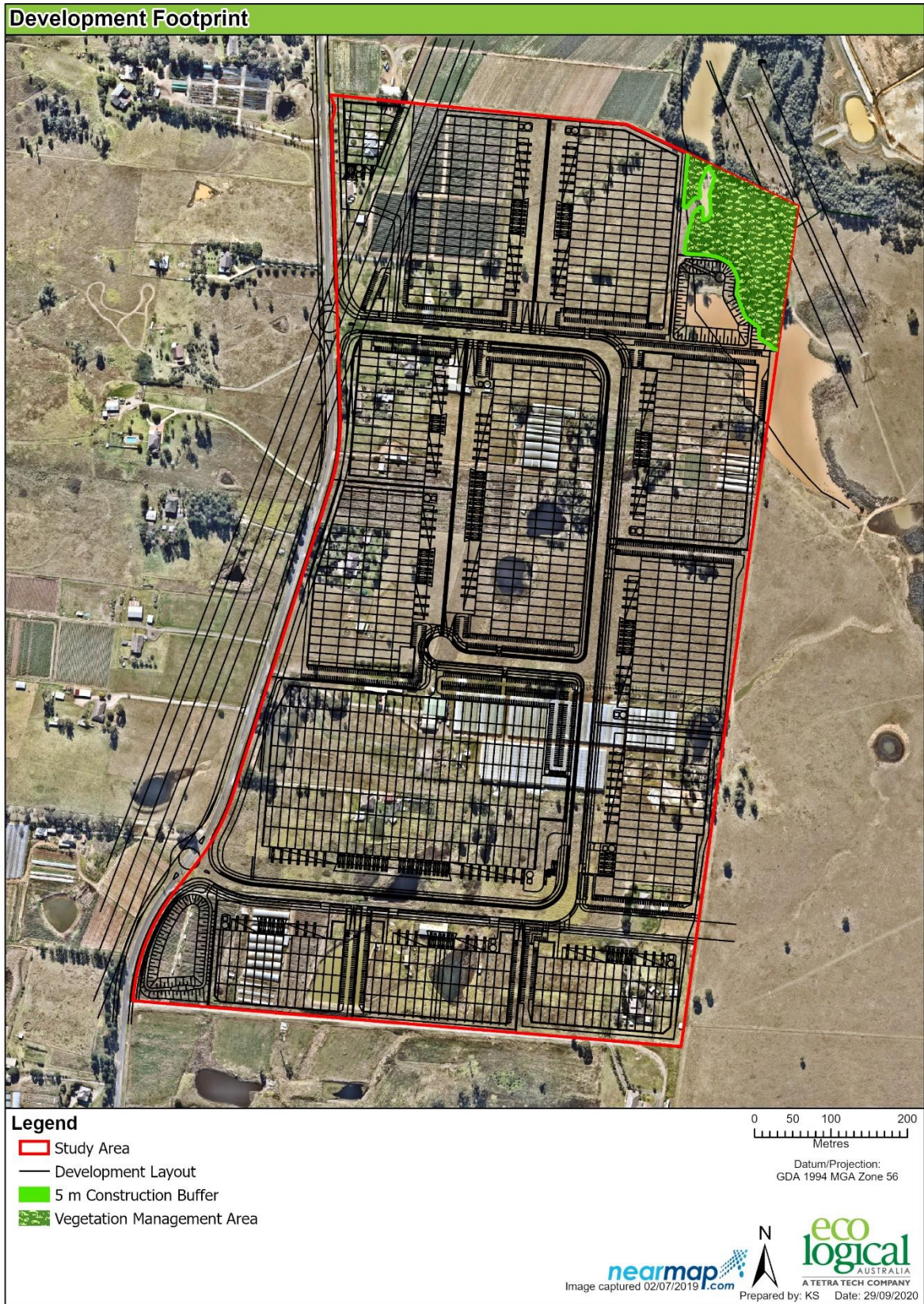


Figure 16: Proposed development footprint

5.1 Principle legislation

5.1.1 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 peelii</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	0	No, no suitable habitat and no records

Scientific Name	Common Name	FM Act	EPBC Act	Habitat Associations	Records within 5 km and catchment	Likelihood of occurrence
				flowing east and south of the main dividing range. This species spends only part of its 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).		within 5 km of site.

Note: E = Endangered, V= Vulnerable.

5.1.2 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 proposed development encroaches into the VRZ of the 1st order watercourse in the north east of the study area, for where the watercourse is mapped on the DPI dataset. However, flood modelling completed by AT&L for Fife Kemps Creek Trust (Figure 17) indicates that the actual flow path of this channel is to the north east of the site and not in the location of the mapped watercourse. Therefore the VRZ of the watercourse is not within the footprint. As Figure 17 shows, half of the large dam that is located on this mapped watercourse (Dam 10) will be filled. The impact of this filling on the 1st order unnamed tributary of Ropes Creek and downstream environments is likely to be minimal, as the current direction of flow is to the north east.

A dam dewatering plan should be prepared prior to the decommissioning of each dam in the development site.



Figure 17: Existing flow directions (provided by AT&L)

5.1.3 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.

5.2 Potential Impacts

5.2.1 Removal of farm dams

As outlined in section 4 of this report, Dams 1 -8 and 10 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 6 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.

Dam 11 isn't connected to a watercourse, however this waterbody contains good aquatic habitat and retains features of a wetland environment, and should be retained as part of the proposed development (Figure 16).

5.2.2 Surface erosion and sedimentation

Any clearing of vegetation or earthworks within the existing riparian zone of the 1st 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.

5.2.3 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.

5.2.4 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.

6. Mitigation measures

6.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) should be prepared prior to commencement of any construction works to address measures required be implemented prior to, during and after works to minimise impacts on the environment. This CEMP should include an Erosion and Sediment Control Plan, prepared in accordance with *The Blue Book – Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) and 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.

6.2 Timing and location of works

The proposed construction footprint encroaches into some areas of the riparian corridor. Actual works within these areas are yet to be fully documented, but it is recommended that higher-disturbance activities (such as noisy machinery, flood lights, generators and compounds) be located as far from the riparian buffer as practically possible. This is to avoid disturbance to fauna that rely on the riparian corridor for refuge, roosting, navigation, foraging and breeding. Works for the crossing should preferably take place in dry periods.

6.3 Vegetation Management Plan

A Vegetation Management Plan (VMP) should be prepared prior to construction commencing and should encompass methods for establishment and maintenance of the Vegetation Management Area plus landscape maintenance works required within the site. 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 amount of maintenance work will, in part, be dictated by the land use and associated condition of the watercourses upstream.

The VMP should also specify that high-density planting may be required to provide bank stabilisation following construction of the batters around the basins.

Water quality protection measures are recommended for adherence where the proposed development includes activities that require:

- Clearing of groundcover (grasses, herbs and shrubs, including exotic species) to bare earth
- Clearing of any native vegetation or mechanical weed removal within the riparian buffer zone
- Construction of any permanent car parks and roads
- Temporary staging areas, compounds and storage areas of oils and chemicals
- Wastewater discharge points, including pumping of groundwater from any below-ground excavation and vehicle wash down bays.
- Construction and maintenance of sediment detention and water quality ponds vegetated with macrophytes help filter and uptake nutrients and pollutants bound to sediment. Ponds may need periodic cleaning to remove excessive sediment, especially in the early stages of

development. Overflow points should lead through a secondary pond and / or slow channel planted with dense reeds rather than directly into the creekline.

Urban design should aim to reduce organic pollutants entering the waterway, such as:

- Use native street trees where leaves may enter the stormwater system. Deciduous trees should only be used if leaf drop is contained within a parkland environment.
- Provide a small buffer between mown lawns in public space and stormwater drains. This aims to reduce grass clippings entering the creek.

6.4 Aquatic Fauna Protection

Aquatic fauna should be protected during construction activities, including the decommissioning of the farm dams. 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.

6.4.1 Water Management Act 2000

The overland flow path of the water within the 1st order tributary in the north-east shows that water drains to the east of the location of the mapped stream. While on paper it appears that this watercourse will be disconnected from downstream areas, the development footprint has been designed to avoid any impact to the overland flow path and therefore the watercourse in this area.

The proposed works will incorporate WSUD features and GPTs and would allow for protection of watercourses and downstream areas. This means that the water quality of adjacent and downstream water sources will be protected and enhanced as a result of the proposed development. Areas within the site are currently used as market gardens or grazed by small numbers of sheep and horses, which

would be contributing nitrogen to the catchment and were observed to have trampled the edges of dams. The redevelopment of the site would remove these animals from the study area and ensure that riparian vegetation adjacent to the wetland area in the north of the site would have animals excluded. Removing the sheep and horses from the site would also contribute to ongoing stability of the edge of wetland areas.

A VMP would be required for revegetation and maintenance of the Vegetation Management Zone area within the north east of the study area. As a result, vegetated areas would be created along the boundaries of the site where they are currently covered with exotic species.

6.5 State Environmental Planning Policy (Western Sydney Employment Area) 2009

6.5.1 Part 6 Miscellaneous provisions

Works proposed within the site involve the creation of detention basins and revegetation alongside the wetland, which will contribute to the establishment of a vegetated riparian zone. A number of clauses within Part 6 of the SEPP WSEA are relevant to these works.

6.5.1.1 Clause 33H Earthworks

Prior to any earthworks commencing on site, an Erosion and Sediment Control Plan would need to be developed and implemented, to ensure that there is no detrimental impact on environmental functions and processes within the site as well as downstream. This plan would outline where erosion and sediment control measures are to be constructed to prevent mobilisation of soil from the site, particularly within the watercourse, as sediment entering the watercourse (even when dry) has the potential to degrade water quality within the site and downstream.

The proposed detention basins have been designed with consideration for drainage patterns of the whole site, as well as downstream environments and properties. Therefore, the proposed works are unlikely to disrupt or have a detrimental effect on existing drainage patterns within the site or downstream of the development site.

6.5.1.2 Clause 33I Development on flood prone land

The existing wetland area at Dam 11 does not have a fully vegetated riparian corridor alongside it. As outlined in Section 4.1.2, the vegetation alongside the waterbody is predominantly exotic and includes only a few native canopy trees. A VMP would cover the maintenance of native vegetation within this area.

6.5.1.3 Clause 33L Stormwater, water quality and water sensitive urban design

The development at Aldington Road will include installation and ongoing maintenance of Water Sensitive Urban Design (WSUD) components such as detention basins. This will ensure that once the development is completed and during the ongoing operation of the site, stormwater management systems will be integrated into the landscape and allow for improvement of water quality within the site, as stormwater and overland flow originating from the site will be delivered to the watercourse (and ultimately downstream environments) with an improved water quality when compared to the existing situation.

Realignment of the 2nd order watercourse will allow for instream habitat features (such as pool, riffle and run sequences) to be constructed, ultimately increasing the areas of aquatic habitat within the watercourse, compared to the existing watercourse, where instream habitat features are limited.

While the proposed development will include realignment of the existing watercourse and removal of existing riparian vegetation, it will also allow for an increase in the area of managed riparian vegetation, as the VMP prepared for the site requires the new riparian corridor to be fully vegetated, allowing for rehabilitation and restoration of riparian land. This vegetation will also be maintained over the course of the implementation of the VMP, allowing for continual suppression of exotic species and replacement planting where required.

6.5.2 Vegetated riparian zone

The new basin and Vegetation Management Zone is to be planted with natives species. The dense planting will provide habitat for fauna and additional stability to the banks of the waterbody. The proposed new channel will have native plants in each of the ground, shrub and canopy layers. The vegetated area associated with the new basin will also encompass a larger area than the existing vegetated area.

7. 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'*.

The mapped unnamed tributary of Kemps Creek in the south of the site did not meet the definition of a 'river' under the WM Act.

The mapped tributary of Ropes Creek within the north of the site does not flow north in the way that is depicted by the hydrolines. This area is highly modified and contains a series of farm dams. Overland flow paths show that it is likely Dams 10 and 11 connect to Ropes Creek via small channels in an easterly direction from the dams.

The construction of a detention basin in this northern part of the site has been designed to avoid the adjacent endangered ecological communities. Once constructed, rehabilitation of the cleared land to the north of the basin will provide riparian vegetation.

Dams 1-8 provide limited aquatic habitat and are proposed for removal. This can be completed with minimal harm to aquatic species if aquatic fauna handling guidelines are followed.

During construction, a CEMP would need to be implemented to minimise impacts on the environment. Following construction, existing vegetation within the study area and any proposed revegetation should be managed as per a VMP to ensure ongoing protection of riparian areas and waterbodies.

8. References

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Appendix A Master Plan

