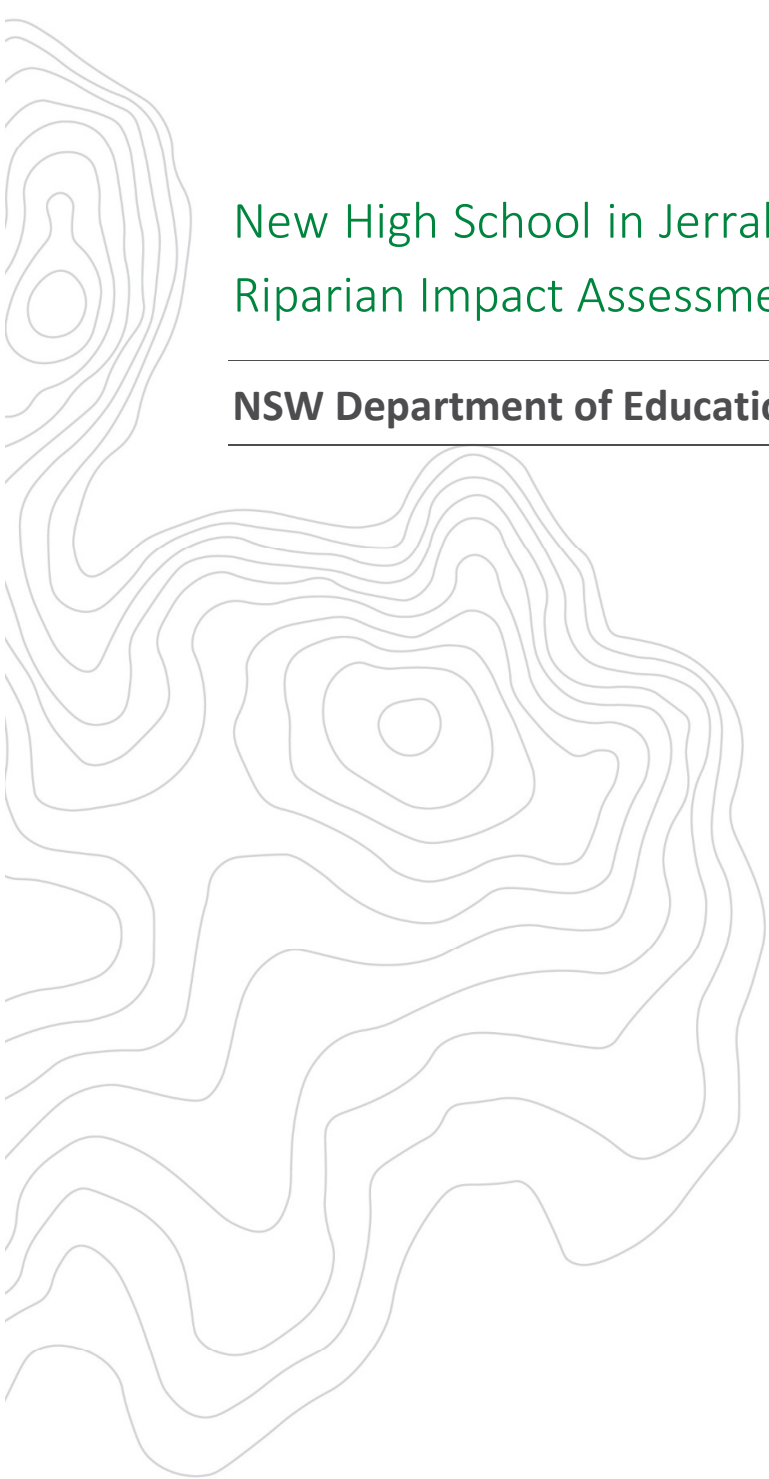


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New High School in Jerrabomberra - Watercourse and Riparian Impact Assessment

NSW Department of Education

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Project Manager	Skye O'Brien
Prepared by	Claire Wheeler
Reviewed by	Peter Hancock
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Template 2.8.1

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Abbreviations

Abbreviation	Description
CEMP	Construction Environmental Management Plan
DPIE	Department of Planning, Industry and Environment
ELA	Eco Logical Australia
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
FM Act	<i>Fisheries Management Act 1994</i>
NRAR	Natural Resources Access Regulator
LEP	Local Environmental Plan
RC	Riparian corridor
SEARs	Secretary’s Environmental Assessment Requirements
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>
WSUD	Water Sensitive Urban Design

Executive Summary

A Watercourse and Riparian Impact Assessment has been prepared to accompany a State Significant Development Application (SSDA No. 24461956) for a new high school at Jerrabomberra. The proposal will include site preparation works, such as clearing and levelling to accommodate the proposed buildings and play areas. The proposal will involve the construction of a series of buildings housing general learning spaces, administration and staff wings, outdoor learning areas, a library and assembly hall.

An unnamed tributary of Jerrabomberra Creek is located to the east of the development site. This is a second order tributary under the Strahler classification system that flows from the north-east to the south west and appears to terminate at a dam, adjacent to the south eastern boundary of the site.

The proposed works do not directly impact the second order watercourse or the dam. The development footprint encroaches into the Vegetated Riparian Zone (VRZ) of the dam, but this is unlikely to directly impact on the watercourse and aquatic habitat in this area due to the degraded nature of the area. Revegetation and rehabilitation of the portion of the VRZ adjacent to the dam is not proposed as part of this development, as this area is outside the Department of Education's property. However, a number of mitigation measures are recommended to minimise the impact of indirect impacts on the watercourse by slowing and filtering run off before it leaves the site. These include planting a buffer of groundcover species along the north eastern boundary of the study area and opting for a combination of grassed biofiltration swales, revegetation and permeable paving for the outer VRZ along the eastern boundary. A Construction Environmental Management Plan is to be prepared and implemented in order to prevent waste, sediment and dust from leaving the site and protect the nearby watercourses.

1. Introduction

This Watercourse and Riparian Impact Assessment accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in support of an application for a State Significant Development (SSD No 24461956). The SSDA is for a new high school located at Jerrabomberra.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs), notably:

SEARs Item	SEARs Requirement	Response
17	An assessment of potential impacts on surface and groundwater (quality and quantity), soil, related infrastructure and watercourse(s), including the dam and depression through the south east of the site.	Addressed in Section 6.
17	Details of measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles.	Addressed in Section 7.

1.1. Proposal

The proposed development is for the construction of a new high school in Jerrabomberra. The proposal will meet community demand and ensure new learning facilities are co-located near existing open space infrastructure. The proposal generally includes the following works:

- Site preparation
- Construction of a series of buildings up to three storeys including administration/staff areas, library, hall and general learning spaces
- Construction of new walkways, central plaza and outdoor games courts
- Construction of a new at-grade car park
- Associated site landscaping and open space.

The proposal has been designed to accommodate approximately 500 students with Stream 3 teaching spaces, however the core facilities will be future proofed to a Stream 5 to enable possible future expansion to meet projected demand.

The proposal will include site preparation works, such as clearing and levelling to accommodate the proposed buildings and play areas. The proposal will involve the construction of a series of buildings housing general learning spaces, administration and staff wings, outdoor learning areas, a library and assembly hall.

The proposal will include construction of a new driveway and hardstand with access proposed off the northern stub road east of Environa Drive. Pedestrian access is proposed off Environa Drive and the northern stub road.

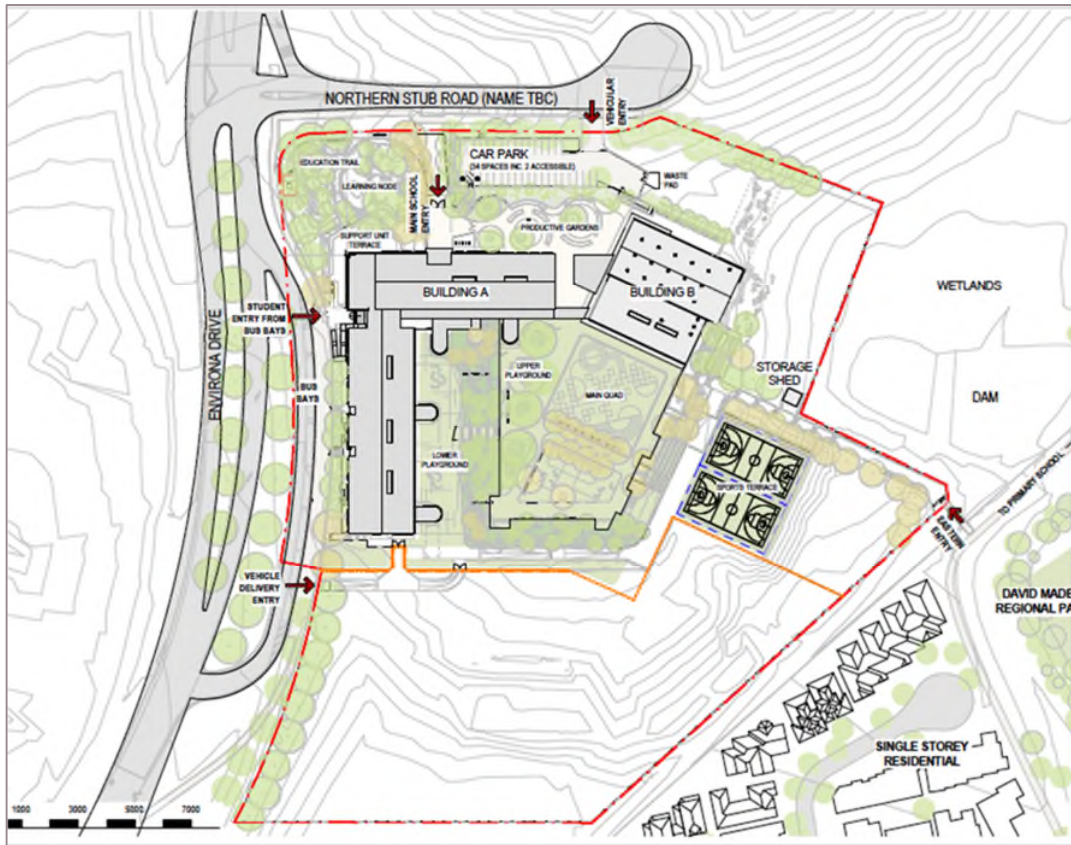


Figure 1: Proposed site plan (TKD Architects)

1.2. Site Description

The proposed development is located within the South Jerrabomberra Innovation Precinct, also referred as the Poplars Innovation Hub, in the local government area of Queanbeyan-Palerang Regional Council.

The school site is part of an existing lot (Lot 1 in DP 1263364), which is approximately 65.49 ha in area and will be characterised by a mix of business park and open space uses and a new north-south connector road named Environa Drive.

Delivery of the Precinct is underway with Environa Drive currently under construction. Most of the lot, however, remains undeveloped.

The school site is subject to a proposed lot (Lot 2 in DP 1263364), which was approved by Council under DA332-2015 on 10 March 2021 but is not yet registered. The approved lot is irregular in shape, is largely cleared and is approximately 4.5 ha in area. A small dam is located adjacent to the south-eastern boundary of the site, which forms part of a broader wetland (Figure 3).

The site is located in excellent proximity to existing open space facilities (Figure 2). It adjoins David Madew Regional Park to the south-east and is located 100 m east of an existing recreational field associated with Jerrabomberra Public School.

A description of the site is provided in Table 1 below.

Table 1: New High School in Jerrabomberra Site Description

Item	Description
Site address	School address yet to be determined however, it is located within the Jerrabomberra Innovation Precinct at 300 Lanyon Drive, Jerrabomberra.
Legal description	Lot 1 in DP 1263364 (existing) Lot 2 in DP 1263364 (proposed, but not registered)
Total area	Lot 1 – 65.49 ha Lot 2 – 4.5 ha
Frontages	The site provides frontage to Environa Drive and the northern stub road, both currently under construction.
Existing use	The site is undeveloped and contains a series of small vegetation clusters scattered across the site.
Existing access	Existing access is via an informal unsealed driveway off Tomsitt Drive along the northern boundary of the existing lot. The site will be accessed via Environa Drive and a secondary access road (North Road), which is currently under construction.
Context	Land to the south is primarily residential in nature. Jerrabomberra Public School and David Madew Regional Park are located to the east/south-east, while land to the west is undeveloped and features Jerrabomberra Creek. The site is located within the South Jerrabomberra Innovation Precinct, which is currently under construction. The areas north and west of the site are currently undeveloped but the site is currently undergoing a transition from rural to business park uses. Development further north on the opposite side of Tomsitt Drive and along Edwin Land Parkway includes retail and commercial uses. Development immediately to the south includes existing low density residential development. Land in the south west has been identified for future low density residential, light industrial and business park uses.



Figure 2: Site aerial depicting the land subject to the proposed High School (TKD Architects)



Figure 3: Location of study area and mapped watercourses in relation to the proposed development

2. Legislative context

The specific riparian and aquatic regulatory requirements and policies were reviewed to determine their application to the Jerrabomberra site. These included:

- *Fisheries Management Act 1994*
- Fisheries spatial portal, threatened species profiles and Primefacts (Riches et al, 2016)
- *Water Management Act 2000*
- *Water Management (General) Regulation 2018*
- Policy and guidelines for fish habitat conservation and management (Fairfull, 2013)
- Queanbeyan Local Environmental Plan (West Jerrabomberra) 2013.

2.1 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) governs the management of fish and their habitat in NSW. 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.

A search of the Commonwealth Protected Matters Search tool, the Department of Planning, Industry and Environment (DPIE) BioNet database search, Fisheries Threatened Species distribution maps (Riches et al, 2016) and Primefact publications in September 2021 identified three species of fish with potential to be found within the study area (Table 2). As there are no records within 5 km of the site and a lack of suitable habitat on site, it is unlikely that these species would be found within the proposed development area.

Table 2: 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>Bidyanus bidyanus</i>	Silver Perch	CE	V	Prefers faster-flowing water including rapids and open sections of river. However, they are a highly migratory species which may utilise a range of habitats during migration.	0	Unlikely, no suitable habitat. The nearest NSW BioNet record is from Cotter Dam, a tributary of the Murrumbidgee River.
<i>Maccullochella peelii</i>	Murray Cod	V	-	Inhabits clear rocky streams to slow-flowing, turbid rivers and billabongs. Frequently found in the main river channel and larger tributaries, and also in floodplain channels when they contain water.	0	Unlikely, no suitable habitat. The closest NSW BioNet record is in the Murrumbidgee River, which is not hydrologically connected to the watercourse on 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	Unlikely, no suitable habitat. The closest NSW BioNet record is in the Molonglo River, which is not hydrologically connected to the watercourse on site.

Note: CE = Critically Endangered, E = Endangered, V = Vulnerable

2.2 Water Management Act 2000 and Water Management (General) Regulation 2018

The main objective of the *Water Management Act 2000* (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 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):

- a. *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.*

Under the WM Act framework, activities and works proposed on waterfront land are regulated. These activities include:

- the construction of buildings or carrying out of works
- the removal of material or vegetation from land by excavation or any other means
- the deposition of material on land by landfill or otherwise
- any activity that affects the quantity or flow of water in a water source.

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, to inform a comparative and acceptable assessment of watercourse and 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) outlines 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 4). 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 3).

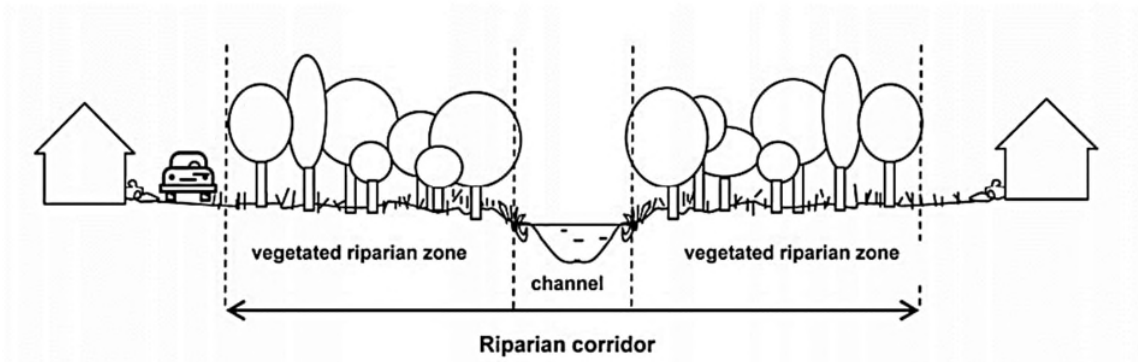


Figure 4: Vegetated Riparian Zone and watercourse channel comprising the riparian corridor (NRAR, 2018)

Table 3: 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 4). Non-riparian uses consistent with NRAR's guidelines in the outer 50% of the VRZ are permitted as long compensation (1:1 offset) is achieved within the site. The outer VRZ that is impacted is to be offset elsewhere on site using the 'averaging rule' (Figure 5).

Table 4: 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	•	•	•		•			•	•

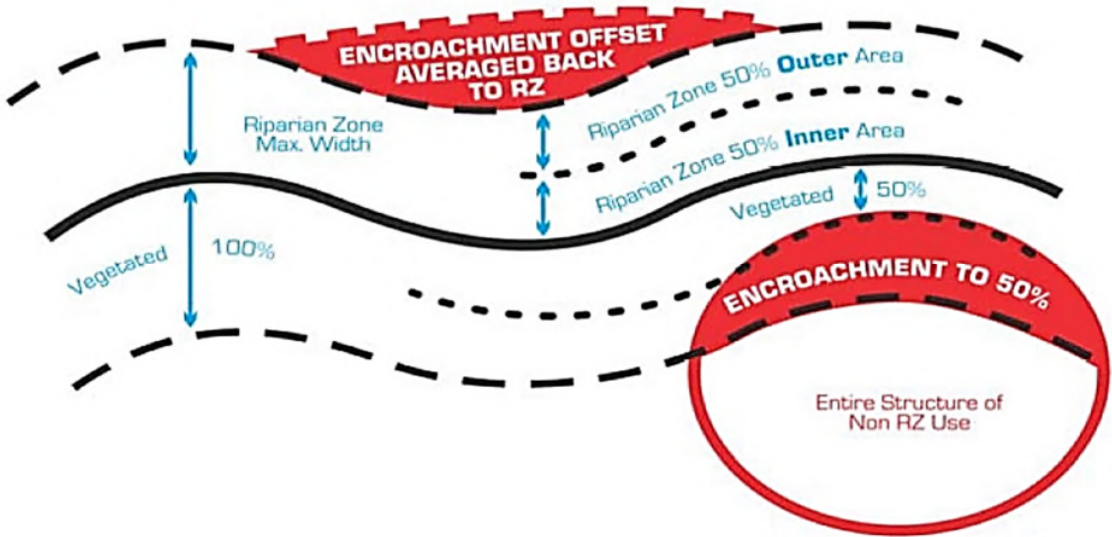


Figure 5: Riparian 'averaging rule' for offsetting encroachment into the outer 50% of the VRZ (NRAR, 2018)

2.3 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 were 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 provides guidance for assigning a rating for fish habitat sensitivity (Table 5) and the class of KFH.

Table 5: Key fish habitat and associated sensitivity classification (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:
Posidonia australis (strapweed)
Zostera, Heterozostera, Halophila and Ruppia species of seagrass beds >5 m ² in area
Coastal saltmarsh >5 m ² in area
Coral communities
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)
Marine park, an aquatic reserve or intertidal protected area
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
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
Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act
Mound springs
TYPE 2 – Moderately sensitive key fish habitat:
Zostera, Heterozostera, Halophila and Ruppia species of seagrass beds <5 m ² in area
Mangroves
Coastal saltmarsh <5 m ² in area
Marine macroalgae such as Ecklonia and Sargassum species
Estuarine and marine rocky reefs
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)
Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area
Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna
Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1
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

Key fish habitat and associated sensitivity classification scheme (for assessing potential impacts of certain activities and developments on key fish habitat types)

Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation

2.4 Queanbeyan Local Environmental Plan (West Jerrabomberra) 2013

The development site is zoned RE2 Private Recreation and B7 Business Park under the Queanbeyan LEP (West Jerrabomberra) 2013. Within the B7 zone, 'educational establishments' are permitted with consent. Within the RE2 zone, educational establishments are not listed as permitted.

Section 1.2 (c) outlines the particular aims of the LEP, to identify, protect and manage environmentally and culturally sensitive areas within West Jerrabomberra, including but not limited to waterways and riparian corridors, habitat corridors, native vegetation and associated buffers, and heritage items. Section 6.2 further elaborates the objective of this aim, which is to protect and maintain the following:

- a. water quality within watercourses
 - b. the stability of the bed and banks of watercourses
 - c. aquatic and riparian habitats
 - d. ecological processes within watercourses and riparian areas.
2. This clause applies to the following land:
- a. land identified as "Watercourse" on the riparian lands and watercourses map
 - b. all land that is within 40 metres of the top of the bank of each watercourse on land identified as "Watercourse" on that map.

While the overarching aim of the LEP applies to the development site, the watercourse to the east of the site is not mapped on the Riparian Lands and Watercourses map and therefore Section 6.2 is not applicable to the proposed development.

3. Methods

The Strahler stream order classification was extracted from the Department of Primary Industry's GIS dataset. Top of bank was estimated using aerial photographs and 1 m contours, before being field-validated by a surveyor on 1 September 2021, accompanied by ELA Senior Aquatic Ecologist Ian Dixon. Where the watercourse met the definition of a 'river' under the WM Act it was assigned the appropriate riparian corridor width in accordance with the stream order. The field survey also determined the current condition and extent of riparian and aquatic habitat within the study area:

1. Definition of a 'river' under the WM Act – The waterway adjacent to the SSDA boundary was assessed to determine if it met the definition of a 'river' using definitions outlined in section 2.2 of this report.

2. Riparian habitat assessment – An assessment of riparian condition was conducted for the waterway. This assessment considered native vegetation cover, connectivity and quality, bed and bank stability and habitat diversity.

3. Aquatic habitat assessment – An assessment of the aquatic habitat within the mapped waterway and dam was completed, which examined the quality of aquatic habitats, including vegetation structure and regeneration, weed infestation, woody debris, fish habitat, patch size and connectivity potential.

4. Existing environmental conditions

An unnamed second-order tributary of Jerrabomberra Creek is mapped to the east of the site. It flows in a south westerly direction through a dam and sedge land before ending in a dam located to the immediate east of the proposed development. The watercourse is classified as a second-order creek under the Water Management Regulation (General) 2018 Hydroline mapping; however, the upstream tributaries are highly modified due to urban development. The location of the watercourse in relation to the development site is shown in Figure 6.

The watercourse and riparian corridor to the east of the site was a broad, low-lying sedge-dominated floodplain with a narrow, incised meandering channel (Figure 7), that met the definition of a 'river' under the WM Act. The bank was firm in most places but held mainly by grasses and herbs. Some erosion of the low relief channel banks was evident in areas along the length of the channel between the two dams (Figure 9).

Few macrophytes were observed in the channel, which had limited geomorphic variability, with long pools and infrequent short riffles.

No native riparian woody vegetation was present alongside the channel and the width of the strip of woody exotic vegetation was less than 5 m wide. Artificial dams and bunds had diverted and impounded flows and at times there was no defined channel between small pools, joined only by preferential flow paths through sedges.

The dam adjacent to the eastern side of the development footprint covered an area of approximately 2,500 m². Water in the dam on the day of the field survey was turbid, with a large amount of submerged and floating algae observed (Figure 9). Emergent macrophytes were scattered across the dam and there was no fringing canopy vegetation. Downstream of this dam, no defined channel was observed and no clear connection to Jerrabomberra Creek was evident.

The area was dominated by the native sedge *Carex appressa* (Figure 10). The exotic sedge *Cyperus eragrostis* and the rush *Juncus* spp. were also common. Exotic grasses included *Bromus catharticus* (Prairie Grass), *Phalaris aquatica* (Phalaris) and *Paspalum dilatatum* (Paspalum). Occasional native grass species such as *Poa labillardierei* (Tussock) and *Austrostipa bigeniculata* (Knead Spear-grass) were also observed in low abundance. The exotic shrubs *Crataegus monogyna* (Hawthorn) and *Rosa rubiginosa* (Sweet Briar) were common throughout this area.



Figure 6: Validated watercourse adjacent to the development footprint



Figure 7: Open channel characteristic of the second order watercourse to the east of the development site



Figure 8: Eroded banks of the channel through the sedgeland



Figure 9: Dam adjacent to the eastern side of the development site; looking east



Figure 10: Dense *Carex appressa* alongside the dam

5. Planning and legislative requirements

5.1 Fisheries Management Act 1994

As a second order watercourse with poor instream habitat, the channel to the east of the development site would not be considered KFH. In addition, for the purposes of the Policy, first and second order streams are not considered KFH. Jerrabomberra Creek, located downstream of the site, is considered KFH. However, there would be no direct impact to Jerrabomberra Creek.

Therefore, no permits or offsets under the FM Act are required for the proposed development. Mitigation measures outlined in Section 7 address indirect impacts.

5.2 Water Management Act 2000

To guide land use planning and decisions on watercourses and their riparian zones, NRAR published *Guidelines for Controlled Activities on Waterfront Land* (2018). These guidelines are generally used in conjunction with a ground-truthing riparian assessment. The guidelines state that watercourses should have riparian zones that are measured from the top of bank on each side of the watercourse.

During the field survey, it was ELA's assessment that the second order watercourse to the east of the development met the definition of a 'river' under the WM Act.

There is no revegetation of the VRZ surrounding the dam or watercourse proposed as part of this development. The VRZ is predominantly on property not owned or managed by NSW Department of Education, therefore revegetation of this area is not possible. However, it is recommended that permeable paving and a grassed biofiltration swale be installed where the development footprint overlaps with the outer VRZ and planting a 5-10 m wide buffer of groundcover species along the north eastern boundary of the study area, east of Building B, to slow and filter runoff before it leaves the site.

6. Impact assessment

6.1 Surface erosion and sedimentation

Any clearing of vegetation or earthworks within the existing riparian zones 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 Jerrabomberra 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.

6.2 Degradation of water quality

There is the potential for sediment and waste material generated as part of the construction activities to enter the downstream waterway or adjacent waterway. This would increase the turbidity of the water and potentially introduce chemicals to the creek, and ultimately degrade water quality not only in the immediate works area but also in downstream environments. Increased turbidity can also lead to a decline in dissolved oxygen concentration.

6.3 Weed invasion

Where disturbance from construction associated with the proposed development results in bare ground or increased sunlight penetration into currently vegetated 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.

6.4 Polluted surface water runoff

In areas where the proposed development includes the construction of impervious surfaces, there is an increased risk of motor vehicle oils, litter and warmer surface water entering the creek. Subsequent impacts may include water quality issues (heavy metals, oil and grease pollution from vehicles), inorganic clogging of aquatic habitats (litter/rubbish) and destruction of macroinvertebrate communities (warm water inflows). Another impact common in urban areas is when mass leaf drops from deciduous street trees wash into the creek. Large quantities of non-native leaves deposited in a short period of time create water quality issues, such as declines in dissolved oxygen, during decomposition. These leaves are also not a suitable food resource for macroinvertebrates, which prefer slow-decomposing native leaves that are evenly deposited throughout the year.

6.5 Water Management Act 2000

Revegetation is not proposed in the inner VRZ surrounding the dam or watercourse on land outside of the development site, which is not in line with the *Guidelines for Controlled Activities on Waterfront Land* (NRAR, 2018). However, in this case, the principles of the WM Act can guide activities that are to

take place on waterfront land and be used to provide a merit-based assessment of the proposed development.

The principles set out in this section are the water management principles of this Act.

Generally:

- a. water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded, and*
- b. habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored, and*
- c. the water quality of all water sources should be protected and, wherever possible, enhanced, and*
- d. the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised, and*
- e. geographical and other features of Aboriginal significance should be protected, and*
- f. geographical and other features of major cultural, heritage or spiritual significance should be protected, and*
- g. the social and economic benefits to the community should be maximised, and*
- h. the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.*

Impacts to nearby watercourses are likely to be negligible, due to the disconnect between the watercourse and the development site. Impacts to watercourses could be mitigated by the integration of water quality improvement devices and vegetated buffers into the development.

7. Mitigation Measures

The construction of impervious surfaces as part of the proposed development will have minor indirect impacts on the adjacent and downstream watercourses. This impact is likely to be insignificant if the following mitigation measures are implemented.

7.1 Vegetated buffer and biofiltration swale

It is recommended that a vegetated buffer 5-10 m wide is created on the north eastern edge of the site where the outer VRZ overlaps with the study area (Figure 6), east of Building B. The buffer should be comprised of native groundcovers and grasses and would provide a barrier between the proposed high school and the dam and riparian area, with the aim of filtering runoff before it leaves the site.

In addition to this buffer, the footpath proposed along the eastern boundary should be made of permeable paving to also aid in infiltration of overland flow before leaving the site. Between this footpath and the site boundary, a biofiltration swale is recommended to be installed to provide filtering of runoff before it leaves the site.

7.2 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) is to be prepared prior to commencement of any construction works to address measures required to be implemented prior to, during and after works to minimise impacts on the environment. This CEMP should include a Sediment and Erosion 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’ downstream of the site. The Plan must include, as a minimum, the locations and type of erosion and sediment controls to be erected within and adjacent to the site to protect nearby aquatic habitat. Further, dust suppression activities during the construction phase should not draw water from the dam and watercourse.

7.3 Protection of water quality and habitat condition

Water quality improvement devices are to be integrated into the development to ensure that water quality in the adjacent and downstream habitats is protected from the impacts of the operation of the school, such as increased impervious surfaces. The volume and velocity of flows from the development site should be detained so that post development flows are characteristic of what is currently leaving the site.

Water quality protection measures are recommended for use where the construction-related activities 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.

Key protection measures suitable to mitigate the above activities include:

- Including Gross Pollutant Traps to capture litter from car parks and roads
- Installing sediment fences during construction to slow overland flow and trap sediments created from surface erosion
- Installation of permeable paving where appropriate
- Construction of biofiltration swales along the eastern boundaries of the site to filter overland flow
- Identifying opportunities for re-use of water from any on-site dewatering activities site including dust suppression.

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

- Using 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
- Providing a small buffer between mown lawns in public space and stormwater drains. This aims to reduce grass clippings entering the creek.

8. Conclusion

As the works are considered SSD, a controlled activity approval under the WM Act is not required. There would be no direct impacts to the adjacent and downstream watercourses and revegetation of the VRZ is not possible as the land is not owned or managed by the NSW Department of Education.

There would be no direct impact to Jerrabomberra Creek, which is considered KFH, and no permits or environmental compensation is required under the FM Act.

It is recommended that a revegetated buffer within the development site be created, permeable paving be used to construct footpaths where they are proposed to be located on the eastern boundary, installation of a biofiltration swale between the footpath and the site boundary, as well as the preparation and implementation of a CEMP, in order to mitigate the impacts to the adjacent and downstream watercourses and aquatic habitat.

9. References

DAWE (2021). EPBC Online Protected Matters Database Search. Available at <http://www.environment.gov.au/erin/ert/epbc/imap/map.html>

EES (2021). NSW BioNet: *Atlas of NSW Wildlife online search tool*. Available: (<http://www.bionet.nsw.gov.au/>)

Fairfull, S. (2013). *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update)*. Available online: http://www.dpi.nsw.gov.au/data/assets/pdf_file/0005/634694/Policy-and-guidelines-for-fish-habitat.pdf

Land and Property Information (2015). 'SIX maps aerial imagery'.

Landcom (2004). *Managing Urban Stormwaters: Soils and construction – Volume 1*.

NSW Department of Industry (DPI) 2020. *Hydro line spatial data*. Available online: <https://www.industry.nsw.gov.au/water/licensing-trade/hydroline-spatial-data>.

NRAR (2018). *Guidelines for controlled activities on waterfront land – Riparian corridors*. Available online: https://www.industry.nsw.gov.au/data/assets/pdf_file/0004/156865/NRAR-Guidelines-for-controlled-activities-on-waterfront-land-Riparian-corridors.pdf

Riches, M., Gilligan, D., Danaher, K. and Pursey, J. (2016). *Fish Communities and Threatened Species Distributions of NSW*. NSW Department of Primary Industries

