Water Assessment

Majors Creek 1A
Solar Farm & BESS

March 2026

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DOCUMENT CONTROL

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EDPR Australia Pty Ltd
ABN 38 633 420 309

Level 4, 54 Marcus Clarke Street
Canberra ACT 2601

GPO Box 1429
Canberra ACT 2601

Email: australia@edp.com
Website: www.edpr.com

ABOUT EDPR AUSTRALIA

EDPR Australia, formerly ITP Development, is a renewables developer focused on delivering clean energy to the Australian market. Based in Canberra with a regional office in Sydney, EDPR Australia has a growing portfolio of renewable developments across regional Australia, specialising in both large and town-scale solar farms and BESS projects designed to match current and future electricity demand.

Leveraging expertise from our focused team and specialist consultants, EDPR Australia holds extensive experiences in landholder engagement, planning approvals, systems design, financing, engineering, electrical connection approvals, and commissioning. We maintain relationships with multiple stakeholders to ensure projects are successfully delivered in accordance with their expectations.

EDPR Australia is part of EDP Renewables APAC group, which is headquartered in Singapore and has a pan-regional presence with approximately 1.3 GWp of committed solar capacity. EDP Renewables APAC is part of EDP Renewables (Euronext: EDPR), a global leader in the renewable energy sector with more than 15 GW installed capacity in 29 markets across Europe, North America, South America and Asia Pacific. EDP group is recognised as the world's most sustainable energy utility company with an ambition to be Net-Zero by 2040, under the new Science Based Targets initiative (SBTi) Net-Zero Standard.

ABBREVIATIONS

AC	Alternating Current
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Average Recurrence Interval
BESS	Battery Energy Storage System
BoM	(Australian) Bureau of Meteorology
DC	Direct Current
DCCEEW	Department of Climate Change, Energy, the Environment and Water (NSW)
DCP	Development Control Plan
EPI	Environmental Planning Instrument
ha	Hectare
LEP	Local Environmental Plan
MW	Megawatt, unit of power (1 million Watts)
NDWI	Normalized Difference Water Index
NSW	New South Wales
PV	Photovoltaic
SDL	Sustainable Diversion Limit
SES	State Emergency Service
SEPP (T&I)	State Environmental Planning Policy (Transport and Infrastructure) 2021
WM Act	Water Management Act 2000

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1. INTRODUCTION

1.1. Overview

This report, which provides a desktop water assessment to support the Development Application for the project, includes a:

- Desktop review of local hydrology and catchment and water quality data.
- Desktop review of surface and groundwater quality data.
- Desktop review of the flood risk potential against the Local Environmental Plan.
- Desktop impact assessment against NSW policies and referenced industry standards for solar arrays.
- Desktop management assessment with mitigation measures recommended for construction and operation.

1.2. Limitations of Assessment

The assessment is based on publicly available information and data and does not include a site inspection, sampling, or any additional hydrological and/or hydraulic modelling.

2. PROJECT DESCRIPTION

2.1. Solar Farm

EDPR Australia is proposing to develop a town-scale solar farm (referred to as Orange South 8B & 9B), as described in the summary sheet in ***Table 1*** below. The site is located 6.8km south of the township of Orange within the Orange City Council local government area (see **Figure 1**).

Table 1 – Site Information

Parameter	Description
Site name	Majors Creek 1A Solar Farm & BESS
Lot/DP(s)	Lot 81 / DP755905
Street address	873 Wallaces Gap Road, Ballalaba NSW 2622
Council	Queanbeyan-Palerang Regional Council
AC capacity	4.99 MW
Property area (total parcel)	40.17 ha
Development fenced area	14.11 ha
Current land use	Sheep grazing

EDPR Australia is proposing to develop a 4.99 MW_{AC} solar farm at 873 Wallaces Gap Road, Ballalaba NSW. The solar farm will be located within a 40.17-hectare parcel of land that is used for sheep grazing.

This tracker system project will comprise of solar modules installed in north-south-oriented rows that are about 120 metres long running east to west. The height of each module is approximately 2.0 m to 2.75 m and the mounting system is constructed on piles that are driven into the ground, typically within the depths of 1.5 m to 3.0 m. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day.

The solar farm will also consist of an inverter station, which incorporates two inverter units, the high/medium voltage switchgear and transformers. The inverter station is ground mounted and incorporated on a 12.19 m skid. Allowance is made for a 2.9-metre-high battery energy storage system (BESS) on a 12.1m skid alongside the inverter stations.

During construction, there is expected to be 50 personnel on site working from 7 am – 4 pm Monday to Friday, with approximately 30 personnel on site at any one time. It is anticipated there will be up to around 40 light vehicle trips per day, with a maximum of around 30 light vehicles on site at any one time. The construction

stage is expected to take approximately 3 months. Once operational, the sites will be unmanned, and maintenance is expected to be carried out quarterly by a crew of 2 – 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site can then be returned to the pre-development land use or as agreed to.

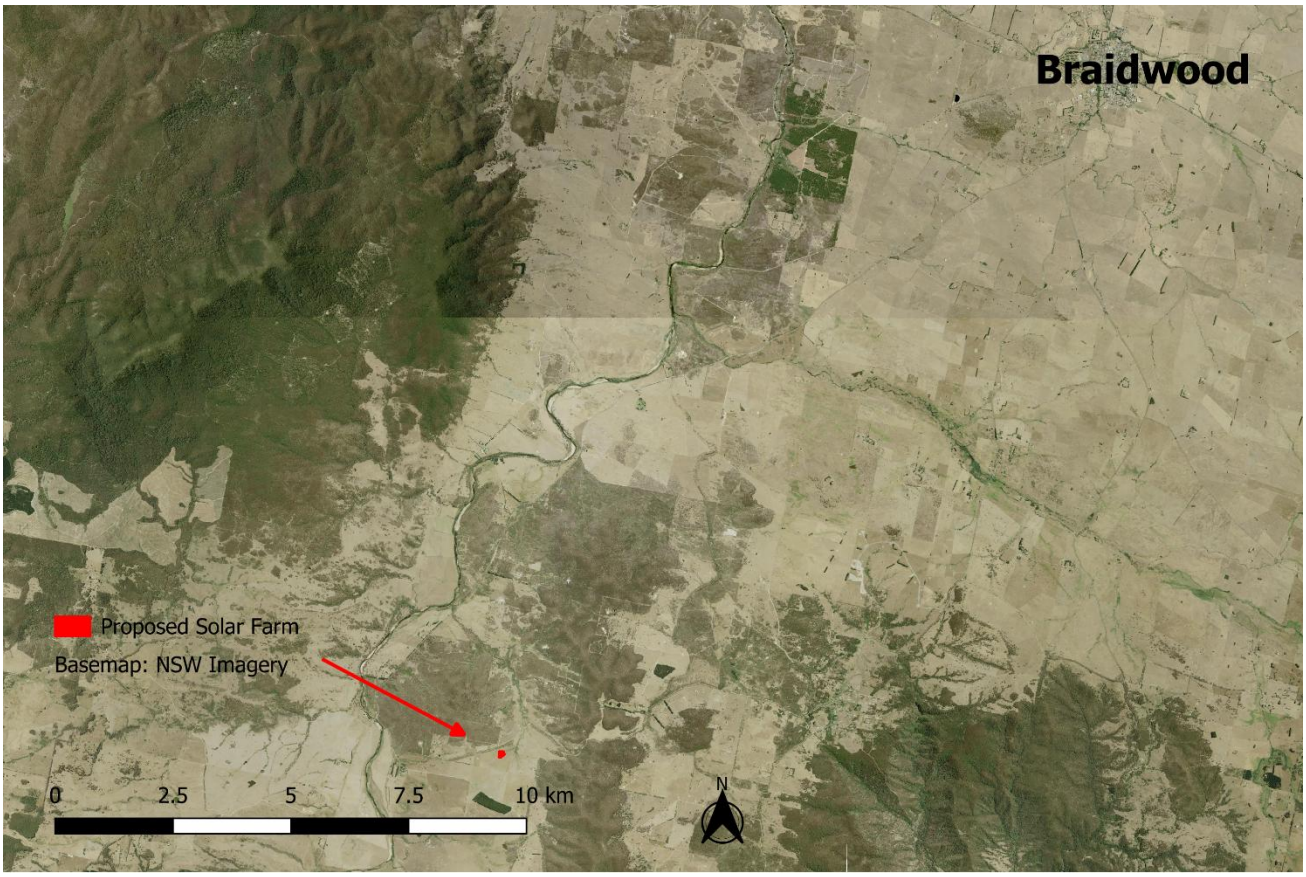

Figure 1 – Proposed solar farm site and surrounding area

2.2. Hydrology, climate and topographic conditions

The proposed site for the Majors Creek Solar Farm & BESS is within the Queanbeyan-Palerang Regional Council Area. Majors Creek in NSW (685m AHD) is located within the upper catchment of the Shoalhaven River. Other towns in the broad vicinity include Braidwood (653 AHD) and Jembaicumbene (668m AHD) to the north.

The primary hydrological feature near the site is the Shoalhaven River. The catchment of the river is approximately 7,300 km^2, making it the sixth largest coastal catchment in NSW. The upper part of the catchment is characterised by rugged terrain south of Braidwood. The river flows for 300 kilometres through farmland and national park areas before forming an estuary east of Nowra where it enters the Pacific Ocean. Approximately half of the catchment has had minimal disturbance to its native vegetation. About 35% of the catchment is used for agriculture, 11% for forestry and only 4% the catchment is urbanised (Oceanwatch Australia, 2021). The central part of the upper catchment has fragmented riparian vegetation where grazing is the predominant land use. The woody riparian cover is largely intact in the outer areas where national parks and state forests are the main tenure (NSWDWE, 2008). These land use practices are dependent on the waterways of the catchment.

2.2.1. Mapped watercourses

The project property contains one mapped watercourse located along the northern section of the site (see **Figure 2)**. According to the Water Management (General) Regulation Hydro Line spatial data, this watercourse consists of two (2) first order streams – as classified by the Strahler System ordering method – which merge to form a second order stream. Based on the spatial data, the watercourse path runs generally in a south-west to north-east direction, connecting to Brick Kiln Creek, located more than 100 metres beyond the eastern boundary of the property.

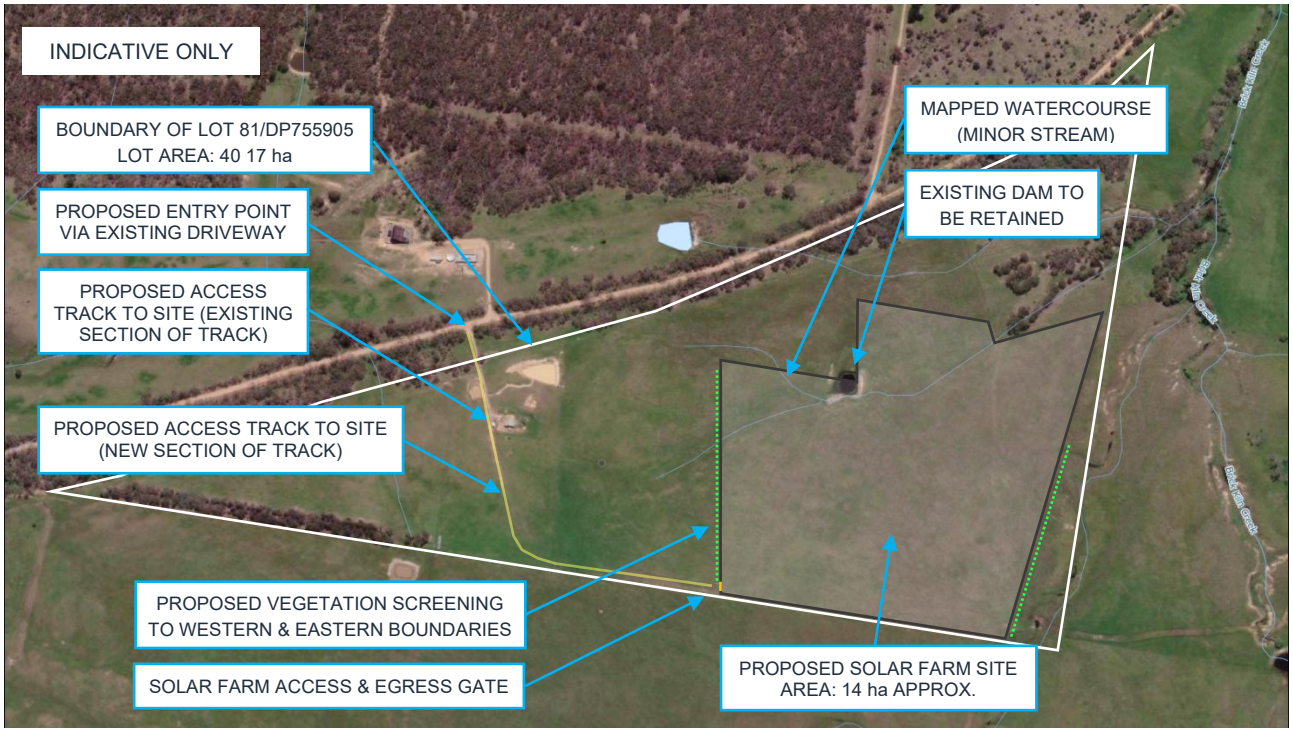

Figure 2 – Mapped watercourse within the development site

Under the WM Act, a mapped watercourse is taken to constitute waterfront land. As such, works within a prescribed riparian corridor are classified as controlled activities and may require Controlled Activity Approval (CCA) from the regulator. However, the *Waterfront Land Guidelines* provide that "where a watercourse does not exhibit the features of a defined channel with bed and banks, the department may determine that the watercourse is not waterfront land for the purposes of the WM Act" (**Figure 3**).

Table 1. Recommended riparian corridor widths

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

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

Figure 3 – Riparian corridor widths (source: Controlled activities – Guidelines for riparian corridors on waterfront land)

Under the Definitions of the Water Management Act 2000 (WM Act), a first order and second order stream is defined as a "minor stream":

> ***minor stream*** means—
>
> (a) any stream or part of a stream—
>
> (i) the location of which is specified in the hydroline spatial data, and
>
> (ii) that is identified as a first or second order stream, or part of such a stream, as determined in accordance with the system set out in Schedule 2, and
>
> (iii) that does not maintain a permanent flow of water, being a visible flow that occurs on a continuous basis, or would so occur if there were no artificial abstractions of water or obstruction of flows upstream, and
>
> (iv) that does not at any time carry flows emanating from a third or higher order stream as determined in accordance with the system set out in Schedule 2, or
>
> (b) any stream or part of a stream the location of which is not specified in the hydroline spatial data.
>
> For the purposes of paragraphs (a)(i) and (b), a stream is specified in the hydroline spatial data if it is identified as a watercourse (however described) in accordance with the legend or terms of that data.

Desktop assessments, supported by on-site investigations, confirmed that the mapped feature does not exhibit the physical characteristics typically associated with a defined watercourse. Site photos were taken by Zenith Town Planning in 2024 to document site conditions. An image taken near the mapped watercourse, as well as a reference map, are provided in the **APPENDIX** section below.

Specifically:

- No discernible bed or banks were identified;
- No defined flow path was observed;
- No evidence of regular or intermittent flow was present;
- Characteristic riparian vegetation was absent; and
- The feature is not identified in the SEED Portal Riparian Vegetation Condition Index mapping.

These findings indicate that, while the feature is mapped in the Hydro Line dataset, it does not function as a physically defined watercourse on the ground.

Nevertheless, the proposed development has been thoughtfully planned and designed to ensure compliance with legislative requirements and guidelines, while maximising land use efficiency. Minimal impact design principles have been incorporated into the solar farm layout, as well as the associated infrastructure, as detailed in **Section 2.2.1.1** below.

Accordingly, the impacts of the proposed works are considered minor in scale, involve negligible earthworks, and will not alter hydrology, bed and bank stability, or riparian function. Considering the low-impact design and nature of the proposed works, and the absence of a physically defined watercourse at the mapped location, it is unlikely that the solar farm development will result in any adverse impacts on the subject land.

2.2.1.1. Minimal impact design and infrastructure

The solar farm layout and infrastructure have been intentionally designed to optimise efficient land use while minimising disturbance to soils, drainage patterns and natural landform.

As illustrated in the DA Drawing Pack submitted with the Development Application, tracker rows are approximately 120 metres in length. The mounting system comprises galvanised steel piles (similar to fence posts) driven into the ground to depths typically ranging between 1.5 metres and 3.0 metres. This approach avoids or significantly minimises the need for concrete footings, bulk excavation or substantial earthworks.

Within each tracker row, piles are spaced approximately 7 to 10 metres apart, with a typical spacing of 6 to 7 metres between rows (pile-to-pile), allowing for operational access and minimising shading. A typical cross-section of the tracker installation is provided in **Figure 3** below. This mounting system elevates the solar modules above ground level and maintains generous spacing between structural elements. As a result:

- The existing natural terrain can be largely retained;
- Surface water flow paths are not obstructed;
- Soil disturbance is localised and limited to pile footprints; and
- The ground surface beneath and between panels remains permeable and vegetated.

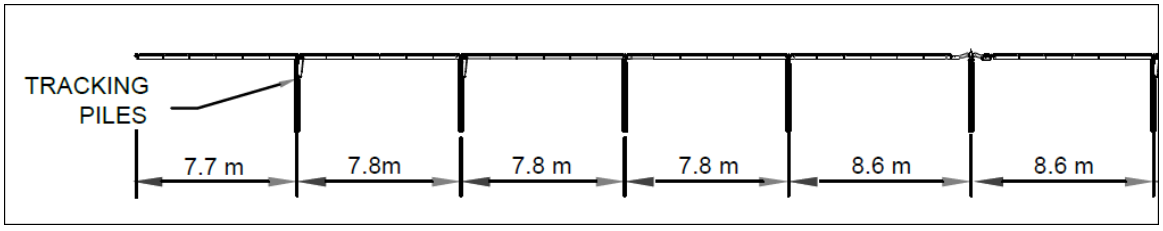

Figure 4 – Tracker System simplified design (typical tracker row)

3. LEGISLATIVE CONTEXT

NSW has a comprehensive legislative and policy framework for the management of floodplain risk and flood prone areas of the state with clear areas of responsibility, as outlined below in ***Figure 5***.

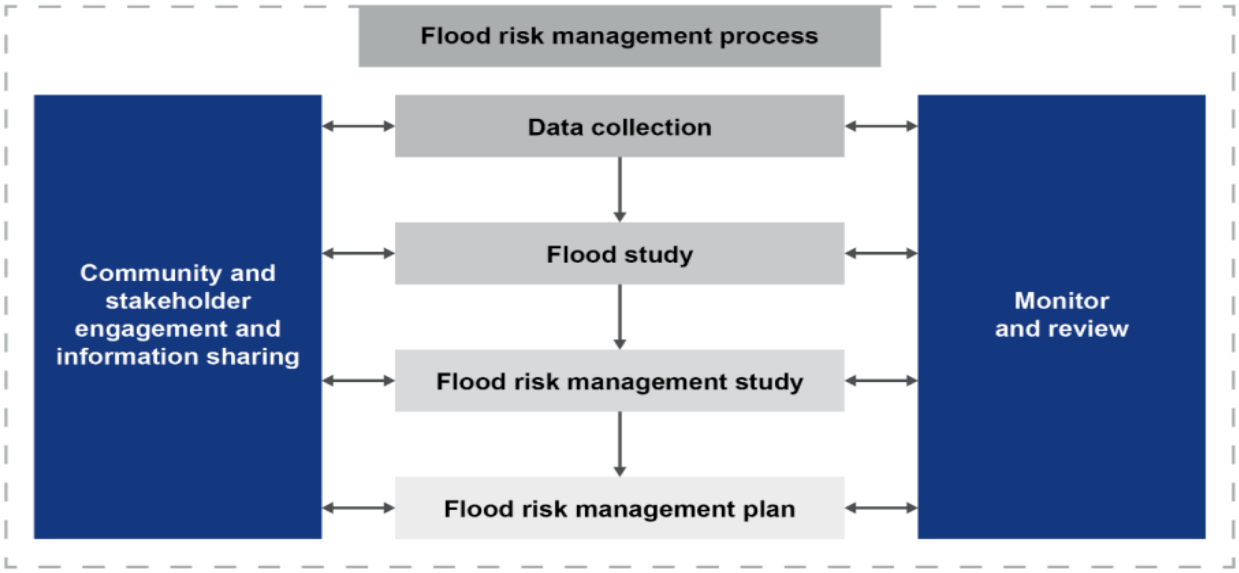

Figure 5 – Floodplain risk management and planning process

3.1. Local Government Act 1993

The Local Government Act provides the legal framework for the system of local governments of the state of NSW. Specific to this project is Section 733, which exempts councils from liability in relation to flood prone land under the provision that they have undertaken substantial assessments in accordance with the latest approval manual.

The 2023 gazetted Floodplain Development Manual is the current approved manual that supports section 733 and the NSW Government's Flood Prone Land Policy. Both the manual and the policy provide councils with the framework to implement processes and sustainable strategies to manage the floodplain risks that specifically impact human occupation.

3.2. Environment Planning and Assessment Act 1979

This is an Act to instate an environmental planning system and assessment arrangement for NSW. In 2017, there were major amendments passed with a view of improving the planning system through simpler processes, improved strategic planning and community participation to enable more balanced and transparent decision making. Section 3.4 makes provision for the preparation of development control plans by relevant authorities (outlined further in Section 3.4.1).

3.3. Water Management Act 2000

The Act offers sustainable and integrated management of the State's water sources for the benefit of both present and future generations. Water management principles are intended to guide decision-making under the Act in relation to floodplain management. They require the existing and future risk to human life and property, arising from occupation of the floodplain, to be minimised.

3.4. Palerang Local Environmental Plan 2014

The Palerang Local Environmental Plan 2014 (current version for July 2025) aims to make local environmental planning provisions for land in the shire in accordance with the relevant standard environmental planning instrument. The LEP includes specific information for residents in the town Braidwood and surrounding areas.

The Plan provides the prohibited and permitted types of development within the local area. Some types of development are also regulated by specific state environmental planning policies. The Plan (Part 6.2) does provide specific management requirements for flood planning, which applies to land at or below the flood planning level (1 in 100 ARI plus 0.5m freeboard). It requires that development consent cannot be granted unless the proposed development is compatible with the flood hazard of the land, will not significantly cause adverse impacts to other developments, the environment and the community, and incorporates measures to manage risk to life.

There are no flood planning maps relevant to the site in the LEP. Given this, the flood risk for the site has been modelled with a range of additional datasets. **Figure 6** shows the site in relation to the surface water in a Normalized Difference Water Index (NDWI) image extracted from Sentinel 2 satellite data for August 22nd 2020. This date is 11 days after major flooding of the Shoalhaven River (ABC, 2020). The NDWI image shows little surface water near the site under these conditions. **Figure 7** shows the site in relation to the potential maximum inundation for a 100-year ARI flood, modelled with 2m Digital Elevation Model (DEM) data.

Flood levels were estimated from flood mapping in the Braidwood Floodplain Risk Management Study (Lyall and Associates, 2019). The site is not at risk of major flooding. There is potential for some localised (minor) inundation from minor drainage lines running through the site (see **Figure 7** below). Hydrological modelling using 2-metre resolution DEM data for the site shows that the drainage channels will flow mostly towards the northeast (see **Figure 8**).

The proposed development is located within a designated drinking water catchment and, as such, must adhere to Water NSW requirements to protect water quality in accordance with the Catchment Protection provisions. Specifically, all developments within these catchments are required to demonstrate a neutral or beneficial effect (NorBE) on water quality, ensuring that the project does not increase pollution levels in any way (Water NSW). The proposed development has been designed to incorporate a range of mitigation measures, as detailed in **Section 7.2** and **Table 1**, which collectively address potential risks to water quality. These measures include erosion and sediment control, stormwater management, and the maintenance of vegetated buffer zones, all intended to prevent sediment and pollutants from entering local waterways during both construction and operational phases. Through the implementation of these measures, the project is expected to comply with the NorBE requirement and maintain the integrity of the catchment. The flowchart presented in **Figure 6** below outlines the process undertaken by Council to assess compliance with NorBE requirements.

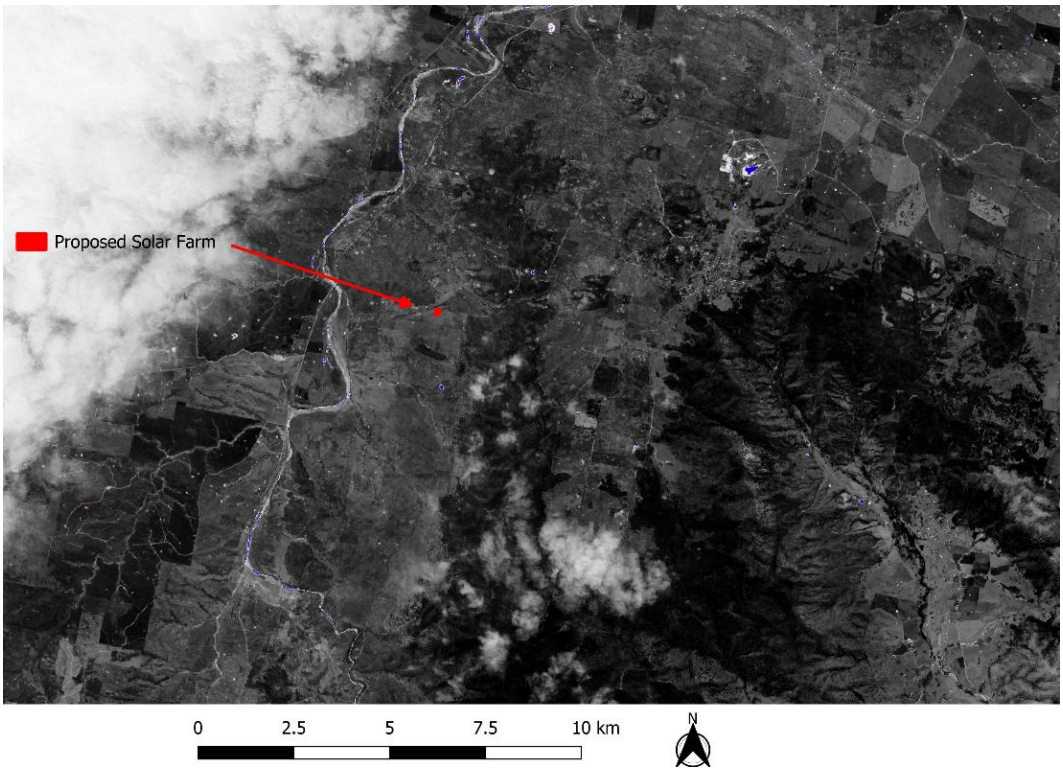

Figure 6 – Normalized Difference Water Index (NDWI) for 22/08/2020 (Sentinel Hub, 2025))

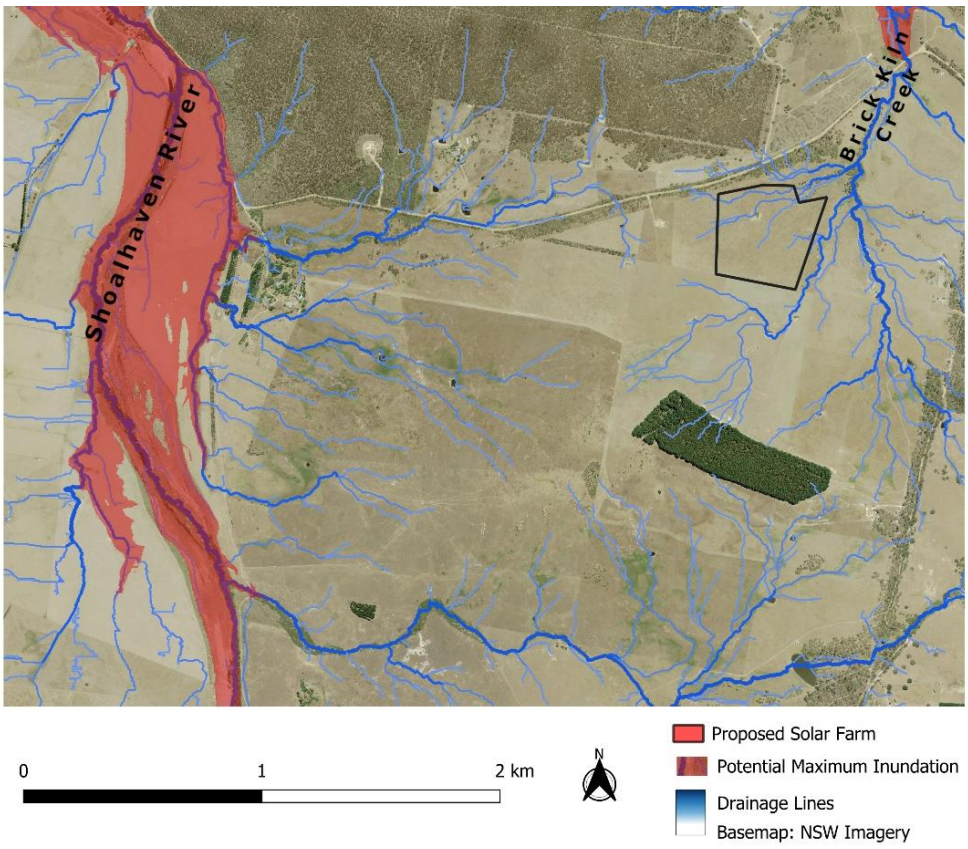

Figure 7 – Localised drainage patterns and potential maximum inundation (1:100 ARI) modelled from 2m DEM data

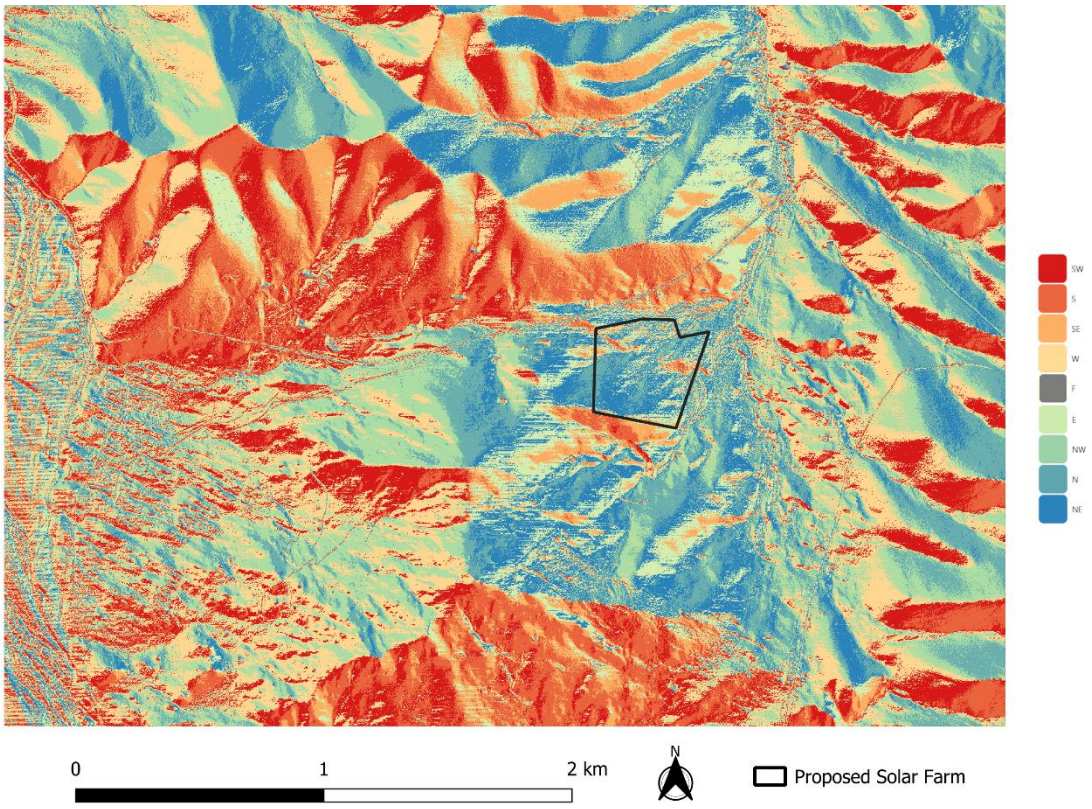

Figure 8 – Flow direction modelled from 2m DEM data

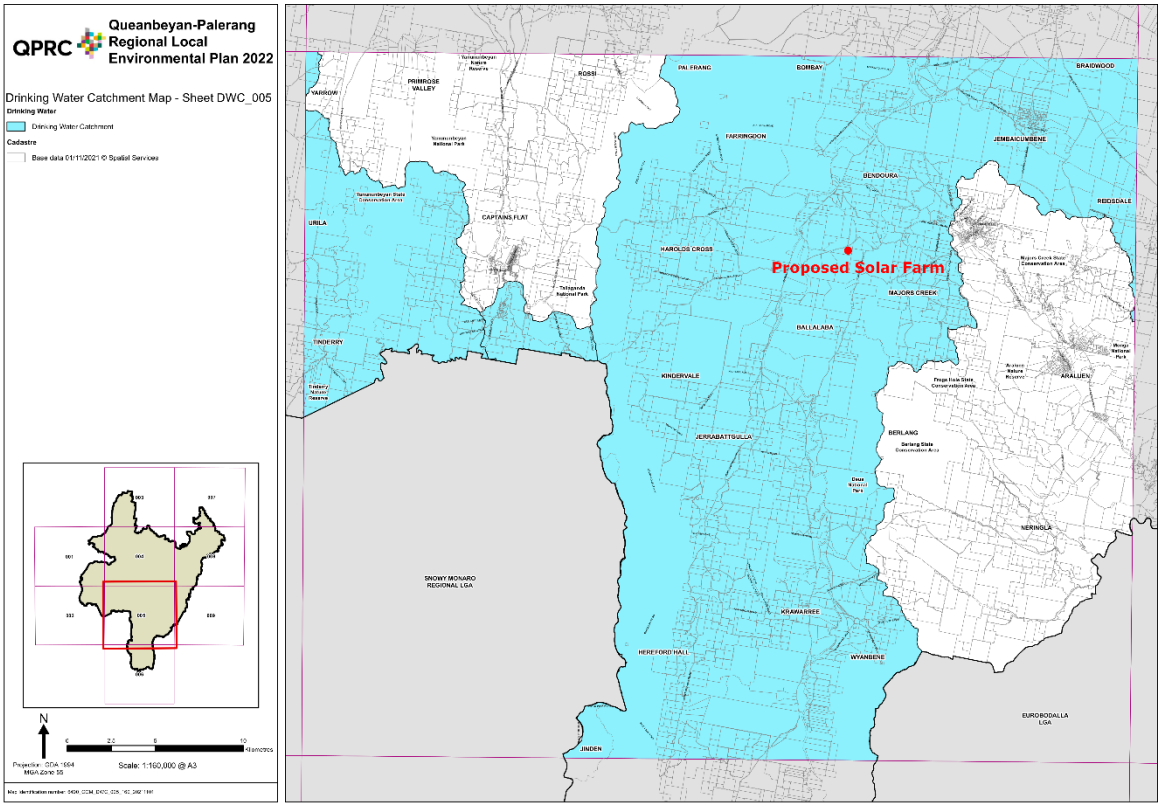

Figure 9 – Proposed solar farm site in relation to the QPRC LEP

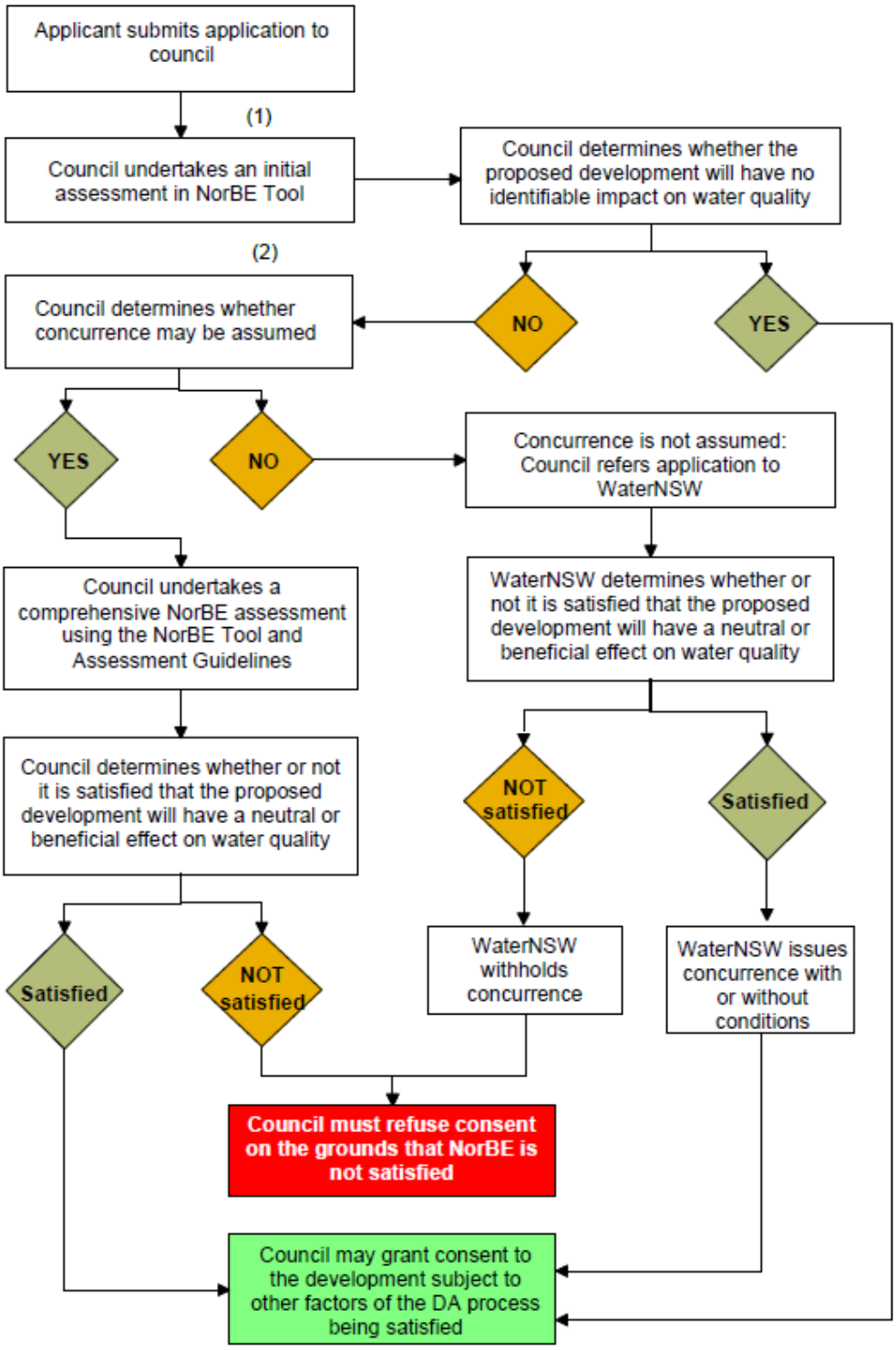

Figure 10 – Neutral or beneficial effect (NorBE) Part 4 Local Development Assessment

3.4.1. Palerang Development Control Plan 2015

The Palerang Development Control Plan (DCP) 2015 provides guidance for developments and the statutory planning controls of the Palerang Local Environmental Plan 2014 (NSW Legislation, 2025). The guidance provides proponents with assistance to address criteria in development applications to ensure that the development:

a. Is compatible with the flood hazard of the land; and
b. Is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and
c. Incorporates appropriate measures to manage risk to life from flood; and
d. Is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.

Development Control Plans typically state that planning restrictions will apply to development on land below the 'flood planning level' of watercourses. The 'flood planning level' refers to "…the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard" (NSW Legislation, 2020, page 48).

NSW local government DCPs also typically provide guidance on stormwater drainage systems for rural lots and large residential lots, which are relevant to the proposed solar farm site. Guidelines typically suggest that, where drainage easements over downstream properties is required, consent from the owners of the downstream properties is to be submitted with the development application. The Palerang DCP states that drainage measures may be required to control stormwater and sediment generated by the development and that runoff peak flow is to be "..no more than pre-development levels" (Queanbeyan-Palerang Regional Council, 2015: 95).

3.4.2. Queanbeyan-Palerang Region Community Strategic Plan 2042

The Queanbeyan-Palerang Region Community Strategic Plan 2042 is planned and executed under key themes identified through extensive community consultation. It is the council's highest level of planning and has been developed following an extensive consultation process (Queanbeyan-Palerang Regional Council, 2025). The vision is underpinned by five strategic pillars:

- **Our community:** A safe, harmonious, happy and healthy community leading fulfilled lives
- **Our economy:** A diverse, resilient and smart economy that creates choice and job opportunities
- **Our environment:** A clean, green community that cherishes its natural and physical character
- **Our infrastructure:** A well-connected community with good infrastructure enhancing quality of life
- **Our civic leadership:** We have contemporary civic leadership and governance that is open, transparent and accountable

The only themes that specifically mention flood or water management aspects is "Our environment" and "Our infrastructure" with stated objectives to ensure that "… Our land, vegetation and waterways are managed in an integrated and sustainable manner" and "Maintain and protect open spaces, parks, reserves, and waterways" (Queanbeyan-Palerang Regional Council, 2025: 20 and 22). However, also implicit within the themes above, is the need for strategies that minimize the impact on the environment from development activities and to maintain and manage water quantity and quality.

3.5. State Environmental Planning Policy (Transport and Infrastructure) 2021

Part 2.3, Division 7 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP (T&I)) relates to 'Flood Mitigation Work'. This policy provides details on the types of works which may be required for land that is susceptible to flooding by the probable maximum flood event, also known as flood liable land. The SEPP (T&I) states that consultation with the relevant council is required if the proposal will alter flood patterns other than to a minor extent, and their response must be taken into consideration. The Project area is not within the mapped flood planning area under the Local Environmental Plan and does not require additional flood mitigation work.

As noted in **Section 3.4** above, there is the potential for some flooding of the project area.

3.6. Protection of the Environment Operations (POEO) Act 1997

The POEO Act aims to protect, restore and enhance the quality of the environment in NSW, while still having regard for ecological sustainable development.

With relevance to the site, the Act aims to reduce risks to human health and avoid degradation of the environment by promoting pollution prevention through the reduction of materials used and advocating for the re-use, recovery or recycling of materials. The Act contains the requirements for the management of water discharges and the offences that relate to pollution. Section 148 requires that any pollution incidents, or those that threaten material harm to the environment, must be notified to the relevant authority (e.g., NSW Environment Protection Authority).

3.7. Soil Conservation Act 1938

This Act makes provisions for the conservation of soil resources and mitigation of erosion. The Act allows the Minister for Primary Industries [1] to issue soil conservation notices, declare areas to be sites of erosion hazard and proclaim works in catchment areas. The Act also outlines specific regulations regarding the Rural Assistance Act 1989.

Of general relevance to this project is the promotion of sustainable use and prevention of loss of soil resources from a site.

[1] Except Parts 2A, 3 and 4, and sections 15 and 30A insofar as they relate to Parts 2A, 3 and 4, jointly with the Minister for the Environment.

4. CATCHMENT AND FLOOD HISTORY

The Project is located in the Queanbeyan-Palerang Regional Council, to the south of the town of Braidwood. According to spatial data from the Australian Hydrological Geospatial Fabric (Geofabric), the proposed facility is located within a sub-catchment that includes part of the Shoalhaven River (see **Figure 11** below).

The project site is on a gently sloping hillside with a northerly aspect and a height of approximately 708m (AHD) (**Figure 12**). The site is surrounded by hills to the north and east reaching elevations of between 770-780m. The centre of the site has an elevation of 708.7m (AHD), with the nearest part of Brick Kiln Creek to the northeast having an elevation of 696.1m (AHD) [2]. The land is mostly cleared of native vegetation and is currently used for farming.

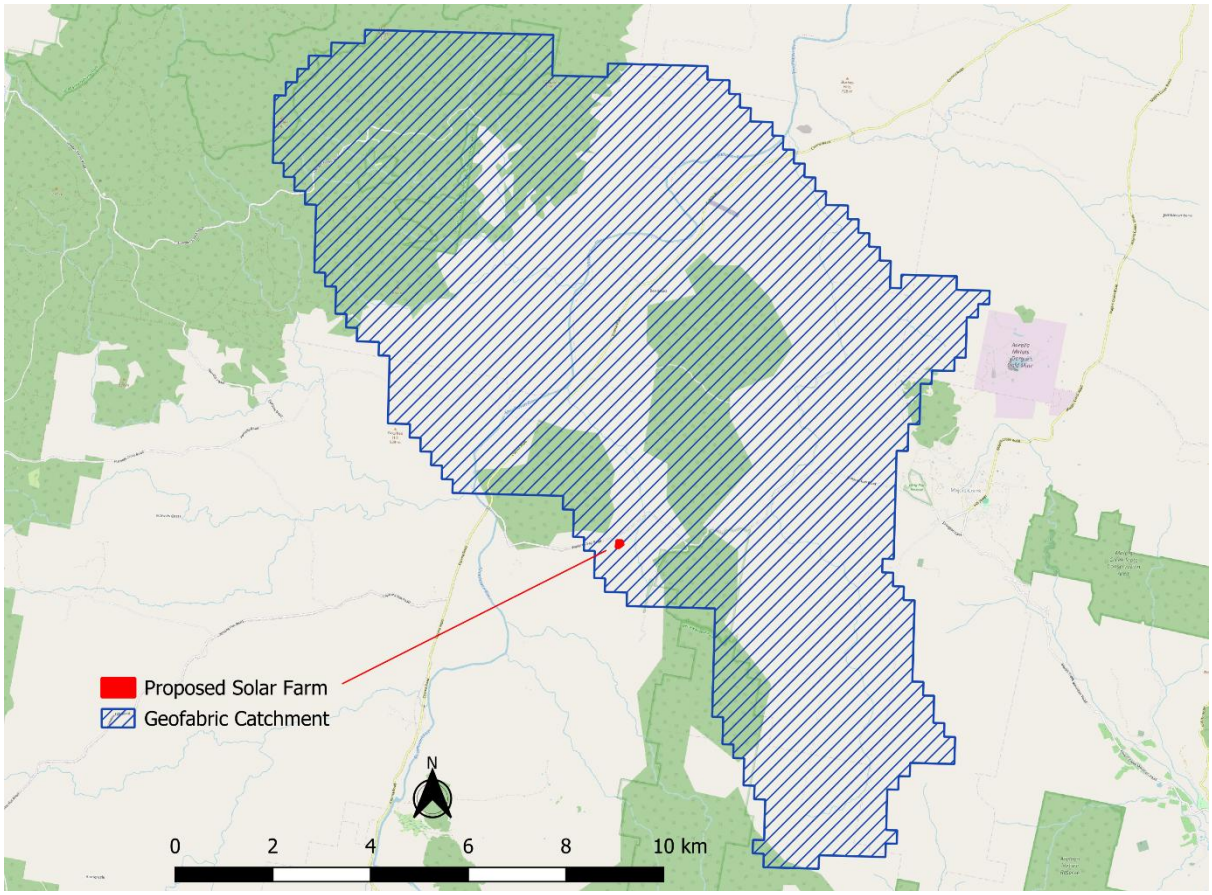

Figure 11 – Catchment of the project area identified in Geofabric

[2] Elevation values sourced from ELVIS - Elevation and Depth - Foundation Spatial Data (locations -35.5785491°/ 149.6602608° and -35.5767190°/ 149.6642272°)

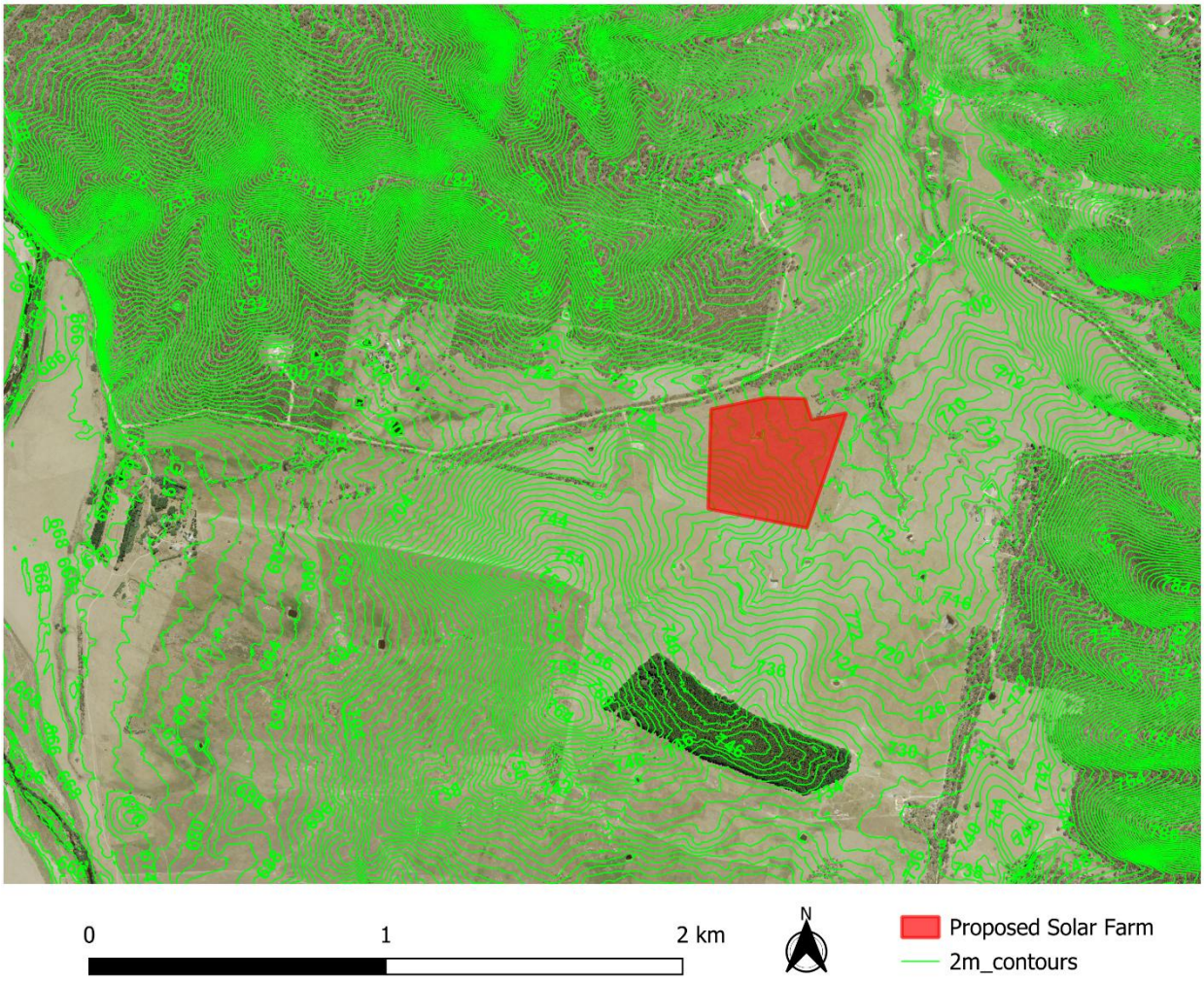

Figure 12 – Site topography

4.1. Historical Floods

Since 1860, there have been 21 floods classified as major floods along the Shoalhaven River. These floods are associated with weather systems generating intense rainfall events and have been in the lower part of the river catchment, impacting coastal towns including Nowra, Bomaderry and Greenwell Point (NSW SES, 2025). There is relatively little information on flooding in the upper reaches of the Shoalhaven River. However, the Queanbeyan-Palerang Regional Council has undertaken a flood studies and floodplain risk management study for the town of Braidwood, to the north of the project stie.

The flood hazard modelling of AEP events for Braidwood generally show that inundation is localised and associated with Gillamatong, Flood and Recreation Creeks within the vicinity of the town (Lyall and Associates, 2019). **Figure 7** (above – **Section 3.4**) provides an indication of the location of the project site in relation to a modelled 100-year ARI flood. The site is not at risk of major flooding. There is potential for some localised (minor) inundation from minor drainage lines running through the site (see **Figure 7** above).

5. AVAILABLE DATA

Climatic data and water quality and quantity monitoring information is available in the region as outlined in the following sections.

5.1. Rainfall for selected stations

The Bureau of Meteorology (BOM, 2020) has a station at Braidwood (station number 069010). Table 2 outlines the average annual and maximum daily, monthly and annual rainfall for this station and another selected station (i.e., station number 070061– Majors Creek). Average monthly values for these rainfall stations are provided in **Table 3**.

Table 2 – Rainfall

Station Number	Station Name	Period of Record	Rainfall (mm)			
			Average Annual	Highest Annual	Maximum Daily	Highest Monthly
069010	Braidwood (Monkittee Street)	1887 - present	784.3	1341.7	199.9	357.2
070061	Majors Creek (Larmer Street)	1898 - present	1110.6	1773.1	312.9	511.4

Table 3 – Average Monthly Rainfall

Station Number	Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
069010	71.1	68	70.5	54.1	56	65	45.1	49.2	49.6	62.3	66	65.8
070061	99.2	104.1	146.3	104.6	74.9	82.5	57.1	61.8	84.2	95.7	102.3	83.8

Flood-producing weather systems across the region include inland troughs, cold fronts, and thunderstorms. Consequently, each rainfall event is a function of the prevailing meteorological conditions. Therefore, the rainfall data provides useful information about expected seasonal rainfall in the area.

5.2. Streamflow

There is a government surface water monitoring site located on the Shoalhaven River 15.5 km north of the site. Streamflow records (**Table 4**) for this site are available for this location from the WaterNSW Real-time portal. Another water monitoring site on Jembaicumene Creek (215241) is listed as having full streamflow records as well.

Table 4 – Stream Gauging Stations

Station Number	Station Name	Available/Relevant Data	Distance from project area
215209	Mountview	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	15.5 km north
215241	Bendoura	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	10.0 km north

Generally, data from the available stream gauges do not provide specific information on local site flooding but are more useful in the context of assessing major regional flooding events that may impact on-site access. Information is publicly available from WaterNSW Real-time data portal and could be incorporated into site management plans.

5.3. Groundwater and Hydrogeological Conditions

The site falls within the Lachlan Fold Belt Greater Metropolitan Groundwater Source, as shown in **Figure 13** below. The water sharing plan for this source limits domestic and stock rights for this water source at 4,083 ML/year with a long-term average annual extraction limit of 11,407 ML/year. The plan recognises the effect of climatic variability on the availability of water through having provisions within the limits of water availability on a long-term average annual basis.

Cenozoic sediments within this groundwater source directly overlay rocks of Carboniferous age or older (NSWDPIE, 2023). Alluvial deposits occur along the valleys, creeks and floodplains of the Shoalhaven River. These deposits are generally shallow, forming unconfined aquifers that are responsive to rainfall and streamflow, with groundwater recharge primarily coming from rainfall (Bioregional Assessments, 2019).

The land salinity hazard for the broader area is low to moderate (see **Figure 14** below). The nearest areas of groundwater vulnerability are to the west along the Murrumbidgee River and the rivers in the area have moderate to high potential for groundwater dependent ecosystems (see **Figure 15** below). The project catchment site does not fall within areas of groundwater vulnerability according to Environmental Planning Instrument (EPI) data (see **Figure 16** below).

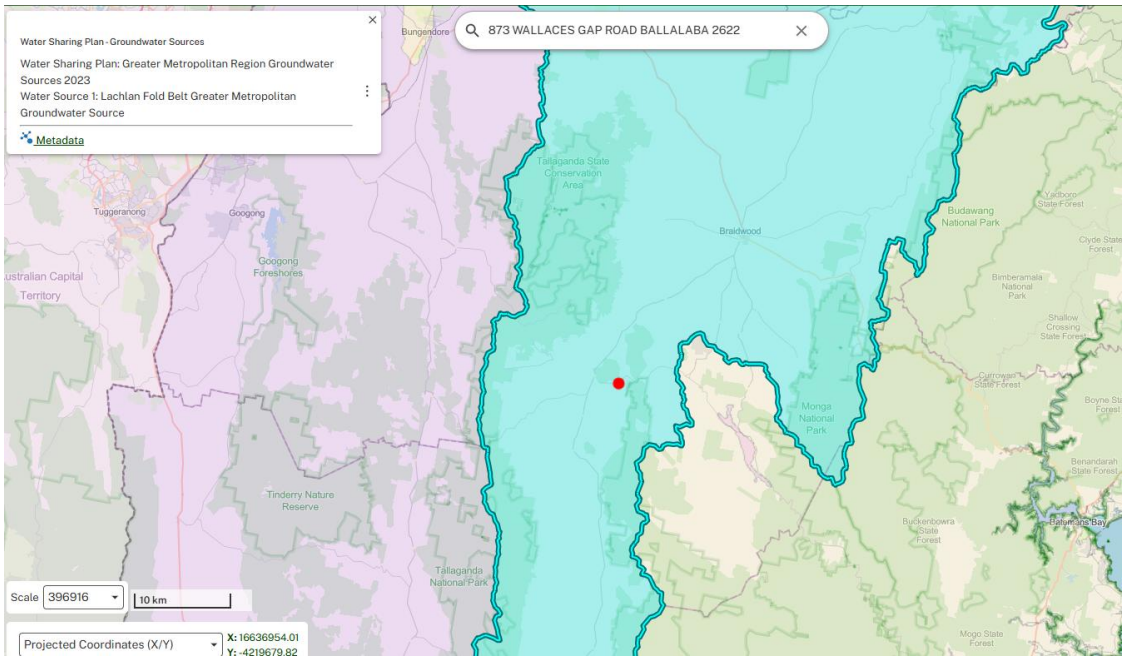

Figure 13 – The Lachlan Fold Belt Greater Metropolitan Groundwater Source (source: NSW DCCEEW, 2022)

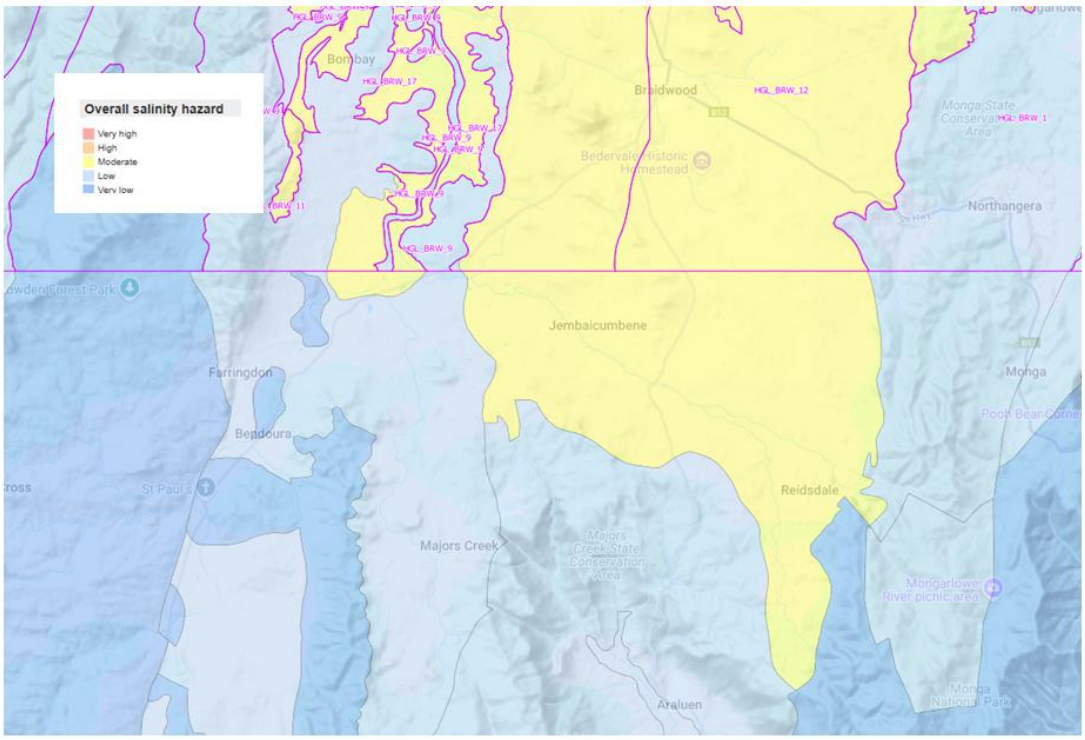

Figure 14 – Land salinity (source: NSWDPIE, 2020))

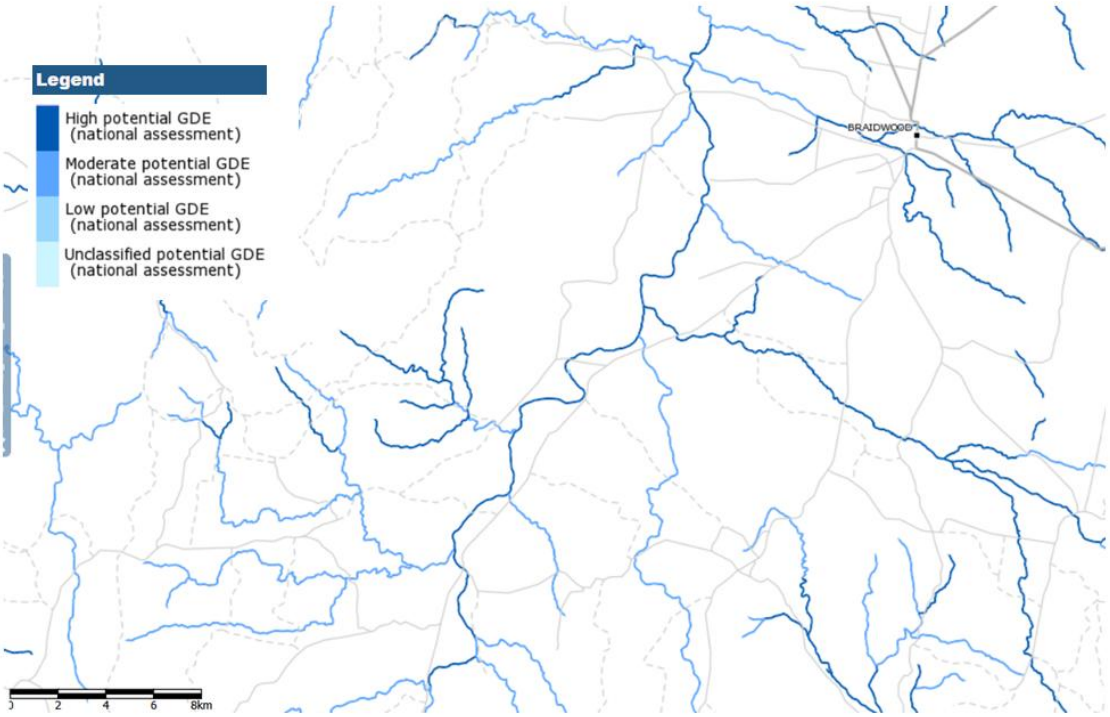

Figure 15 – Groundwater dependent ecosystems near Majors Creek (source: BOM, 2020)

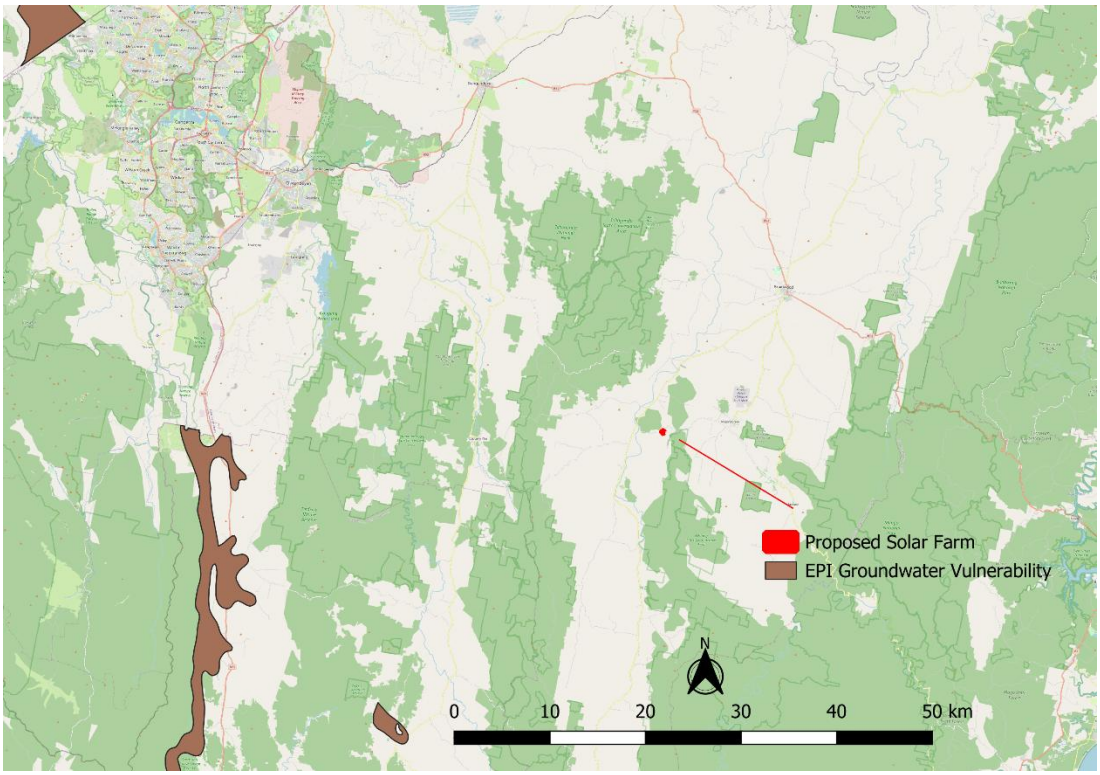

Figure 16 – The project location and EPI groundwater vulnerability areas

5.4. Surface Water and Riparian Conditions

The proposed site is within the upper Shoalhaven River catchment. This is the largest catchment (7300 km^2) in the Southern Rivers region, which includes all coastal catchments south of the Illawarra to the Victorian Border (NSW DECCW, 2010). The upper Shoalhaven catchment has an overall hydrology condition ranking of good, though pressure from alien fish is a significant issue, as is cold water pollution (CWP) associated with Tallowa Dam below the Shoalhaven Gorge. Macroinvertebrate condition in the Braidwood area is moderate to poor and overall fish condition scores are very poor (NSW DECCW, 2010). Water quality values for the Shoalhaven Uplands are between 10-50% higher than targeted values for total nitrogen (Total N), oxidised nitrogen (NOX), total phosphorus (Total P) and turbidity. In the montane region of the upper catchment, all water quality indicators are below target, except for oxidised nitrogen. This demonstrates that the forested areas of the upper catchment are in good condition, with the agricultural and cleared areas showing a marked decline in water quality.

The overall River Condition Index (RCI) scores for the project catchment are moderate to good (see **Figure 17** below). The proposed site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

Based on the current available information, potential adverse surface water-related impacts to the site include:

- Site accessibility and inundation.
- Managing downstream sedimentation.

As there will be no extraction of groundwater or interference with the groundwater table during project activities, potential for impacts have not been considered further.

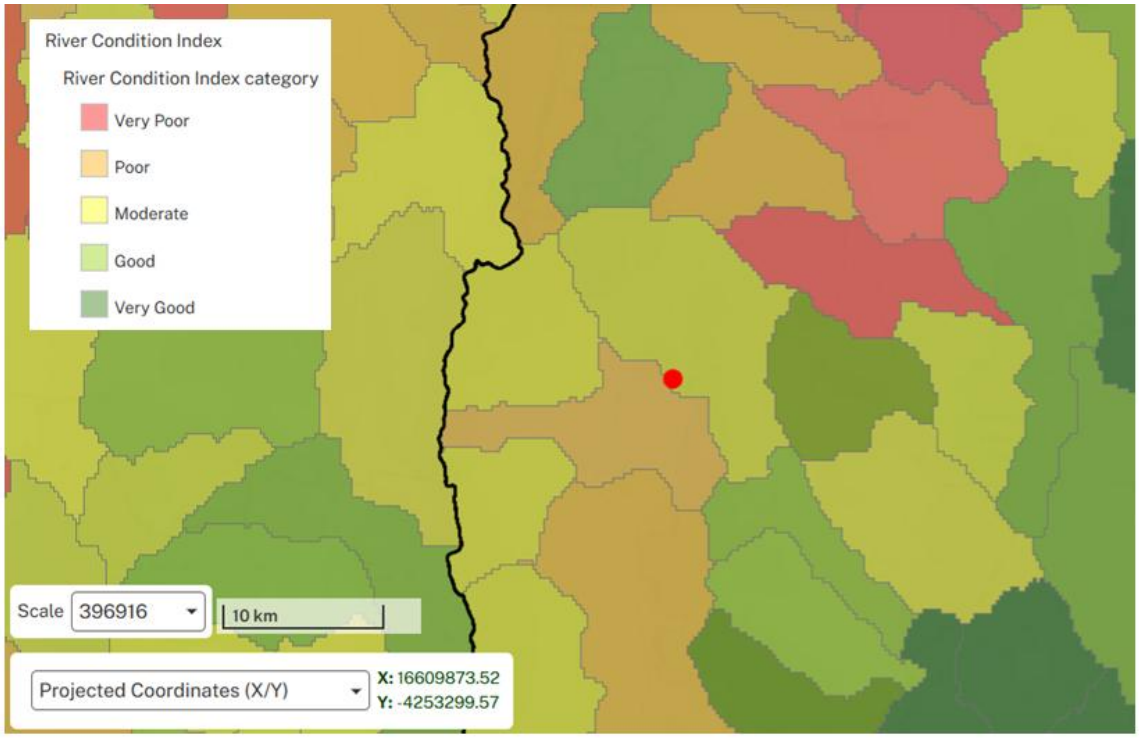

Figure 17 – River Condition Index for Project Area (source: NSW DCCEEW, 2022)

6. POTENTIAL IMPACTS

The proposed site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

Based on the current available information, potential adverse surface water-related impacts to the site include:

- Site accessibility and inundation.
- Managing downstream sedimentation.

As there will be no extraction of groundwater or interference with the groundwater table during project activities, potential for impacts have not been considered further.

6.1. Flooding

The site is not at risk of major flooding. Modelling of the potential maximum inundation for a 100-year ARI event using 2m DEM data shows that flooding would be contained within the immediate area of the Shoalhaven River (see **Figure 8** above). There is potential for some localised (minor) inundation from minor drainage lines running through the site, with flow direction mostly towards the northeast (see **Figure 7** and **Figure 8** above).

6.2. Water quality and erosion

The project has the potential to alter existing water quality conditions within the site. The impervious area of solar facilities is typically only marginally increased owing to associated hardstand and building areas. However, the panels may impact the nature of vegetation/grass coverage on the site, which has the potential to increase surface runoff and peak discharge. Increased flow concentration off the panels also has the potential to erode soil at the base of solar panels (Cook & McCuen, 2013).

Furthermore, as the site has been historically used for farming there is very little natural ground cover vegetation. The eSPADE resource (NSWOEH, 2020), provides a Soils Profile Report (id: 1005170) for a site 900 metres to the southwest of the proposed solar site (see **Table 5** and **Figure 18** below). Site 1005170 indicates a soil profile of sandy loam in the top horizons with minimal cracking. The area is imperfectly drained with hard set surface condition and moderate erosion hazard. There is the potential that the proposed solar site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways.

Table 5 – Site details for eSPADE site 1005170

SITE DETAILS

Site Location:	29.8m, 78 degrees from marker at 740274E 6059028N
Profile Details:	MER Southern Rivers CMA Survey (1005170), Station 64, Profile 1, collected from a core sample by Mr Wayne Cook on 11 November, 2008
Map Reference:	MGA Grid Reference: Zone 55, 740305E, 6059033N. 8826 ARALUEN (1:100000) map sheet.
Physiography:	hillcrest under grassland/herbland on metamorphic, granite lithology and used for improved pasture. Slope 11.0% (measured), elevation 770.0 m, aspect north. Surface condition is hard set, profile is imperfectly drained, erosion hazard is moderate, and no salting evident
Vegetation/Land Use:	extensive clearing at the site, used for improved pasture, with improved pasture in the general area
Surface Condition:	hard set when described, ground cover is 100%
Erosion/Land Degradation:	moderate; no salting evident
Soil Hydrology:	profile is slowly permeable and imperfectly drained, no free water, run on is low and runoff is very high
Soil Type:	Mottled Class Undetermined Red Chromosol; , thick, slightly gravelly, loamy, clayey, moderate (No data and insufficient knowledge) (ASC 2nd Edition), Red Podzolic Soil (GSG)
Base of observation:	
Profile Field Notes:	mapped as granite - field evidence suggests metaseds are large component of parent material.

SOIL DESCRIPTION

Layer 0		
0.00 - 0.00 m		
	Coarse Fragments:	not evident,
Layer 1	Horizon: A1	
0.00 - 0.15 m	Texture:	sandy loam
	Colour:	dark brown (brownish black) (7.5YR 3/2) [moist] with no recorded mottles
	Structure:	moderate pedality (polyhedral, 5 - 10 mm,)
	Coarse Fragments:	few (2-10%), as parent material, fine gravel (2-6 mm), common (10-20%), quartz, fine gravel (2-6 mm),
	Roots:	abundant (>100/10x10cm) (Root size <1 mm), few (1-10/10x10cm) (Root size 1-2 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	dry, non-sticky, disruptive test result was very weak force, shearing test result was brittle,
	Erodibility Tests:	Crumb (EAT) test showed no change,
	Field chemical tests:	Field pH is 4.5 (Raupach),
	Sample taken:	disturbed
	Layer Notes:	A1

Figure 18 – The location of the eSPADE site 1005170 (Source: espade.environment.nsw.gov.au)

7. PROPOSED MITIGATION MEASURES

7.1. Site accessibility and inundation

The site accessibility and potential for inundation issues may be managed in the project's risk management register(s) owing to the regional nature of the events and the potential to impact whole of site works. There should be procedures in place to halt construction during heavy rainfall to reduce impacts to the project construction and to increase sedimentation downstream.

7.2. Downstream sedimentation

Impacts associated with erosion and sedimentation resulting from construction activities can be minimised by undertaking works in accordance with provisions of the NSW government's best practice sediment and erosion control series, Managing Urban Stormwater: Soils and Construction (DECC, 2008).

Proposed mitigation measures associated with managing downstream actionable nuisance (sedimentation) are outlined in **Table 6.**

Table 6 – Proposed Mitigation Measures

Stage	Measure	Activities/Approach
Design	Site drainage and water quality controls	Design Basis • Undertake hydrological assessment of the site's catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff. • Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008). • Develop a site erosion and sediment control plan in accordance with the Blue Book. • Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. • Permanent site drainage should coincide with temporary arrangements where possible.
Construction and/or Demolition	Site drainage and water quality controls	General site works: • Catch drains to be located downslope of any proposed road works. • Install location appropriate sediment fences or other applicable control measures, depending on whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable.

		• All stormwater collection points need to have appropriate sedimentation and erosion controls. • Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. • Vibration grids or wash bays at all construction exits. • Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow-like conditions are maintained. • Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turfing and revegetation.
Construction and/or Demolition	Stormwater point source control	In the event of concrete works: • Do not undertake works if chance of heavy rain. • Store rinsate[3] water, if applicable, separately to other water on site and dispose of offsite as appropriate. • Block on site drains in the area of the works and remove any contaminated runoff. In the event that dewatering practices are required: • Pump hose intakes for withdrawing water from excavations will be elevated to minimise sediment pumping and directed to a containment area for settling prior to discharge. • Limit direct discharge offsite (consistent with the design requirements for sediment pond discharge). • Stormwater collected on site should be reused where possible. Controls should be inspected and maintained on a regular basis. All water released from sediment basins should be clear or disposed of offsite by vehicle. • Material and waste storage areas should be designed and operated to minimise interaction with surface waters. • Vehicle washdown areas should be located away from water courses.

[3] A dilute solution of chemical resulting from washing the container and equipment with water, as defined by NSW EPA accessed 20 December 2018 https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/authorised-officers/glossary#r

8. APPENDIX

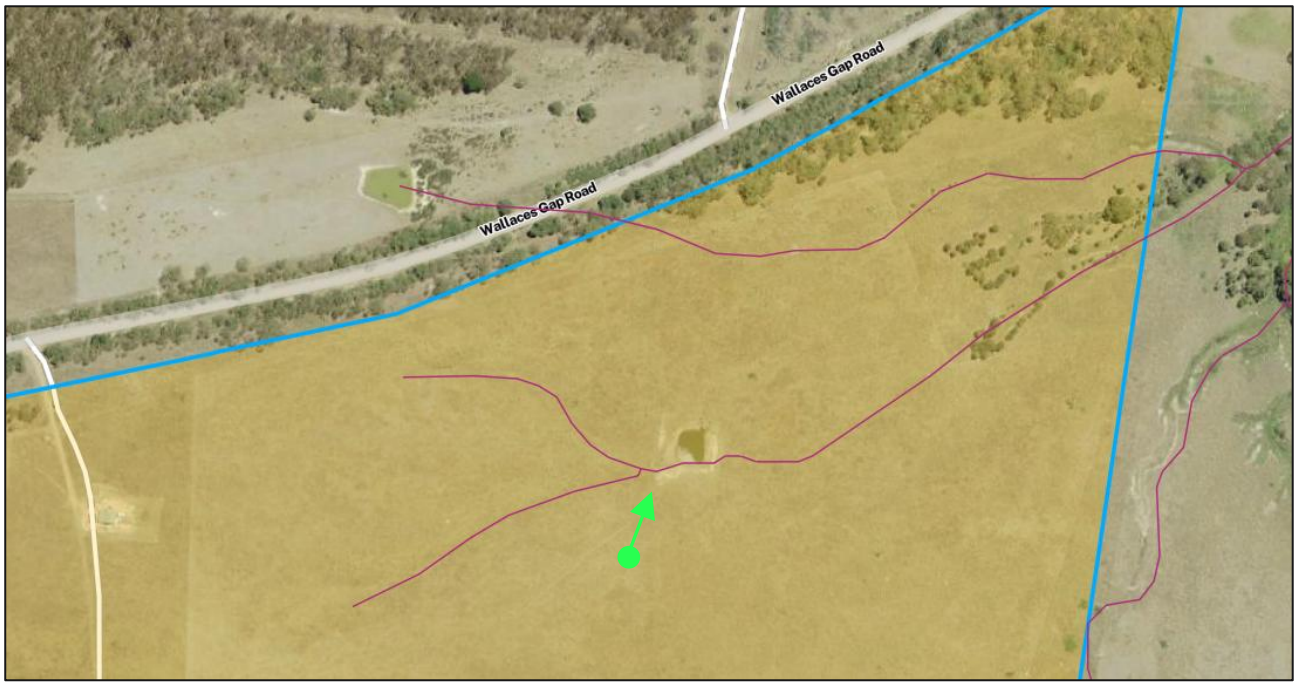

Figure 19 – Site photo reference map; refer to Figure 17 site photo below

Figure 20 – Site photo in vicinity of dam and mapped stream; north-east-facing from within project site (source: Zenith Town Planning 2024)

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