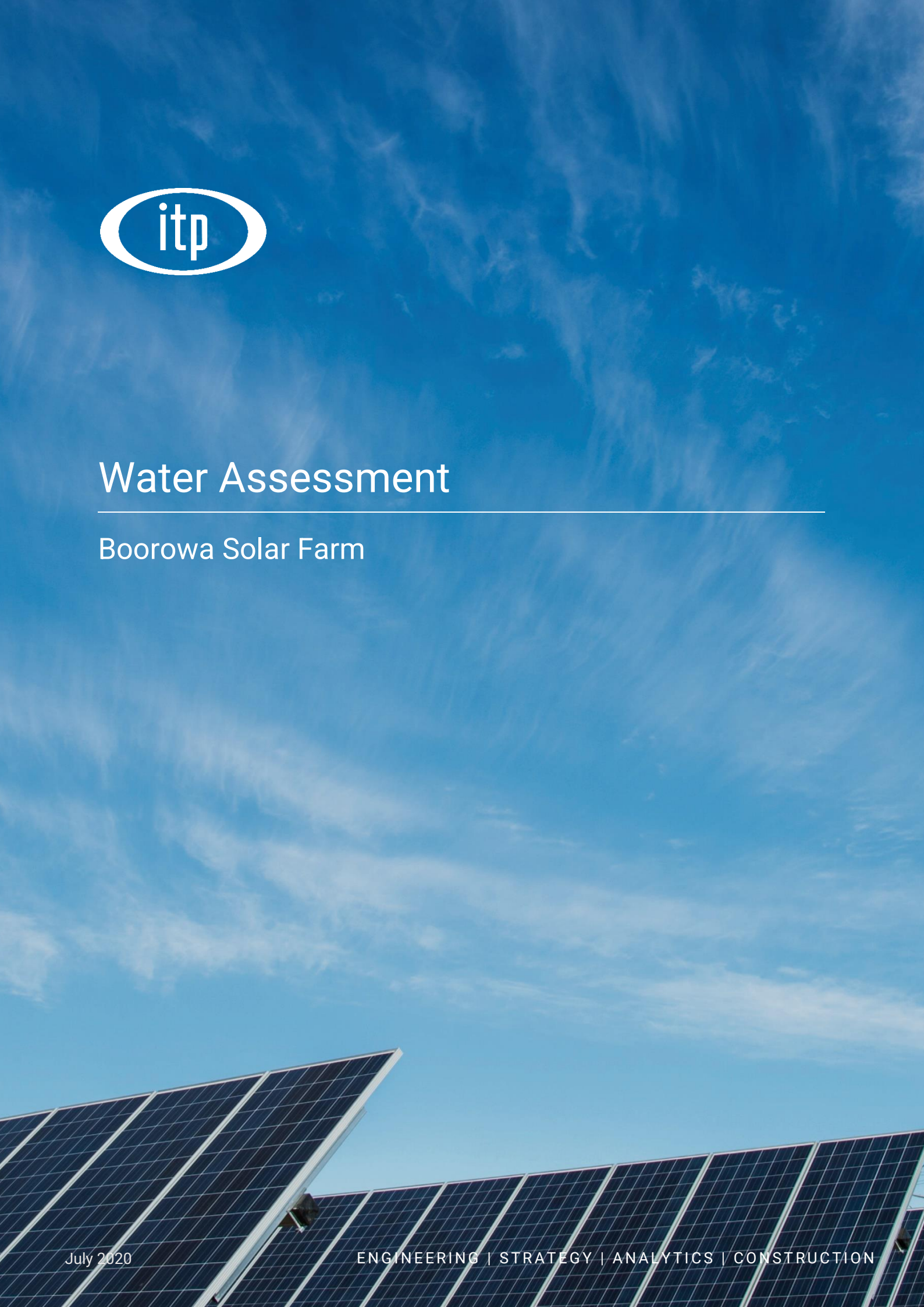


Water Assessment

Boorowa Solar Farm

July 2020

ENGINEERING | STRATEGY | ANALYTICS | CONSTRUCTION

DOCUMENT CONTROL

Report Title		Water Assessment – Boorowa Solar Farm			
Rev	**Date**	**Status**	**Author/s**	**Reviewed By**	**Approved**
1	8/06/2021	For Submission	B.D.	Z.A.	M.T.

A person or organisation choosing to use documents prepared by ITP Renewables accepts the following:

(a) Conclusions and figures presented in draft documents are subject to change. ITP Renewables accepts no responsibility for use outside of the original report.
(b) The document is only to be used for purposes explicitly agreed to by ITP Renewables.
(c) All responsibility and risks associated with the use of this report lie with the person or organisation who chooses to use it.

ITP Renewables

Office: Level 1, 19-23 Moore St
Turner ACT 2612

Postal: PO Box 6127
O'Connor ACT 2602
Australia

Email: info@itpau.com.au
Phone: +61 (0) 2 6257 3511

itpau.com.au

ABOUT ITP RENEWABLES

ITP Renewables (ITP) is a global leader in renewable energy engineering, strategy, construction, and energy sector analytics. Our technical and policy expertise spans the breadth of renewable energy, energy storage, energy efficiency and smart integration technologies. Our range of services cover the entire spectrum of the energy sector value chain, from technology assessment and market forecasting right through to project operations, maintenance and quality assurance.

We were established in 2003 and operate out of offices in Canberra (Head Office), Sydney, North Coast NSW, Adelaide and Auckland, New Zealand. We are part of the international ITPEnergised Group, one of the world's largest, most experienced and respected specialist engineering consultancies focussing on renewable energy, energy efficiency, and carbon markets. The Group has undertaken over 2,000 contracts in energy projects encompassing over 150 countries since it was formed in 1981.

Our regular clients include governments, energy utilities, financial institutions, international development donor agencies, project developers and investors, the R&D community, and private firms.

TABLES

FIGURES

TABLE OF CONTENTS

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

ITP Development (ITP) is proposing to develop the Boorowa Solar Farm (also referred to as BOO1B), as described in the solar farm summary sheet for this proposal (see Table 1). It will be located 3.0 kilometres to the south west the town of Boorowa, NSW (see Figure 1). Details of the layout are contained in the drawing BOO1B-G-2100.

Table 1 - Site Information

Parameter	Description
Site name	Boorowa Solar Farm
Lot/DP(s)	130,131,132,133,136,137,138,139 / 2493
Street address	Meads Lane, Boorowa, NSW 2586
Council	Hilltops Council
AC capacity	5 MW
DC capacity	6.4 MW
Project area	11.99 ha

ITP is proposing to construct a solar farm with a DC capacity of 6.4 MW and AC output of 5 MW, on an approximately 11.99 ha site that is currently used for grazing and cropping.

There are to be approximately 12,100 solar modules installed on around 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The spacing between each row is 6.25m. The hub height of each tracker is 1.5m, with the peak of the modules reaching a height of approximately 2.75m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm and the array tracker details are shown in drawing BOO1B-G-2100 and BOO1B-E-3400.

The solar farm will also include two 3 MW inverter stations. The station is to be located within the array and each are mounted on a 12.19 m skid. Each of these inverter stations incorporates the high/medium voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing BOO1B-E-4300.

Allowance is made for a 2.9-metre-high battery energy storage facility (BESS) alongside the inverter stations. A 2.5-metre-high kiosk is to be located at the north-eastern corner of the array. The arrangement of the BESS is shown in drawing BOO1B-E-4100 and BOO1B-E-5300.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 50 personnel on site working from 7 am – 4 pm, Monday to Friday. The construction is anticipated to take approximately 3 months. Once operational the site will be unmanned. 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.

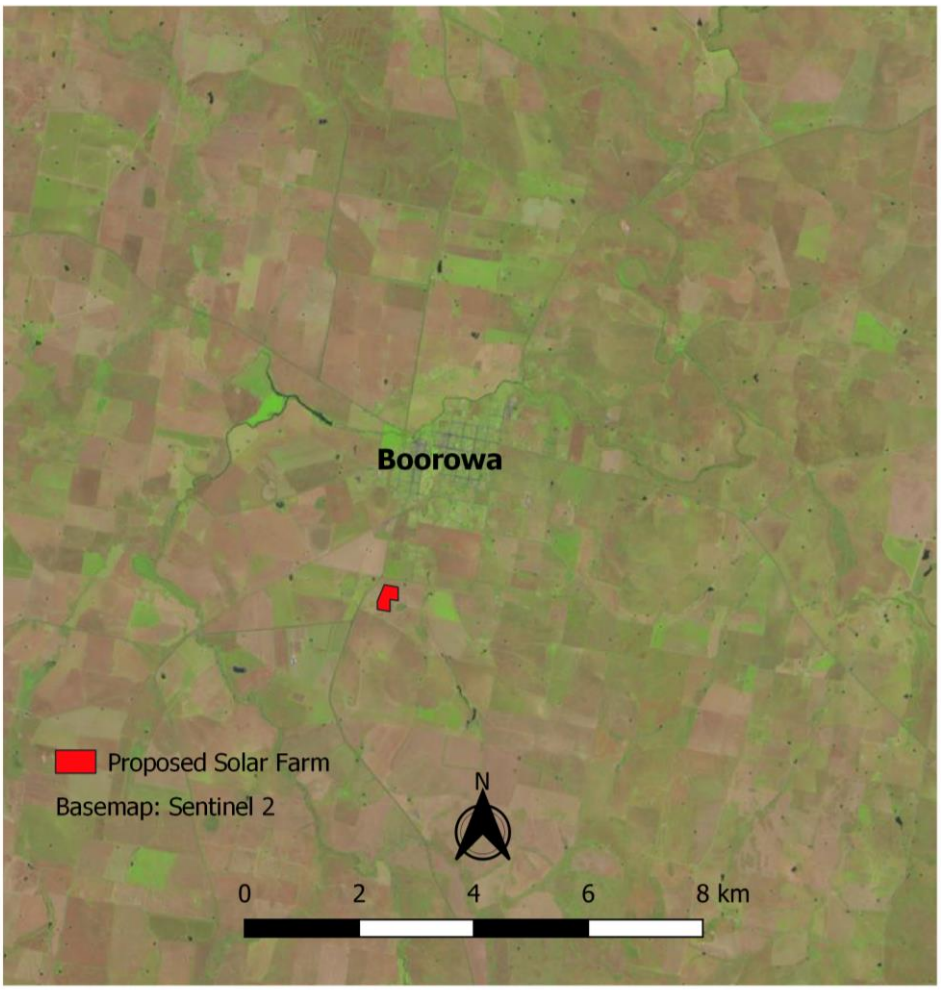


Figure 1 - Proposed solar farm site and surrounding area

2.2 Hydrology, climate and topographic conditions

The project area for the Boorowa Solar farm is within the Hilltops Council Area.

Boorowa in NSW (490m AHD) is located in the south-eastern part Lachlan Water Resource Plan Area. Other towns in the vicinity include Cowra (299m AHD) to the north, Yass to the south (493m AHD) to the south and Harden (403m AHD) to the southwest. The Borrowa River runs through the town towards the east before eventually discharging into the Lachlan River. The topography of the eastern parts of the Lachlan River catchment are characterised by elevations up to 1,400 metres and an annual average rainfall in these cooler regions ranges from 800–1,000m (MDBA, 2021). Tributaries of the Lachlan River include the Abercrombie, Belubula, Boorowa rivers and Mandagery Creek. The catchment area of the Lachlan River covers 8% of the Murray–Darling Basin and contributes 6.5% of water in the basin (MDBA, 2021). Agriculture has been the predominant industry throughout the catchment since 1900 and currently land is primarily used for livestock grazing and dryland cropping (NSWDPI, 2016). Native vegetation in the Lachlan catchment was largely altered by the development of land for the purposes of timber, agriculture, mining (CSIRO, 2008). These landuse practices are dependent on the waterways of the catchment.

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 2.

Figure 2 - 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 2005 gazetted Floodplain Development Manual is the current approved manual and 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 to improving the planning system through simpler processes, improved strategic planning and community participation, in order to enable more balanced and transparent decision making. Section 3.43 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 Boorowa Local Environmental Plan 2012

The Boorowa Local Environmental Plan (LEP) 2012 (current version for 16 February 2021) 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 Boorowa. 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 cause significantly adverse impacts to other developments, the environment and the community, and incorporates measures to manage risk to life. The site is shown in relation to a series of flood maps from the most recent floodplain risk management study (Lyall & Associates, 2018). Figure 3 shows the project site in relation to the 1% AEP and PMF flood extents and figure 4 illustrates the same area with indicative depts for a 1% AEP. It can be seen that the most extensive flooding is predicted to take place to the north of Boorowa. The flood risk maps suggest that there are no major floodways through the site, though there is potential for some minor inundation in the north-east of the site, from the direction of Ryans Creek.

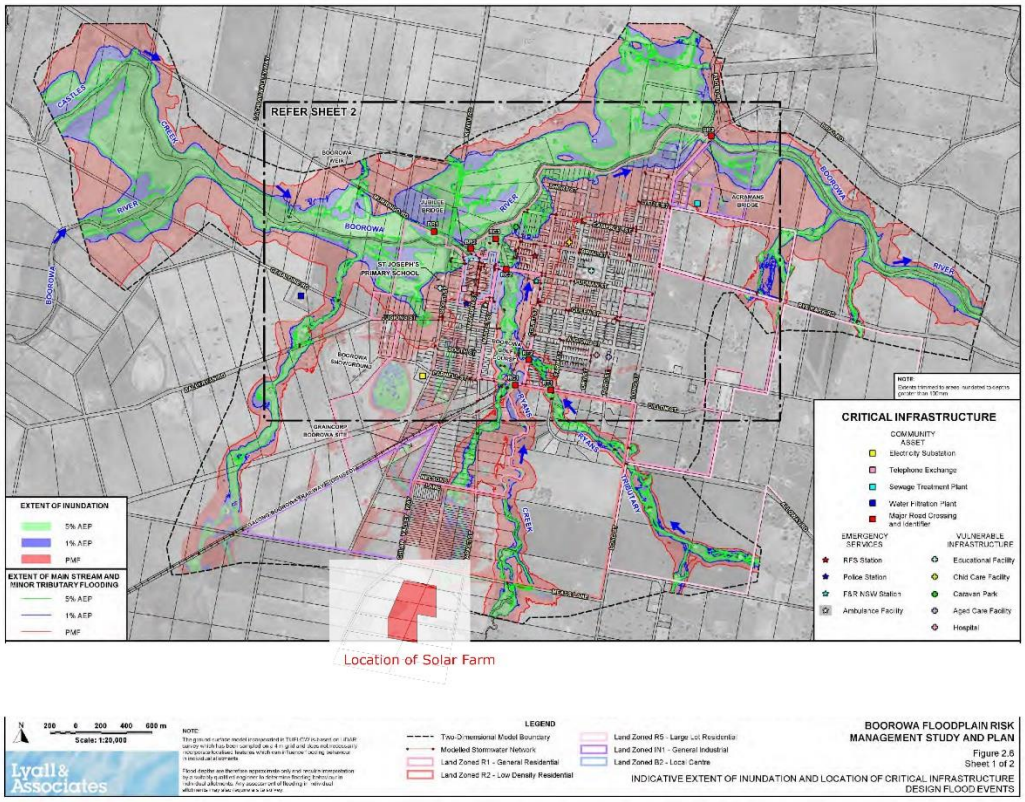


Figure 3 - Site in relation to 1% AEP and PMF flood extents (Source: adapted from Lyall & Associates, 2018 - page 14)

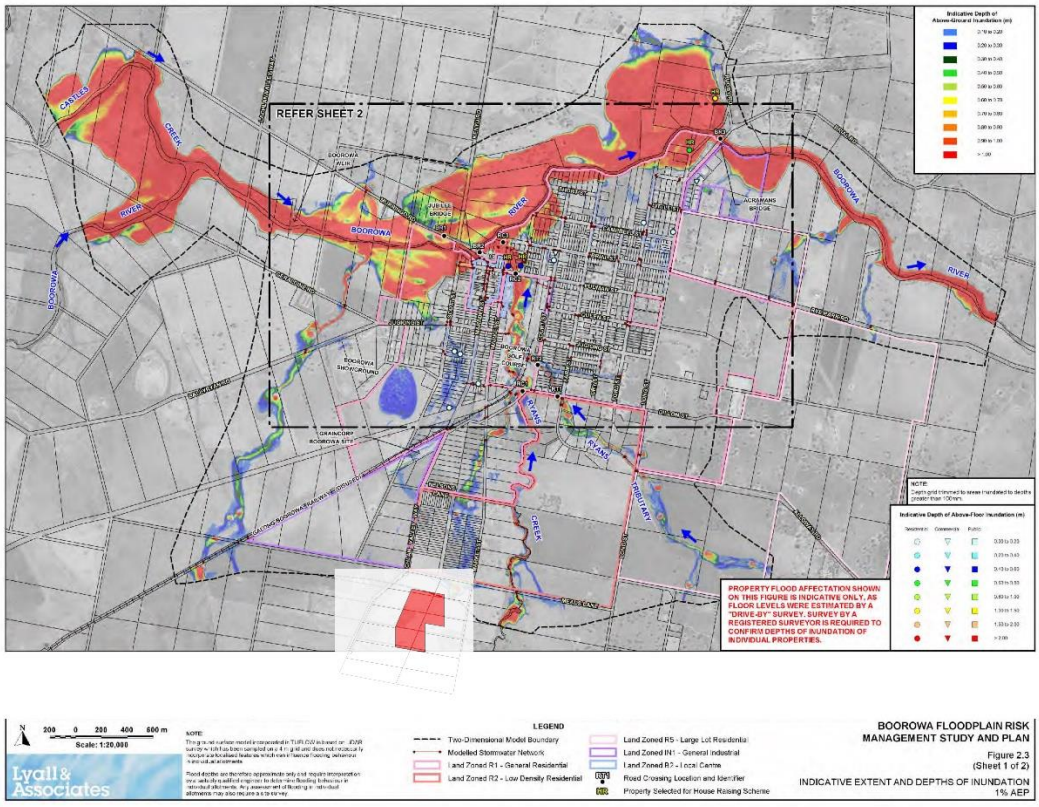


Figure 4 - Site in relation to 1% AEP flood depths (Source: adapted from Lyall & Associates, 2018 - page 7)

3.4.1 Boorowa Development Control Plan 2013

The Boorowa Development Control Plan (DCP) 2013 provides guidance for developments and the statutory planning controls of the Boorowa Local Environmental Plan 2012 (NSW Legislation, 2021). The guidance provides proponents assistance with criteria to address in development applications.

The guidance on flood protection in the Boorowa Local Environmental Plan 2012 (NSW Legislation, 2021) states that the consent authority must be satisfied on a number of points regarding developments, including 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
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 river banks or watercourses, and
e. is not likely to significantly adversely affect the environment or
f. cause avoidable erosion, siltation, destruction of riparian
g. vegetation or a reduction in the stability of river banks 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 Boorowa DCP states that consideration must be given to the potential for flooding as well as measures to control stormwater flow and water quality are required. The the 1 in 100 year ARI for existing natural flow, existing development flow and post developed flow is typically used as guidance for flood planning maps.

3.4.2 Hilltops Community Strategic Plan 2030

The Hilltops Community Strategic Plan 2030 is planned and executed under key themes identified through extensive community consultation. It sets out the long-term aspirations of the Hilltops community in terms of where the community sees the region heading over the next ten years and to capture what it is most value about living in the area (Hilltops Council, 2019). Key outcomes identified for the ten years of the plan include five wellbeing pillars:

- **Loving where we live:** We are a network of inclusive and diverse communities' who treasure our country lifestyle, have strong connections and cultural history which enriches our quality of life;
- **Nurturing our natural environment:** We are custodians of our natural environment and landscapes and will protect and improve it for future generations;
- **Building a strong & robust regional economy:** Hilltops is a connected and growing region, with both the local society and economy driven by a culture of innovation and collaboration, capitalising on our agricultural strength.;
- **Strengthening the region's connectivity and maintenance of our assets**
- **& infrastructure:** Our community is well serviced and has high quality equitable connectivity to social, built and communications infrastructure.

The primary theme that specific mentions flood or water management aspects "Nurturing our natural environment" which emphasizes the importance of maintaining, improving water quality; keeping waterways clean and using water thoughtfully (Hilltops Council, 2019: pages 19-20). 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 (Infrastructure) 2007

Part 3, Division 7 of the State Environmental Planning Policy (Infrastructure) 2007 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 policy 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.

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 the ecologically 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 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

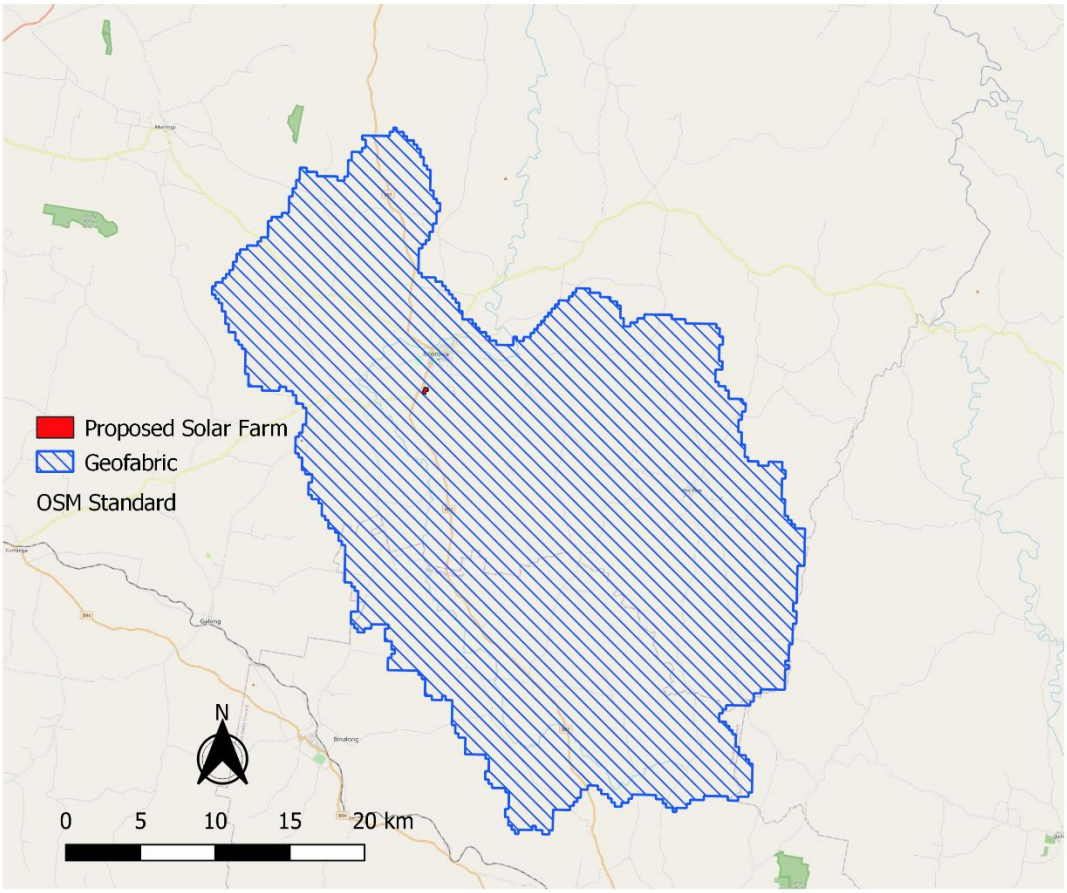
This Act makes provisions for the conservation of soil resources and mitigation of erosion. The Act allows the Minister for Primary Industries [1] to issue soil conservation notices, declare areas to be sites of erosion hazard, proclaim works in catchment areas and outlines specific regulations regarding 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 Shire Council, to the south of the town of Boorowa. According to spatial data from the Australian Hydrological Geospatial Fabric (Geofabric), the proposed facility is located within a large sub-catchment that includes part of the Boorowa River to the north of the town before flowing into the Lachlan River below Lake Wyangala (see Figure 5 below). The project site is within a relatively flat north-facing slope, with heights ranging from approximately 515m (AHD) on the southern side of the site to 507m (AHD) on the eastern side. (Figure 6). The surrounding area has some relatively steep hills to the east and south reaching heights of between 550-580m contour values. The centre of the site has an elevation of 508m (AHD), with the nearest part of the Ryans Creek, which feeds into the Boorowa River, having an elevation of 505m (AHD) [2]. The land is mostly cleared of native vegetation and is



currently used for farming.

[2] Elevation values sourced from ELVIS - Elevation and Depth - Foundation Spatial Data (locations -34.45968°/148.71128° and -34.46262°/148.71780°

Figure 6 - Site topography

4.1 Historical Floods and Boorowa Floodplain Risk Management Study 2018

Figure 5 - Catchment of the project area identified in Geofabric

The Hilltops Council funded a floodoplain risk management study and plan in 2018 (Lyall & Associates, 2018). The plan provides a 1% AEP inundation map for the immediate town area which shows the potential for flooding of some urban parts of Borrowa, particularly the northern side b ordering the Boorowa River to the North (Lyall & Associates, 2018). The plan also shows potential for flooding along tributaries such as Ryans Creek that discharge into the Boorowa River on the northern side of the town. A stream gauge which has been in operation at Prossers Crossing near Boorowa since 1938 indicates that the most significant floods occurred in the June 1952, September 1974 and December 2010 floods North. Residents were also affected by a flooding event in 2016. The heights recorded at the Prossers Crossing gauge was in December 2010 when floodwaters reached recorded levels of 7.58m. The June 1952 flood is considered to be the flood of record at Boorowa and is used by council for flood planning purposes. This flood is estimated to have had an equivalent AEP of between 1 and 0.5% at Park Street and Long Street and about 0.2% at the Jubilee Bridge in the town (Lyall & Associates, 2018, page 5).

Figures 3 and 4 (above – Section 3.4) provide an indication of the location of the project site in relation to key maps provided in the Boorowa floodplain risk management study. These

maps indicate that the project site is unlikely to flood from the direction of Boorowa. The flood risk maps suggest that there are no major floodways through the site, though there is potential for some minor inundation in the north-east of the site, from the direction of Ryans Creek.

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 the Boorowa Post Office (station number 070220). Table 2 outlines the average annual and maximum daily, monthly and annual rainfall for the Boorowa Post Office station another selected station (i.e., station number 073109 - Murringo). 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
070220	Boorowa Post Office	1897 - 2021	633.6	958.6	143.0	241.0
073109	Murringo (Yallambee)	1968 - 2021	555.0	1009.9	94.6	265.0

Table 3 - Average Monthly Rainfall

Station Number	Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
070220	55.6	48.2	45.6	57	56.1	37.2	52	59.5	57	60	50.2	55.2
073109	50.1	54.2	47.8	48.7	51.6	56.2	61.9	60.1	58.3	59.9	57.6	59.9

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

The nearest government surface water monitoring site is located to the north on the Boorowa River approximately 68kms 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 the Mookie River (419084) 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
412029	Boorowa Prossers Xing	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	68 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

Boorowa falls within the Lachlan Surface Water Resource Plan Area (SW10) as shown in Figure 7 below. SW10 is currently being revised (MDBA, 2021b). The site is also with the Lachlan Alluvium Water Resource Plan (GW10) area. Groundwater quality and availability for the environment within the upper Lachlan Alluvium expressed in terms of risks to recharge, land management practices and mining are generally listed as Nil to Low (NSWDPIE, 2019). Boorowa is not within the Upper Lachlan Alluvial Groundwater Source (see figure 8 below). There are few ground water dependent ecosystems near the site, with values along the Broorowa River Creek showing low potential (see figure 9 below). The project catchment site does not fall within any major areas groundwater vulnerability of according to Environmental Planning Instrument (EPI) data (see figure 10 below and NSW Government, 2020). However, the town of Boorowa to the north does fall within a groundwater vulnerability area.

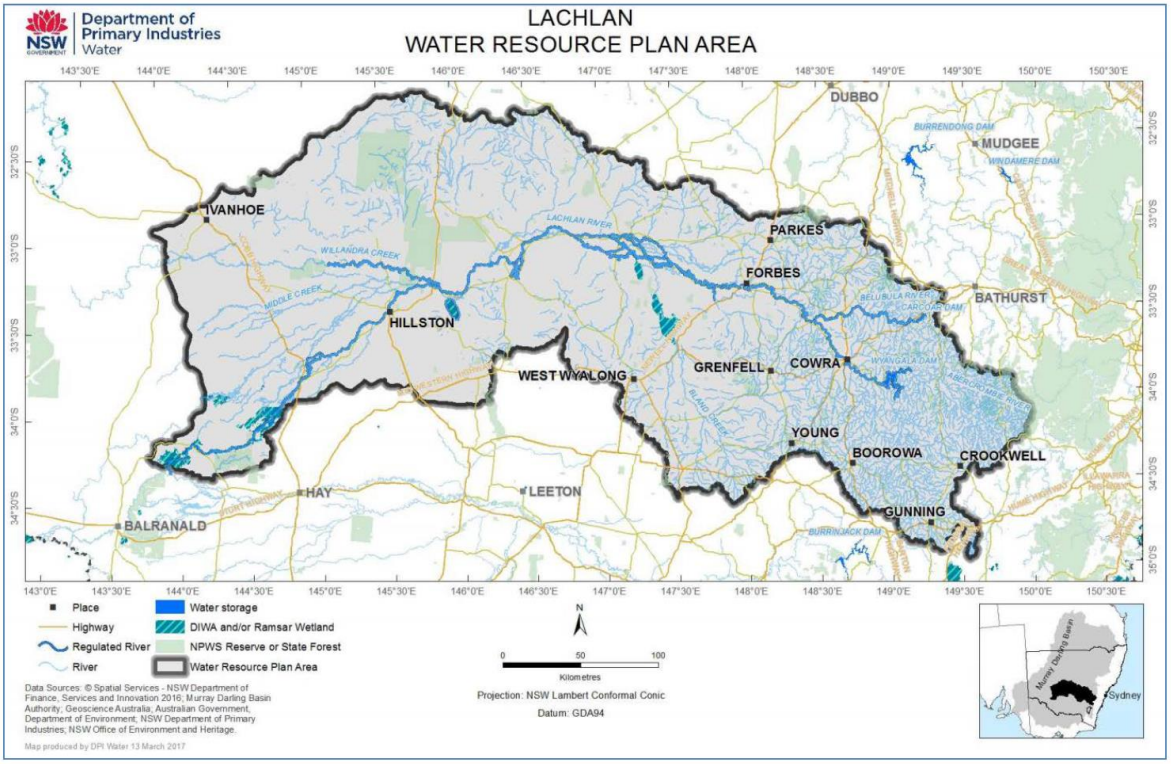


Figure 7 – The Lachlan Water Resource Plan Area (source: NSWDPI, 2018: 27)

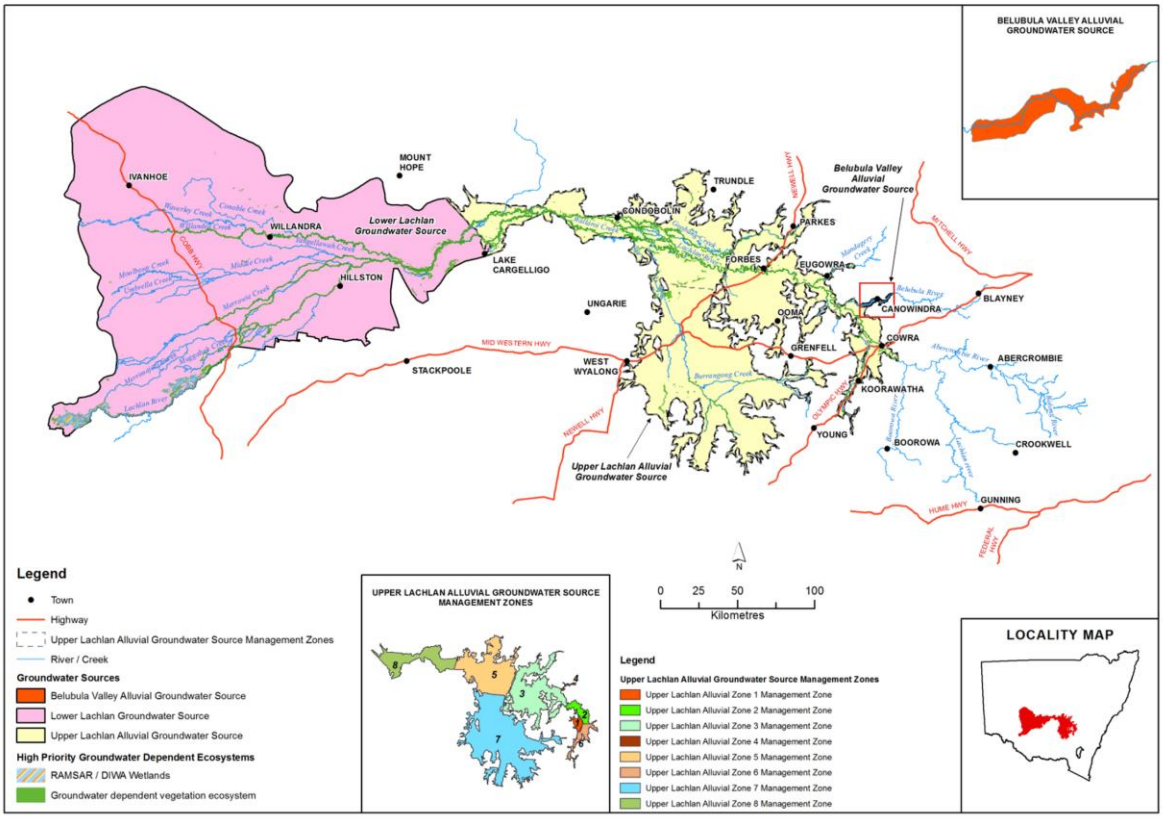


Figure 8 – Lachlan Alluvial Groundwater Sources (source: NSW Legislation (2020, page: 44))

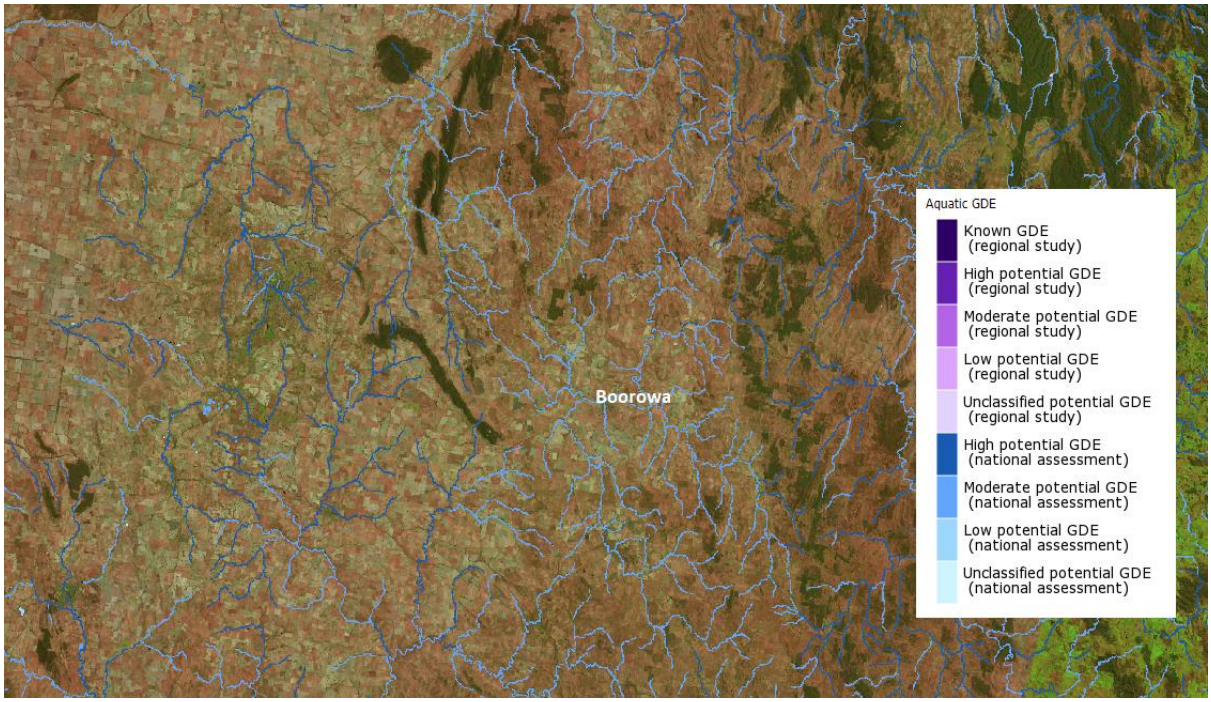


Figure 9 – Groundwater dependent ecosystems near Boorowa (source: BOM, 2021)

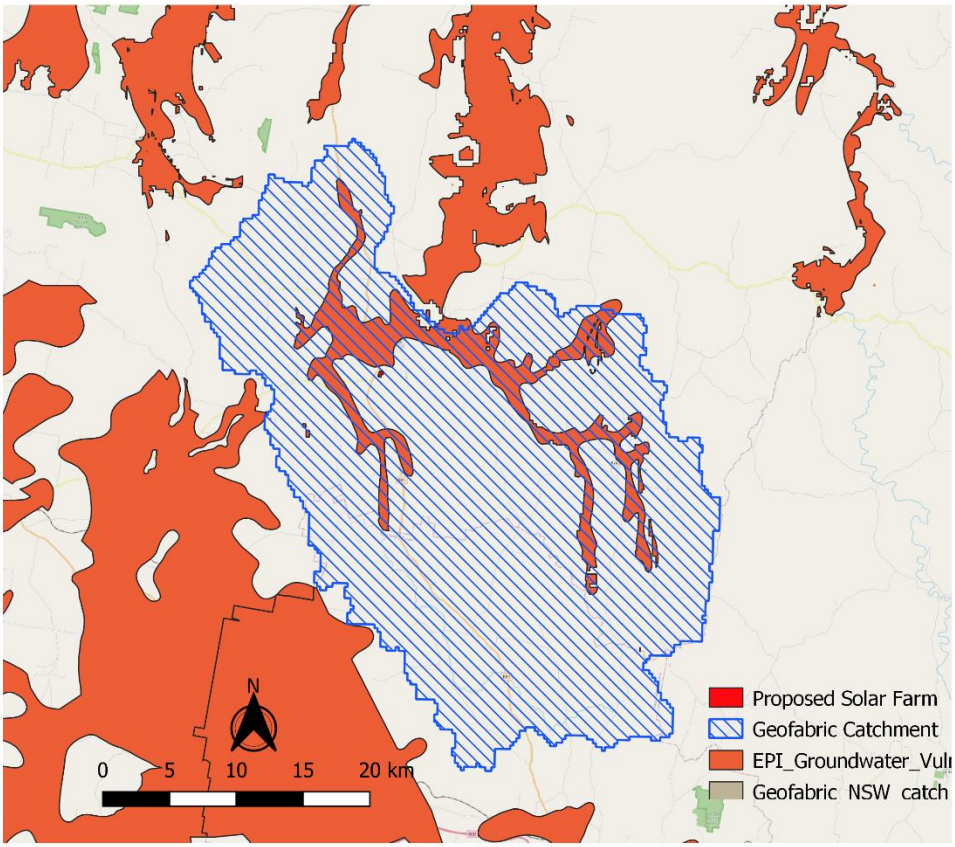


Figure 10 – The Project Geofabric Catchment and EPI Groundwater vulnerability areas

5.4 Surface Water and Riparian Conditions

The Lachlan SWRP is designed to set out how the obligations of the Murray-Darling Basin Plan 2012 will be met in the area. NSWDPIE (2019) describes the Lachlan SWRPA. Key objectives and strategies of the plan are summarized below:

- Manage groundwater salinity by ensuring extraction does not result in a change in the beneficial use category;
- Limit total water extraction (basic rights and groundwater take) between and within each groundwater source;
- Reduce induced flow from high salinity groundwater;
- Improve land management practices including the planting of deep-rooted vegetation to reduce rainfall recharge displacing saline groundwater to surface water system;
- Reducing nutrients entering the water resource is largely related to land, vegetation and natural resource management;
- Reduce microbial contamination to groundwater sources from animal faeces;

Water quality in the Lachlan WRPA is listed as fair in the Boorowa area based on the Integrated water quality index (see figure 11 below). There are no key environmental assets or hydrologic indicator sites near Boorowa, other than the Boorowa River to the west being listed as a main river (see figure 13 below).

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.

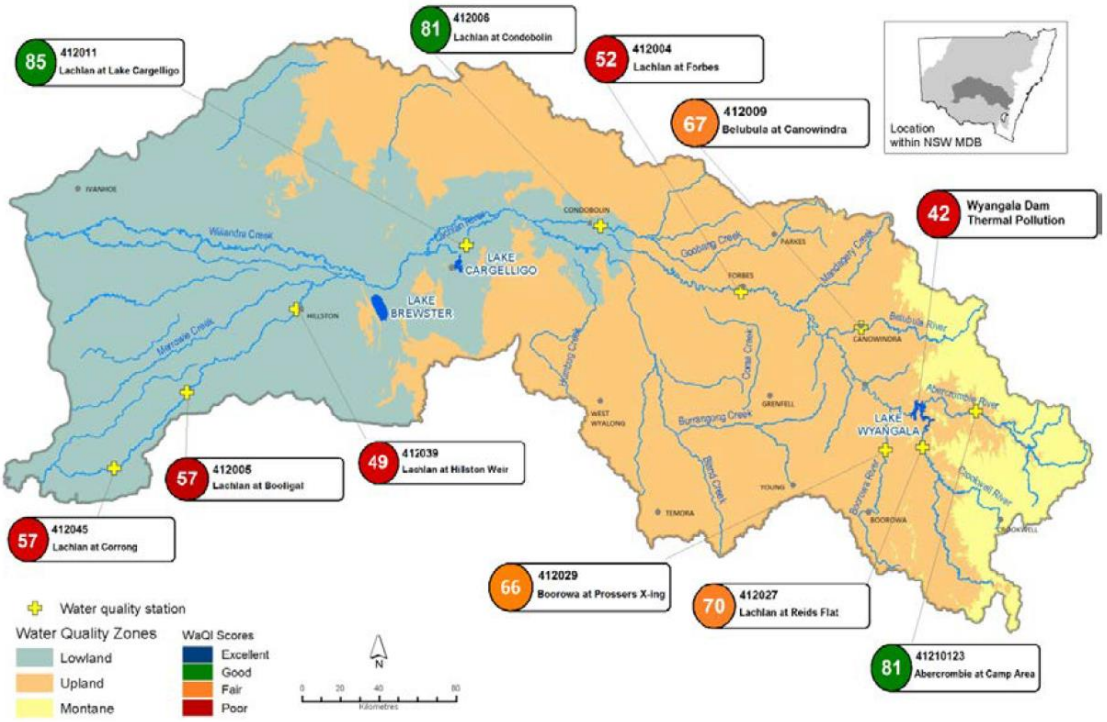


Figure 11 – Lachlan WRPA water quality index (WaQI) scores (source: NSWDPI, 2019:69)

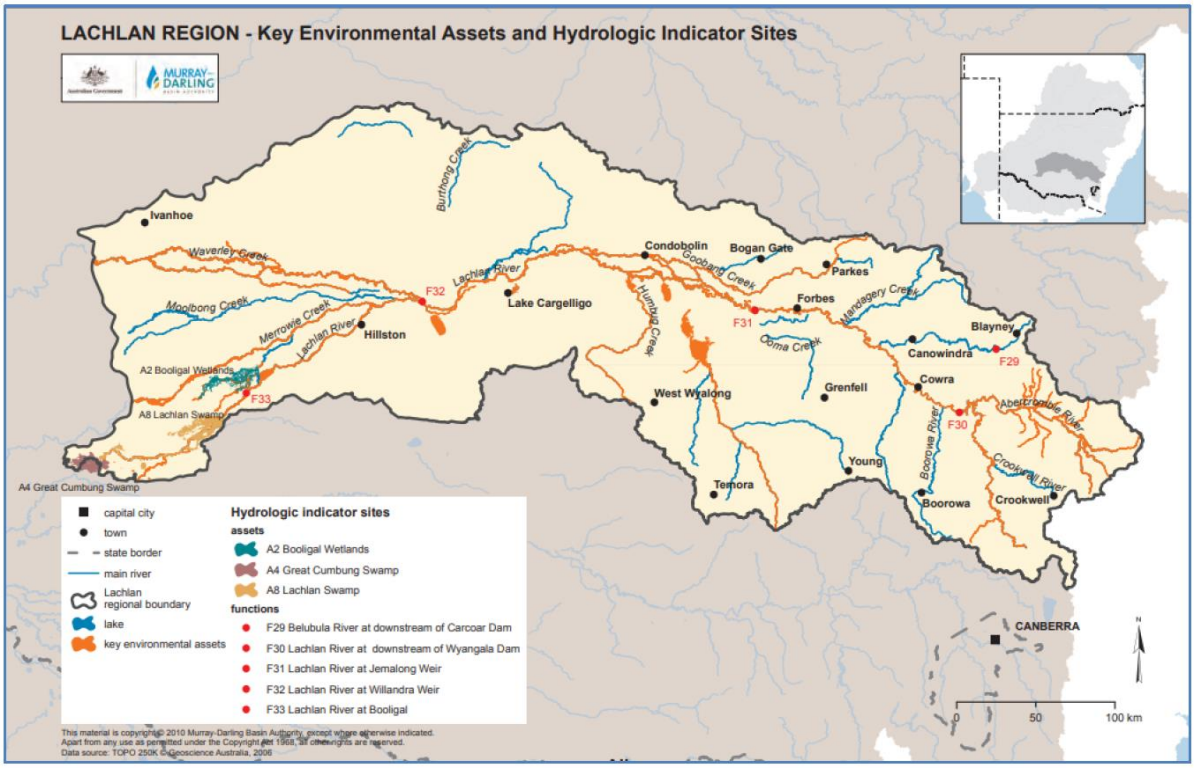


Figure 12 – Key environmental assets and hydrologic indicator sites (source: NSWDPI, 2018))

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 Probable Maximum Flood (PMF) area for Boorowa and the 1% AEP map provided by Lyall & Associates (2018; see figures 3 and 4 above) indicate that the project site is at low risk of flooding from the direction the Boorowa River. There is some potential for localized (minor) inundation from minor drainage lines running associated with Ryans Creek to the east of the site.

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: 1000102) for a site 500 meters to the south of the proposed solar site (see figure 14 and table 5 below). Site 1000212 indicates a soil profile with dark yellowish brown loam with a massive structure and few coarse fragments in the top horizons and reddish clay in the lower horizons. The physiography shows that the area is used for improved pasture with hard set service conditions and imperfect drainage. The erosion hazard is moderate with no salting evident.

Table 5 - Site details for eSPADE site 1004554

NSW SOIL AND LAND INFORMATION SYSTEM

Soil Essentials Report

SITE DETAILS

Site Location:	Profile 157
Map Reference:	MGA Grid Reference: Zone 55, 656913E, 6184884N. 8629 BOOROWA (1:100000) map sheet.
Profile Details:	Soils and vegetation of the Natural Gas pipeline, Section 4 (NGL) Survey (1000102), Profile 157, collected by Mr Barry Craze on 22 May, 1975
Physiography:	drainage depression under woodland grass understorey on fine-acidic lithology and used for improved pasture. Slope 1% (estimated), elevation 515.0 m, aspect east. Surface condition is hard set, profile drainage is imperfectly drained, erosion hazard is moderate, and no salting evident
Soil Type:	Solodic Soil (GSG), Dy3.23 (PPF)
Base of observation:	
Profile Field Notes:	1075.9 KM FEW SCATTERED BLAKELY'S RED GUM TREES

SOIL DESCRIPTION

Layer 0

Layer 1

0.00 - 0.15 m A1 Horizon	dark yellowish brown (brown) (10YR 4/4) [moist] loam, common (10-25/10x10cm) (Root size unknown), field pH is 5.5. Coarse fragments are few (2-10%), igneous, fine gravel (2-6 mm), pans are not evident, segregations are not evident; smooth gradual (50-100 mm) boundary to ...

Layer 2

0.15 - 0.25 m A2 Horizon	brown (dull orange) (7.5YR 5/4) [moist] loam with massive structure, few (1-10/10x10cm) (Root size unknown), field pH is 6.0. Coarse fragments are common (10-20%), igneous, coarse gravel (20-60 mm), gravel (6-20 mm), fine gravel (2-6 mm), pans are not evident, segregations are not evident; not evident boundary to ...

Layer 3

0.25 - 0.36 m A2 Horizon	brown (dull orange) (7.5YR 5/4) [moist] silty loam with massive structure, few (1-10/10x10cm) (Root size unknown), field pH is 6.5. Coarse fragments are few (2-10%), igneous, gravel (6-20 mm), fine gravel (2-6 mm), pans are not evident, segregations are not evident; smooth gradual (50-100 mm) boundary to ...

Layer 4

0.36 - 0.59 m B1 Horizon	reddish yellow (orange) (7.5YR 6/6) [moist] light clay with strong pedality (platy, 5 - 10 mm, smooth-faced peds), none (Root size unknown), field pH is 6.0. Coarse fragments are few (2-10%), igneous, gravel (6-20 mm), fine gravel (2-6 mm), pans are not evident, segregations are none, fine (< 2 mm), manganiferous, none, fine (< 2 mm), ferruginous; smooth gradual (50-100 mm) boundary to ...

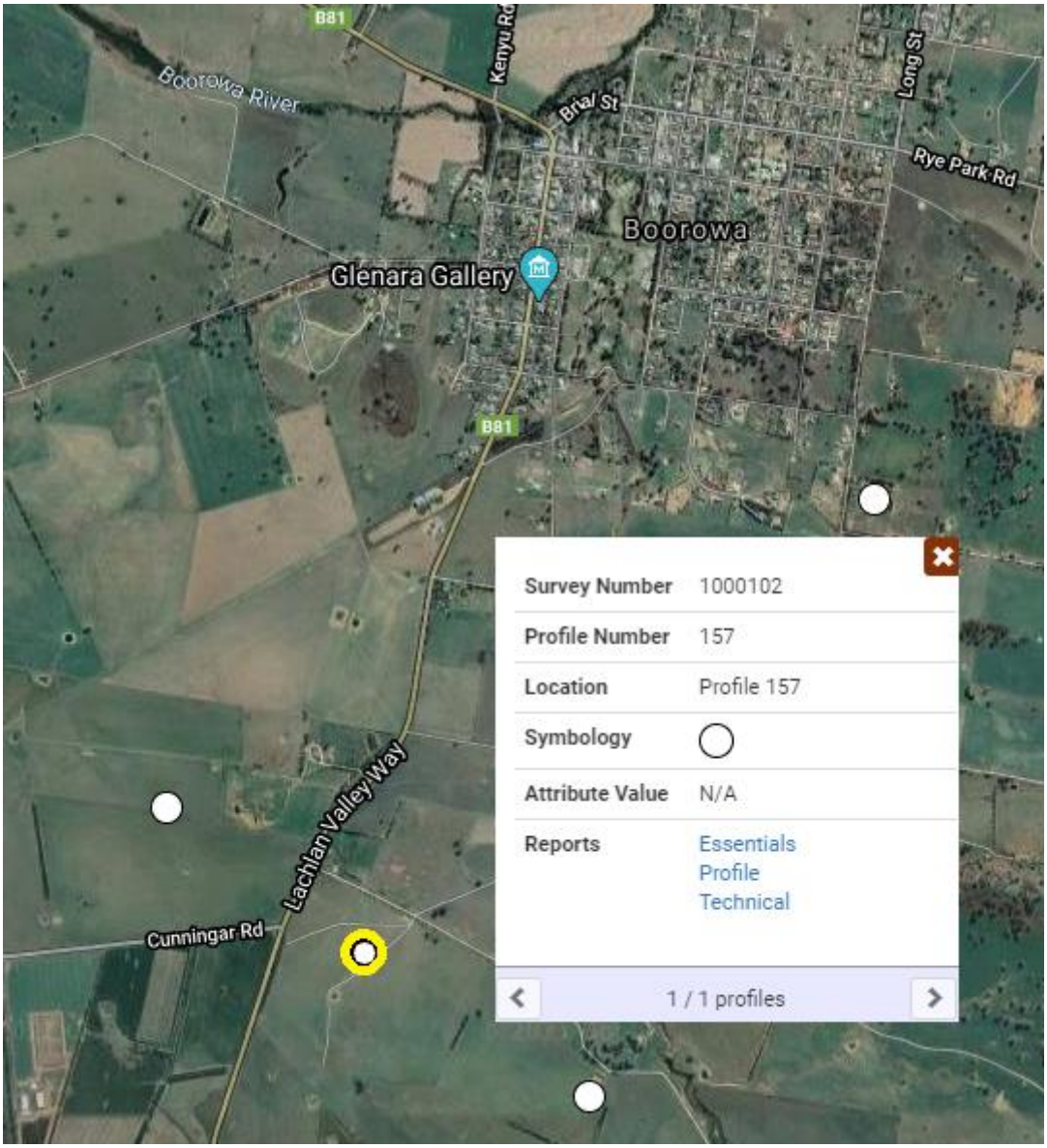


Figure 13 - The location of the eSPADE site 1000102 (source: espade.environment.nsw.gov.au © State of NSW and Office of Environment and Heritage 2021)

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 REFERENCES

Bureau of Meteorology (2021) Australian Data Archive for Meteorology, online database, Commonwealth of Australia, http://www.bom.gov.au/climate/data/ [accessed 18th February 2021]

Bureau of Meteorology (2020) Groundwater Dependent Ecosystems Atlas, online, Commonwealth of Australia, http://www.bom.gov.au/water/groundwater/gde/ [accessed 18th February 2021]

CSIRO 2008, 'Water availability in the Lachlan. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project', Commonwealth Scientific and Industrial Research Organisation, Canberra.

Cook, L. M., McCuen, R. H. (2013) Hydrologic response of solar farms, Journal of Hydrologic Engineering, v 18, n 5, p 536-541.

Department of Environment, Climate Change and Water (2008) Managing Urban Stormwater: Soils and Construction Vol 2A.

Langford, R., Jenkins, J., Elliot, L. and Hilhorst, D. (2005), Hovels Creek Landcare, Boorowa River Catchment – An Overview, https://hovellscreeklandcare.org.au/images/Boorowa%20Catchment%20Plan%20Part%202.pdf [accessed 17th February 2021]

Lyall & Associates (2018), Boorowa Floodplain Risk Study and plan, https://www.hilltops.nsw.gov.au/ENVIRONMENT/Waterways-Flooding/Waterways-Flooding.aspx [accessed 10th February 2021]

Murray-Darling Basin Authority (2010), Guide to the proposed Basin Plan: Technical background, Murray–Darling Basin Authority, Canberra.

Murray-Darling Basin Authority (2021a), Lachlan - The landscape and its water https://www.mdba.gov.au/water-management/catchments/lachlan [accessed 15th February 2021]

Murray-Darling Basin Authority (2021b), Water resource plans https://www.mdba.gov.au/basin-plan-roll-out/water-resource-plans [accessed 15th February 2021]

Natural Resources Commission (2013), Review of 2004 water sharing Plans NSW Office of Water, https://www.nrc.nsw.gov.au/_literature_177684/Review_of_2004_water_sharing_plans_-_Final_report [accessed 25th November 2019]

NSW Government (2021), Environmental Planning Instrument - Groundwater Vulnerability (spatial data) https://www.planningportal.nsw.gov.au/opendata/dataset/epi-groundwater-vulnerability [accessed 15th February 2021]

NSW Department of Primary Industries (2006). Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources – Background document for amended plan 2016 https://www.industry.nsw.gov.au/water/plans-programs/water-sharing-plans/status/lachlan-region [accessed 15th February 2021]

NSW Department of Primary Industries and Environment (2019). Lachlan Alluvium Water Resource Plan https://www.mdba.gov.au/sites/default/files/pubs/nsw-lachlan-alluvium-water-resource-plan-2019.pdf [accessed 15th February 2021]

NSW Department of Industry (2018). Lachlan Surface Water Resource Plan - SW10 Lachlan Surface Water Resource Plan Area https://www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/lachlan-surface [accessed 15th February 2021]

NSW Department of Planning, Industry and Environment, (2021), eSPADE resource, https://www.environment.nsw.gov.au/eSpade2Webapp [accessed 15th February 2021]

NSW Legislation, (2021) Boorowa Local Environmental Plan 2012 https://www.legislation.nsw.gov.au/view/html/inforce/current/epi-2012-0252 [accessed 15th February 2021]

NSW Legislation, (2020) Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020https://www.legislation.nsw.gov.au/view/whole/html/inforce/current/epi-2011-0622 [accessed 15th February 2021]

NSW Office of Environment and Heritage (2021) eSPADE, https://www.environment.nsw.gov.au/eSpade2Webapp [accessed 15th February 2021]

ITP Renewables

Office: Level 1, 19-23 Moore St
Turner ACT 2612

Postal: PO Box 6127
O'Connor ACT 2602
Australia

Email: info@itpau.com.au
Phone: +61 (0) 2 6257 3511

itpau.com.au