WATER IMPACT ASSESSMENT

Finley Battery Energy Storage System

BESS Pacific Pty Ltd

Job No: P001993_WIA_001
Rev: D
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Premise

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Prepared By		**Reviewed By**		**Authorised By**	
Hugh Shackcloth - Bertinetti	[signature]	Daniel Balkin	DB	David Walker	[signature]
Vidura Deshapriya	[signature]				

ABBREVIATIONS

Abbreviation	Definition
ADWG	Australian Drinking Water Guidelines 2011.
AEP	Annual Exceedance Probability: The probability of a flood occurring in any year expressed as a percentage.
AHD (m)	Australian Height Datum (metres): Elevation from the Australian Height Datum reference.
AIA	Agricultural Impact Assessment.
ANZECC	Australia and New Zealand Environment and Conservation Council.
ANZG	Australian & New Zealand Guidelines for Fresh & Marine Water Quality.
ARF	Areal Reduction Factors (ARF).
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand.
ARR	Australian Rainfall and Runoff: National guideline document, data and software suite for the estimation of design flood characteristics in Australia.
ASC	Australian Soil Classification.
BESS	Battery Energy Storage System.
BoM	Bureau of Meteorology.
BSC	Berrigan Shire Council.
CEMP	Construction Environmental Management Plan.
DCCEEW	Department of Climate Change, Energy, the Environment and Water.
DCP	Development Control Plan.
DEC	Department of Environment and Conservation.
DEM	Digital Elevation Model.
DGV	Default Guideline Values.
DPE	Department of Planning and Environment.
DPHI	Department of Planning, Housing and Infrastructure.
DPI	Department of Primary Industries.
DPIE	Department of Planning, Industry and Environment.

DPIRD	Department of Primary Industries and Regional Development.
DRNSW	Department of Regional New South Wales.
EIS	Environmental Impact Statement.
EPA	Environment Protection Authority.
EPL	Environmental Protection Licence.
ESCP	Erosion and Sediment Control Plan.
GDE	Groundwater Dependent Ecosystem.
GRD	Groundwater Resource Description.
ha	Hectares.
HGL	Hydrogeological Landscape.
HSC	Hydrologic Soil Group.
IFD	Intensity–Frequency–Duration: Design rainfall data from ARR.
IFD	Rainfall Intensity-Frequency-Duration.
km	kilometres
LEP	Local Environmental Plan.
LGA	Local Government Area.
LiDAR	Light Detection and Ranging: Remote light sensing to measure ranges and provide topographic data.
LiDAR	Light Detection and Ranging.
LTAAELs	long-term average annual extraction limits.
LUCRA	Land Use Conflict Risk Assessment.
m	metres
MDBA	Murray-Darling Basin Authority.
MHRDC	maximum harvestable right dam capacity.
MW	Megawatt
MWh	Megawatt hour
NSW WQ&RFO	NSW Water Quality and River Flow Objectives.
PMF	Probable Maximum Flood.

POEO Act	Protection of the Environment Operations Act 1997.
SDL	Sustainable Diversion Limit.
SEARs	Secretary's Environmental Assessment Requirements.
SES	NSW State Emergency Service.
SSD	State Significant Development.
SWMP	Soil and Water Management Plan.
TUFLOW	Two-Dimensional Unsteady Flow Model: A suite of advanced 1D/2D/3D computer simulation software for flooding, urban drainage, coastal hydraulics, sediment transport, and water quality.
WAL	Water Access License.
WBNM	Watershed Bounded Network Model: Event based hydrologic model for calculating flood hydrographs.
WBZ	Water Bearing Zone.
WIA	Water Impact Assessment.
WM Act	Water Management Act 2000.
WQMP	Water Quality Management Plan.
WRP	Water Resource Plan.
WRPA	Water Resource Plan Area.
WSP	Water Sharing Plan.

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EXECUTIVE SUMMARY

BESS Pacific Pty Ltd c/o Gransolar Development Australia (BESS Pacific) proposed to develop an approximate 100 Megawatt AC (MW_{AC}) / 200 Megawatt Hour (MWh) Battery Energy Storage System (BESS) at Riverina Highway, Finley, NSW within the Berrigan Local Government Area (LGA) The project is characterised as State Significant Development (SSD) and is to be known as the Finley BESS.

The development site for the Finley BESS includes the BESS infrastructure, an access arrangement and internal driveways, substation upgrades, a connecting electricity transmission cables and screening vegetation. The development site is located across the following land parcels:

- Lot 3 DP740920 (private land under agreement with the applicant);
- Lot B DP961693 (land hosting the Transgrid Finley Substation); and
- The road reserves of Canalla Road and Broockmanns Road.

Premise Australia Pty Ltd (Premise) have been commissioned by BESS Pacific Pty Ltd c/o Gransolar Developments Australia Pty Ltd to prepare a Water Impact Assessment (WIA) to respond to the Planning Secretary's Environmental Assessment Requirements (SEARs).

This WIA provides an assessment of surface water and groundwater impacts associated with the proposed development. The assessment of surface water and groundwater impacts has been informed by the characterisation of surrounding water resources, the application of water resource planning areas and review of publicly accessible data. The WIA outlines mitigation and management measure to minimise the potential for impacts to groundwater and surface water resources together with a consideration of water supply arrangements and approval requirements applying to the development.

The WIA has also included the completion of flood modelling for pre- and post-development scenarios, focused on a 1% Annual Exceedance Probability (AEP) flood event. The results of the model were analysed to understand constraints applying to the development and the potential for the development to impact existing conditions including, flood depth, velocity, levels and hazards.

The pre-development flood scenario indicated that a 1% AEP flood would affect the development site, with an average flood depth of 0.27 m and an average flow velocity of 0.03 m/s. After accounting for the proposed development, the flood depth increased slightly to 0.28 m, while the flow velocity rose to 0.04 m/s. The maximum increase in flood level (afflux) on-site was 0.04 m, and the maximum increase in flood velocity was 0.07 m/s between the pre- and post-development scenarios. Flood modelling has indicated that the site is currently impacted by a low flood hazard and that the proposed development is unlikely to lead to significant changes in flood patterns or hazards.

Overall, the results indicate that the proposed development is unlikely to significantly affect surrounding surface water or groundwater resources. Subject to the implementation of mitigation measures during the construction, operation and decommissioning phases of the development no significant impacts to surface water or groundwater resources are anticipated.

1. INTRODUCTION

1.1 Background

Premise Australia Pty Ltd (Premise) have been commissioned by BESS Pacific Pty Ltd Pty Ltd c/o Gransolar Development Australia Pty Ltd (BESS Pacific) to prepare a Water Impact Assessment (WIA) to support State Significant Development Application (SSD-72430958) for a proposed Battery Energy Storage System (BESS) and ancillary infrastructure including transmission and connection works at Riverina Highway, Finley NSW 2713. The proposed development is known as Finley BESS and is located within the Berrigan Shire Council (BSC) Local Government Area (LGA).

The regional context of the proposed development is shown in **Figure 1**.

1.1.1 THE DEVELOPMENT SITE

The entire footprint of the proposed development, including the area utilised for the BESS, the access arrangement, substation upgrade works, and the proposed transmission cables are collectively referred to as the 'development site.'

The development site is located approximately 5 km west of the town of Finley in the Riverina region of NSW. The development site is located across several land parcels including:

> Lot 3 DP740920 (private land under agreement with the applicant),
> Lot B DP961693 (land hosting the Transgrid Finley Substation); and
> The road reserves of Canalla and Broockmanns Road.

The development site is zoned *RU1 - Primary Production* under the *Berrigan Local Environmental Plan 2013* (LEP).

The development site has an area of approximately 10 hectares (ha) and is depicted in **Figure 2**. The proposed BESS infrastructure would occupy a footprint of approximately 3 ha within the southern extent of Lot 3 DP740920. This lot has historically been used for irrigated cropping and is bound by Broockmanns Road to the south and Canalla Road to the west. An existing connection to Broockmanns Road is provided along the southern boundary of Lot 3 DP740920. Heavy vehicle access for the construction of the BESS is to be provided via a new connection to Canalla Road. Two (2) light vehicle access arrangements are proposed to connect to Broockmanns Road (one new and an upgrade to the existing access).

The development includes electrical transmission cables to facilitate a connection to the Transgrid Finley Substation located on Lot B DP961693. The Transgrid Finley substation is located southwest of the proposed BESS and is bound by Broockmanns Road in the north and Canalla Road in the east. Several existing overhead electricity transmission lines transect the development site and land throughout the locality to facilitate connections to Finley Substation including along the alignment of Broockmans Road and Canalla Road.

No natural watercourses are located in the development site. However, the Mulwala No. 19 Channel is located south of Broockmanns Road in the northern extent of Lot B DP961693. This channel forms part of the Berriquin Irrigation System managed by Murray Irrigation Pty Ltd. The project transmission cables would be constructed under this channel via underboring methods. Other waterways in the surrounding region include Mulwala Canal located 1.4 km north of Lot 3 DP740920, the Ulupna Channel situated 850 m to the east of the development site and the Murray River located 17 km south of the development site.

1.1.2 DEVELOPMENT PROPOSED

The development will involve the construction, operation and eventual decommissioning of an approximate 100 MW_{AC} / 200 MWh BESS, connected via transmission cables directly to the existing adjacent Transgrid Finley Substation.

The Finley BESS will include the following key infrastructure

- Containerised lithium-ion batteries;
- Power conversion systems including associated transformers;
- Underground power and fibre optic cabling interconnecting the equipment;
- Grid connection equipment including switchgear, protection and control equipment, metering, reactive power equipment, filtering equipment, auxiliary transformers and enclosures/buildings for housing equipment;
- An electrical transmission cable and associated upgrade works to the existing 132/66kV Transgrid Finley Substation to accommodate the connection of the BESS.
- Earthing and lightning protection systems;
- Storage area/enclosure, internal access tracks, on-site parking, security fencing, CCTV, and temporary construction laydown area;
- Vegetation screening; and
- Internal access roadways for the BESS together with a site access arrangement to connect to Broockmanns and Canalla Roads.

The construction phase is anticipated to take approximately 11 months (including a peak period of 3 months). Once operational, the development is designed to operate autonomously with limited human intervention. The proposed development is expected to have a lifespan of approximately 20 to 25 years. The development, however, may receive an extension of its lifespan during its operation subject to future infrastructure upgrades and approvals.

Decommissioning of the development would be conducted following the cessation of the project's lifespan and at that time would include suitable remediation works to return the site to its former agricultural landuse.

1.2 Scope

This WIA has been prepared to address relevant requirements of the Secretary's Environmental Assessment Requirements (SEARs) issued for the development by the NSW Department of Planning, Housing and Infrastructure (DPHI) and to support the Environmental Impact Statement (EIS).

SEARS and Regulatory submissions relevant to the preparation of this WIA are listed in **Table 1** and **Table 2**. These tables include references to relevant sections of this WIA where requirements are addressed.

Table 1 – Relevant SEARs

SEARs	Requirement	Addressed
Key Issues: Water	> *an assessment of the likely impacts of the development (including flooding and flood modelling) on surrounding watercourses (including their Strahler Stream Order), groundwater resources and surface water movements, and measures proposed to monitor, reduce and mitigate these impacts including water management issues;*	**Section 6** (Impact Assessment)
	> *a site water balance for the development;*	**Section 4** (Proposed Water Management)
	> *details of water requirements and supply arrangements for construction and operation (including consultation with suppliers);*	**Section 4** (Proposed Water Management)
	> *a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom, 2004) and Managing Urban Stormwater: Soils and construction - Volume 2A manual (Landcom, 2008);*	**Section 6** (Impact Assessment)
	> *assessing the impacts of the development, including any changes to flood risk and overland flows on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required; and*	**Section 6** (Impact Assessment)
	> *where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary) Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003), and Policy & Guidelines for Fish Habitat Conservation & Management (DPE, 2013)*	**Section 6** (Impact Assessment)
	> *identification of any flood risk on site having regard to adopted flood studies, the potential effects of climate change and any relevant provisions of the NSW Flood Risk Management Manual;*	**Section 5** (Flood Modelling) **Section 6** (Impact Assessment) **Section 7** (Mitigation and Management Measures)
	– *where the development could alter flood behaviour, affect flood risk to the existing community or expose its users to flood risk, provide a flood impact and risk assessment (FIRA) prepared in accordance with the Flood Impact*	

SEARs	Requirement	Addressed
	and Risk Assessment – Flood Risk Management Guide LU01;	
	– *detailed design solutions and operational procedures to mitigate flood risk where required.*	

Table 2 – Relevant Regulator Submissions

Regulator	Requirement	Addressed
NSW DCCEEW - Water Group	*Water Take and Licensing*	
	> *A detailed and consolidated site water balance.*	**Section 4** (Proposed Water Management)
	> *Description of all works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent.*	**Section 6** (Impact Assessment)
	> *Details of all water take for the life of the project and post closure where applicable. This is to include water taken directly and indirectly, and the relevant water source where entitlements are required to account for the water take. If the water is to be taken from an alternative source confirmation should be provided by the supplier that the appropriate volumes can be obtained.*	**Section 4** (Proposed Water Management) **Section 6** (Impact Assessment)
	> *Details of Water Access Licences (WALs) held to account for any take of water where required, or demonstration that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth where water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licenses under the Water Management Act 2000 should be detailed by the proponent.*	**Section 2** (Legislative Context and Policy Framework)
	Water Impacts	
	> *A description of groundwater conditions that provides an understanding of groundwater level across the site under a range of wet and dry conditions.*	**Section 6** (Impact Assessment)
	> *Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, groundwater dependent ecosystems, and ground*	**Section 6** (Impact Assessment)

Regulator	Requirement	Addressed
	water levels; including measures proposed to reduce and mitigate these impacts.	
	> *Proposed surface and groundwater monitoring activities and methodologies.*	**Section 7** (Mitigation and Management Measures)
	Assessment against Policy and Guidelines	
	> *Identification and impact assessment of all works/activities located on waterfront land including an assessment against Guidelines for Controlled Activities on Waterfront Land (NRAR 2018).*	**Section 6** (Impact Assessment)
	> *Assessment of project against relevant policies and guidelines*	**Section 2** (Legislative Context and Policy Framework) **Section 6** (Impact Assessment)

1.3 Limitations

This WIA has been prepared for BESS Pacific to examine potential water impacts associated with Finley BESS. The results of this assessment may not be applicable beyond this scope and for this reason, any other third parties are not authorised to utilise this report without further input and advice from Premise.

This WIA is further based on a conceptual design of the BESS. The assessment of detailed design elements including excavation depths, proposed infrastructure and drainage design are subject to the finalisation of detailed design.

The assessment of potential impacts has been prepared based on data sources and information detailed throughout this WIA. For the avoidance of doubt, no additional water quality or quantity field data has been collected as a component of this WIA. The characterisation of existing surface water and groundwater environments is based on the analysis of historical data and publicly available information.

1.4 Qualifications

Our analysis and overall approach have been specifically catered for the requirements of BESS Pacific Pty Ltd and may not be applicable beyond this scope. For this reason, Premise does not assume responsibility for the use of, or reliance on, the report by any third party and the use of, or reliance on, the report by any third party is at the risk of that party.

Premise has relied on the information as outlined in the **Section 3** of this report. While Premise's report accurately assesses peak flows from design storms in accordance with current industry standards and guidelines, the project area is in an ungauged catchment and consequently future observed flows may vary from that predicted. Increase in predicted flood levels can be experienced due to factors such as blockages or obstructions to overland flow path. For these reasons appropriate freeboards should be adopted.

1.5 Data Collection and Review

This WIA has been prepared with reference to the following information:

> Project information provided by BESS Pacific, including conceptual details on the layout of the development.

> Topographical data across the Project Area including:
  - Survey Light Detection and Ranging data (LiDAR) in the form of a digital elevation model (DEM) with a grid resolution of 1 metre, across the development site, provided by the proponent; and,
  - Aerial LiDAR data in the form of a DEM with a grid resolution of 5 metre, for areas surrounding the development site, obtained from NSW Government Spatial Services.

> Historical climate records obtained from the Bureau of Meteorology (BoM) website including:
  - Climate data gathered from nearby weather stations including rainfall, evaporation, and temperature data; and,
  - 2016 Intensity-Frequency-Duration (IFD) design rainfalls.

> Catchment loss parameters and 2016 Ensemble temporal pattern data obtained from the Australian Rainfall and Runoff (ARR) Datahub website.

> Satellite imagery gathered from Google Earth and aerial Imager source from NSW Spatial Services Six Maps.

> Water quality data published under the NSW State of Environment report, the requirements of the Murray Darling Basin Plan and detailed within the Water Quality and River Flow Objectives (Refer to **Section 3.6**).

> All other information sources, including mapping datasets and external reports referenced throughout this WIA.

Sources: © State of NSW, Department of Customer Service, Spatial Services 2024
Gransolar Development 2024; ESRI 2024

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Legend

- Development Site
- Lot
- Major Road
- Railway
- Runway
- Major Water Body
- Major Watercourse

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Finley BESS

Figure 1: Regional Context

Legend

- Development Site
- BESS Lease Area
- Substation
- Indicative BESS Security Fence
- Lot
- Road
- Water Body
- Watercourse
- Essential Energy OH
- Essential Energy UG
- Transgrid Optic Fibre
- Easement

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Finley BESS

Figure 2: Local Context

2. LEGISLATIVE CONTEXT AND POLICY FRAMEWORK

2.1 Commonwealth Water Act 2007

The *Commonwealth Water Act 2007* (the 'Water Act') was prepared to provide a legislative framework for the integrated management of the Murray Darling Basin to ensure that water resources within the basin are managed in the national interest. As detailed by the Australian Government Department for Climate Change, Energy, Environment and Water (DCCEEW, 2025a), the Water Act seeks to:

- *return to environmentally* sustainable *levels of extraction for Murray–Darling Basin water resources*
- *give effect to relevant international agreements*
- *promote the use and management of Basin water resources in a way that optimises economic, social and environmental outcomes*
- *protect, restore and provide for the ecological values of the Basin*
- *ensure information is available on Australia's water resources*. (DCCEEW, 2025a)

The Water Act is responsible for establishing the Murray Darling Basin Authority (MDBA) to prepare and implement the *Murray-Darling Basin Plan 2012* (Refer to **Section 2.1**). The following mandatory requirements are established by the Water Act for the *Murray-Darling Basin Plan 2012* (MDBA, 2025a):

- *limits on the amount of water (both surface and groundwater) that can be taken from the Basin's water resources on a sustainable basis – known as sustainable diversion limits.*
- *identifying risks to the Basin's water resources, such as climate changes, and strategies to manage those risks.*
- *requirements for state water resource plans.*
- *an environmental watering plan to optimise environmental outcomes for the Basin.*
- *a water quality and salinity management plan.*
- *rules about trading of water rights in relation to the Basin's water resources.*

2.2 Murray Darling Basin Plan 2012

The *Murray Darling Basin Plan 2012* (Commonwealth of Australia, 2012) (the 'Basin Plan') is a formal instrument of the Commonwealth *Water Act 2007* which provides a framework for assessing the long-term integrated management of water resources for the Murray Darling Basin.

The Basin Plan prescribes water resource plan areas (WRPA) across the Murray-Darling Basin and requires sustainable diversion limits (SDLs) and water resource plans (WRPs) for the sustainable management of surface and groundwater resources. The application of WRPs for surface water and groundwater resources the development site is further discussed in **Section 2.2.1**.

2.2.1 WATER RESOURCE AND WATER SHARING PLANS

Water resources plans (WRPs) are regulatory instruments established under the *Commonwealth Water Act 2007* and the *Murray Darling Basin Plan 2012*.

WRPs are developed by state governments to detail how water resources within designated WRPAs under the Basin Plan are to be managed. As detailed by the MDBA (2025b), each WRP sets out the water sharing rules and arrangements relating to how water is used at a local or catchment level), including:

- *limits on how much water can be taken from the system;*

- *how much water will be made available to the environment; and*
- *how water quality standards can be met.*

NSW Water Sharing Plans (WSPs) are state regulatory instruments established under the NSW *Water Management Act 2000.* As detailed via the NSW Government (2025a), the purpose of a WSP is to:

- *protect the fundamental environmental health of the water source*
- *ensure the water source is sustainable in the long-term*
- *provide all water users with a clear picture of when and how water will be available for extraction.*

The development of WRPs under the Basin Plan has involved the remake and amendment of existing WSPs to address requirements of the Basin Plan and as outlined in the WRPs, NSW is currently amending WSPs (where necessary) to meet relevant Basin Requirements. This includes the incorporation of statutory provisions made under a WSP into relevant WRPs (DPE, 2023a; DPE, 2022a).

The regulatory framework for water resources in NSW within the Murray Darling Basin, including the relationship between WSPs and WRPs is detailed in **Figure 3** (DPE, 2023a; DPE, 2022a).

A summary of plans and area boundaries applicable to the development site is provided in **Table 3**. References are provided throughout the table to relevant WRP and WSP mapping provided in **Appendix A**. Maps used to identify applicable plans and boundaries were sourced from spatial data published by the MDBA (2025c) and WSP resources for the Murray region, published by the NSW Government (2025b).

Figure 3 –Relationship between Basin Plan, WRP and other instruments

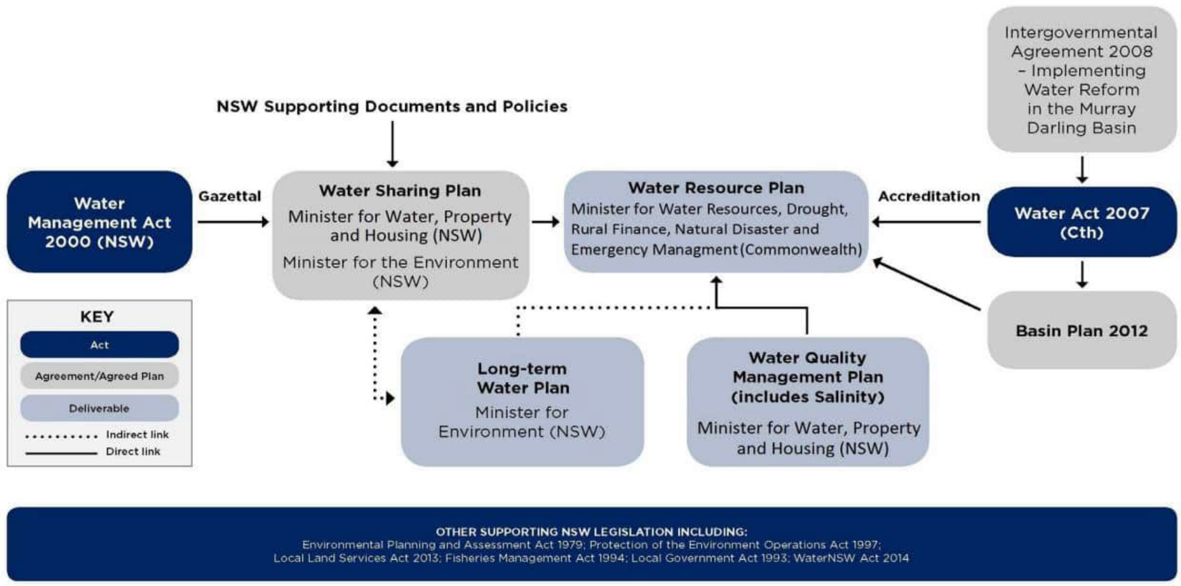


Table 3 — Summary of Applicable Water Planning Areas

Type of Plan Area / Zone	Applicable Plan
Water Resource Plans (WRPs) – Basin Plan	
Surface Water Resource Plan Area	SW8 – NSW Murray and Lower Darling Surface Water Resource Plan (Refer to **Figure 20**).
Surface Water SDL Area	SS14 – NSW Murray (Refer to **Figure 21**).
Groundwater Resource Plan Area	> Murray Alluvium Water Resource Plan (GW8) (Refer to **Figure 22**). > NSW Murray Darling Basin Fractured Rock (GW11) (Refer to **Figure 22**).
Groundwater SDL Area	> Lower Murray Shallow Alluvium (GS27a) (Refer to **Figure 23**). > Lower Murray Deep Alluvium (GS27b) (Refer to **Figure 23**). > Lachlan Fold Belt MDB (GS20) (Refer to **Figure 23**).
Water Quality Zone	Murray Valley Central cMum: middle, upper (Refer to **Figure 24**).
Water Sharing Plans	
Water Sharing Plan Region	Murray region (Refer to **Figure 25**).
Surface Water Sharing Plan(s)	> Murray Unregulated River Water Sources 2024 (Refer to **Figure 26**). **Note**: The development site is not located in proximity to regulated rivers under the NSW Murray and Lower Darling Regulated Rivers Water Sources WSP (Refer to **Figure 30**).
Surface Water Source	10 - Murray Below Mulwala Water Source (Refer to **Figure 26**).
Extraction Management Units	Unregulated Middle Murray Extraction Management Unit (Refer to **Figure 26**).
Groundwater Sharing Plan(s)	> Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020 (Refer to **Figure 27**) > Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020 (Refer to **Figure 28**).
Groundwater Source (Murray Alluvial)	> Lower Murray Shallow Groundwater Source (Refer to **Figure 27**) > Lower Murray Groundwater Source (Refer to **Figure 27**)
Lower Murray Shallow Groundwater Source Management Zone	Lower Murray Shallow (Eastern) Management Zone
Groundwater Source (Fractured Rock)	Lachlan Fold Belt MDB Groundwater Source (Refer to **Figure 28**).
Buried portion of Groundwater Sources (Fractured Rock)	Lachlan Fold Belt MDB Groundwater Source (Refer to **Figure 28**).

2.2.2 WATER TAKE AND CONSUMPTION

All WSPs in NSW include long-term average annual extraction limits (LTAAELs) for managing water take and consumption. WSPs for water sources in NSW, subject to the implementation of the Murray Darling Basin, also include sustainable diversion limits (SDLs) which limit the extraction and quantity of water that can be obtained from the Murray Darling Basin. SDLs are defined for each SDL resource unit in the Basin, including surface and groundwater units (NSW Government, 2025c).

SDLs, as detailed by the *Sustainable Diversion Limit Accounting and Reporting Framework 2025* (MDBA, 2025), reflect:

> *"the long-term average annual volumes of water for consumptive use that can be taken from the surface or groundwater resources of the Basin, leaving sufficient water for the environment"*

The NSW Government is responsible for checking LTAAEL compliance for WSPs and publishes annual compliance assessments against SDL targets for review by the Inspector-General of Water Compliance (NSW Government, 2025d).

LTAAEL compliance assessments are currently limited to annual reports for inland regulated and unregulated WSPs for the Barwon-Darling and Greater Metropolitan Region. LTAAEL compliance assessments, including for the Murray Unregulated River Water Sources 2024 applying to the development site, will only be enabled when sufficient data becomes available (NSW Government, 2025e).

Historical tracking of water extraction for the Lower Murray Groundwater Source published via an online usage dashboard, however, detail an overall reduction in average annual extraction from 79,436 ML in 2020-21 to 35,380 ML in 2023-24 (NSW Government, 2025f). The current extraction for 2024-25, dated 07/04/2025, 43,092 ML (NSW Government, 2025f).

Further consideration of groundwater extraction limits applying to the development site under WSPs is provided in **Section 3.5.3**.

2.2.3 IRRIGATION CORPORTATION

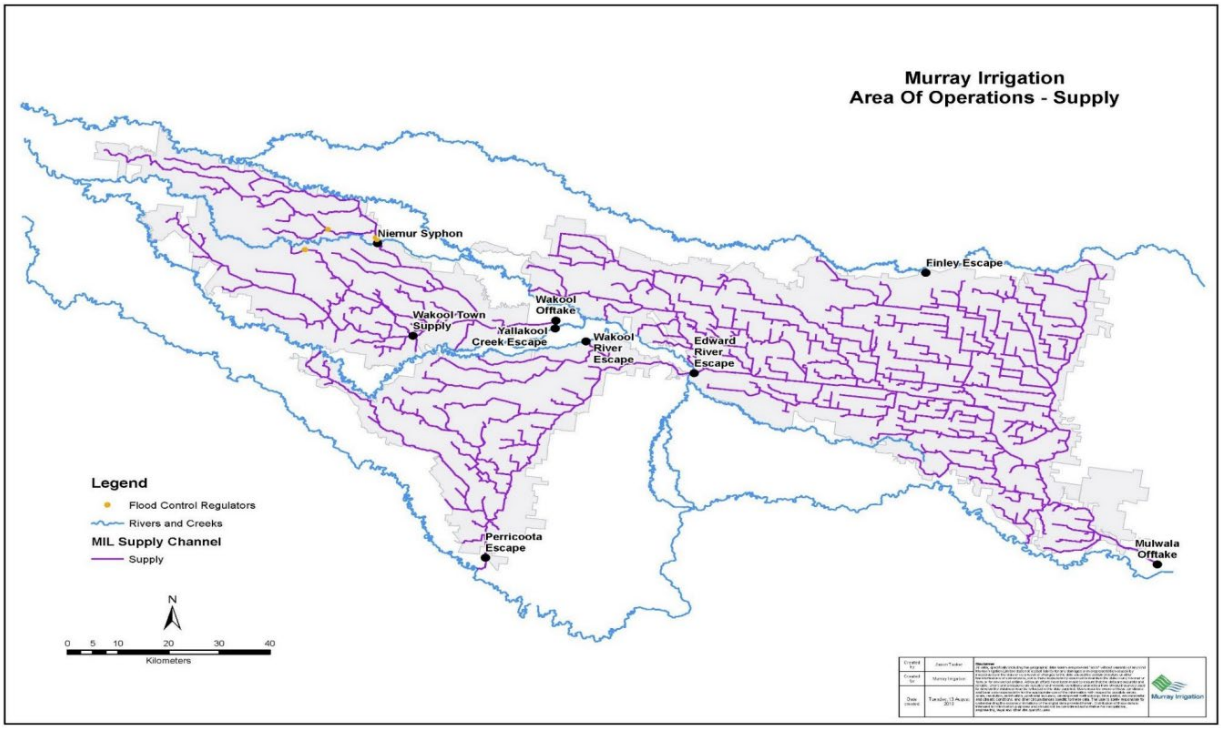
Murray Irrigation Ptd Ltd (Murray Irrigation) is a public company that operates Australia's largest private water supply network. Murray Irrigation is licensed to operate by the NSW Government with general security entitlements to the NSW Murray Regulated River resource and services landholdings and the environment via gravity fed earthen channels across the southern Riverina. This includes the following Water Access Licences (WALs) (Murray Irrigation, 2024):

- WAL8673 – Regulated River (high security)
- WAL8674 – Regulated River (high security) [Town Water Supply]
- WAL8676 – Regulated River (Conveyance)
- WAL8677 – Supplementary Water
- WAL9426 – Regulated River (General Security)
- WAL13833 – Regulated River (General Security)

Water is extracted and used by Murray Irrigation under two combined Water Supply Work Approval and Water Use Approvals (50CA501687 and 50CA512282).

Annual compliance reports are published and made publicly accessible by Murray Irrigation to detail compliance with the requirements of WALs, the combined supply and water use approvals, and the operational requirements of Environmental Protection Licence (EPL) 5014. The current operational map of Murray Irrigation is depicted in **Figure 4**.

Figure 4 – Murray Irrigation Area of Operations



2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) aims to protect, restore and enhance the quality of the environment in NSW, while still having regard to ecologically sustainable development.

To reduce risks to human health and to prevent degradation of the environment, POEO Act seeks the use of mechanisms that promote:

(i) *pollution prevention and cleaner production,*

(ii) *the reduction to harmless levels of the discharge of substances likely to cause harm to the environment,*

(iii) *the elimination of harmful wastes,*

(iv) *(iv) the reduction in the use of materials and the re-use, recovery or recycling of materials,*

(v) *the making of progressive environmental improvements, including the reduction of pollution at source,*

(vi) *the monitoring and reporting of environmental quality on a regular basis,*

Part 5.3 of the POEO Act prohibits the pollution of waters and details maximum penalties for water pollution offences. Section 148 additionally provides a duty for persons to immediately notify the relevant authority, NSW Environment Protection Authority (EPA), after they are aware of an incident that material harm to the environment is caused or threatened. Material harm is defined under section 147 of the POEO act as follows:

> *(a) harm to the environment is material if—*
>
> > *(i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or*
> >
> > *(ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (or such other amount as is prescribed by the regulations), and*
>
> *(b) loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.*

Offenses apply under Section 152 of the POEO Act for failing to notify pollution incidents in accordance with the provisions under Part 5.7.

The project will be managed to ensure pollution risks to soil, waterways and air quality are avoided or minimised. In the event of a pollution incident that causes or threatens material harm to the environment, the EPA would be notified.

Environment protection licences (EPLs) are administered by the EPA under the POEO Act. The development, however, is not a scheduled activity pursuant to Schedule 1, clause 17 of the POEO Act and no EPL will therefore be required to operate the project.

2.4 Water Management Act 2000

The *Water Management Act 2000* (WM Act) applies to all regions in NSW where there is a water sharing plan (WSP) in operation and details regulatory requirements for the use and flow of all water resources in NSW including rivers, lakes and aquifers. Where developments in a WSP take, construct, or use water from a groundwater or surface water resource, approvals and licences under the WM Act may apply.

The following subsections consider the application of

- Basic Landholder rights, including maximum harvestable rights
- Water Licensing and Approval requirements

2.4.1 BASIC LANDHOLDER RIGHTS

Chapter 3, Part 1 of the WM details three (3) types of basic landholder rights (BLR) for NSW:

- Domestic and stock rights – whereby an owner or occupier of a landholding is entitled, without the need for an access licence, water supply work approval or water use approval:
  - to take water from any river, estuary or lake to which the land has frontage or from any aquifer underlying the land, and
  - to construct and use a water supply work for that purpose, and
  - to use the water so taken for domestic consumption and stock watering, but not for any other purpose

- Harvestable rights – whereby an owner or occupier of a landholding within a harvestable rights area is entitled, in accordance with a harvestable rights order and without the need for any access licence, water supply work approval or water use approval:
  - to construct and use one or more water supply works for the purpose of capturing and storing water of a kind specified by the harvestable rights order,
  - to take and use that water.
- Native title rights – whereby a native title holder is entitled, without the need for an access licence, water supply work approval or water use approval, to take and use water in the exercise of native title rights.

2.4.1.1 Harvestable Rights

Harvestable rights allow owners or occupiers of a landholding to collect a proportion of runoff from their property in one or more dams located on a minor stream (defined as first or second order) or unmapped streams and use the water without the need for a licence or water supply work or water use approval.

The volume of water that can be captured and stored for a landholding, under harvestable rights is expressed as a maximum harvestable right dam capacity (MHRDC) and is a function of property size and location.

2.4.1.1.1 Maximum Capacity Calculation

The combined volume of water captured and stored under harvestable rights cannot exceed the maximum harvestable rights dam capacity (MHRDC) as prescribed under a harvestable right order. If the total volume is exceeded, a licence and water use approval is required to authorise the take and use of water for the excess volume. It should be noted that Harvestable rights cannot be applied to runoff capture in storages located in or within 40 m of a non-minor watercourse being a third order stream or above.

The *Harvestable Rights (central inland-draining catchments) Order 2022* applies to the development site and specifies rules relating to harvestable rights, including the method of their calculation. In this catchment up to 10% of the average annual regional rainfall runoff may be captured and used for any purpose.

The Water NSW Maximum Harvestable Rights Calculator (WaterNSW, 2025a) provides a method to estimate the MHRDC based on the location and property area. Based on a total area of approximately 48 ha applying to the landholding hosting the development site, Lot 3 DP740920, the Water NSW calculator estimates the MHRDC as 2.64 ML.

2.4.1.2 Water Licensing and Approvals.

As the project is SSD, Water Use Approvals, Water Management Approvals and Controlled Activity Approvals are not required. Water Access Licences and Aquifer Interference Approvals, however, still apply if the development triggers a requirement under the WM Act. An assessment of approval requirements applying to the proposed development under the WM Act is summarised in **Table 4.**

Table 4 – Approval Requirements under the WM Act

WM Act	Description	Comments
Water Access Licence (WAL) (Chapter 3, Part 2 of the WM Act)	Provides permission for the extraction of water from a surface water or groundwater resources within a WSP	The proposed development does not seek to include the extraction of water from surrounding surface water or groundwater resources. No requirement for a WAL is therefore anticipated.
Water Use Approval (Chapter 3, Part 3, Section 89 of the WM Act)	Provides permission to use water for a particular purpose at a particular location (e.g., irrigation, town water supply, power generation and mining).	An estimation of water use for the development is provided in **Section 4.1**. Notwithstanding the development is SSD and Water Use Approvals are therefore not required.
Water Management Work Approval (Chapter 3, Part 3, Section 90 of the WM Act)	Provide permission to construct and operate water supply works (i.e. pumps, bores), drainage works or flood works.	There are no watercourses located within or in the immediate vicinity of the development site (Refer to **Section 3.3**). No water management works are currently proposed as a component of the development to enable water extraction. Notwithstanding the development is SSD and Water management Work Approvals are therefore not required.
Activity Approvals (Chapter 3, Part 3, Section 91 of the WM Act)	Controlled activity approvals for work on waterfront land	There is no waterfront land located within or in the immediate vicinity of the development site (Refer to **Section 3.3**). Notwithstanding the development is SSD and Controlled activity approvals are therefore not required.
	Aquifer Interference Approvals	No significant impact to surrounding groundwaters including aquifers are anticipated as a result of the development (Refer to **Section 6.2**). No requirement for an aquifer interference approval is currently anticipated. While no water management works for supply via groundwater extraction are currently proposed, it should be noted that up to 3 ML per year prior, could be utilised prior to triggering a requirement for a WAL.

2.5 Planning Instruments

The *Berrigan Local Environmental Plan 2013* (LEP) and *Berrigan Development Control Plan 2014* (DCP) guide planning decisions through zoning and development controls. The LEP and DCP both include considerations for the management of flooding, groundwater and surface water impacts.

The LEP provides the following objectives relevant to flood planning (Section .251)

> *(a) to minimise the flood risk to life and property associated with the use of land,*
>
> *(b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,*
>
> *(c) to avoid adverse or cumulative impacts on flood behaviour and the environment,*
>
> *(d) to enable the safe occupation and efficient evacuation of people in the event of a flood.*

Pursuant to Section 2.10 of the *State Environmental Planning Policy (Planning Systems) 2021*, the DCP is not applicable to the proposed development as it is classified as SSD. Notwithstanding this, the content of the DCP have been considered in the evaluation of existing conditions, constraints and the implementation of management measures to minimise impacts where feasible and reasonable.

It is anticipated that potential surface water quality issues associated with the construction and operation of the development will be adequately addressed with the standard measures including the implementation of a Soil and Water Management Plan (SWMP) prepared during the finalisation of detailed design.

3. BASELINE CHARACTERISTICS / EXISTING ENVIRONMENT

3.1 Topography

The development site is relatively flat. The surrounding locality is predominantly characterised by flat agricultural land with undulating topography adjacent to watercourses and irrigation channels.

A review of elevation within the site via Google Earth Mapping identifies high points of approximately 111 m Average Height Datum (AHD) including along the of the access route, within the northeastern extent of Finley Substation and within the southern portion of location proposed for the BESS. A low point of 107 m AHD is identified along the northern portion of Canalla Road south of the connection with the Riverina Highway.

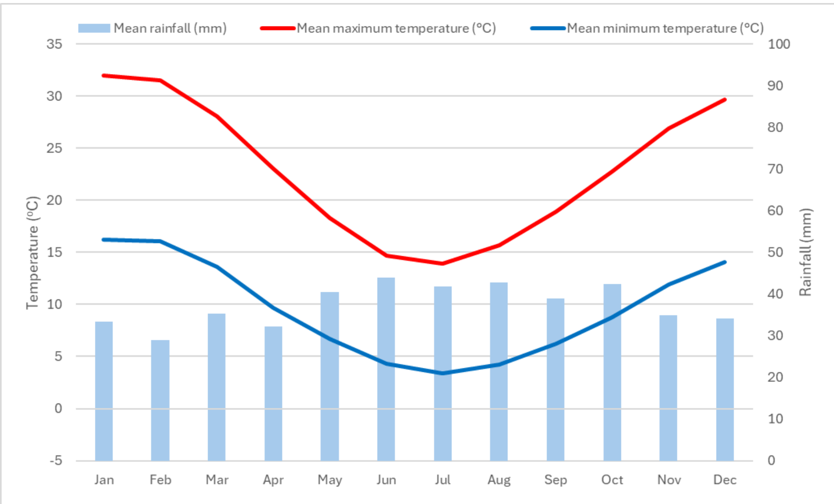
3.2 Climate

The closest Australian Bureau of Meteorology (BoM) weather station with daily weather observations is Tocumwal Airport (Station 074106), located approximately 20.7 km southwest of the development site (BoM, 2025). Other BoM weather stations are closer but only provide daily rainfall and solar exposure statistics.

Summary climate statistics are provided below and depicted in **Figure 5.**

- The mean annual maximum temperature is 23.0°C and the mean annual minimum temperature is 9.6°C. Records indicate that January is the warmest month, and July is the coldest (BoM, 2025).
- Mean annual rainfall is 449.0 mm and records indicate monthly mean rainfall received is highest in June (BoM, 2025).

Figure 5 – Summary Climate Statistics



3.3 Surface Water

3.3.1 HYDROLINES

The development site is situated within a relatively flat agricultural landscape and region comprised of a network of artificially constructed irrigation channels.

No natural watercourses have been observed as transecting the development site. An artificial irrigation channel, Mulwala No. 19 Channel, however, is located south of Broockmanns Road in the northern extent of Lot B DP961693. This channel forms part of the Irrigation System managed by Murray Irrigation Pty Ltd and is transected by the proposed route of the transmission cables to connect Transgrid Finley Substation. A separate irrigation channel, Ulupna channel, is located approximately 700 m west of the development site.

Other waterways in the surrounding region include Mulwala Canal located 1.4 km north of Lot 3 DP740920, the Ulupna Channel situated approximately 850 m to the east of the development site and the Murray River located approximately 17 km south of the development site.

The local drainage systems within and surrounding the development site are not well defined due to generally flat topography. Drainage and flow regimes in proximity to the development site are considered to be predominantly influenced by natural depressions and the nature of surrounding land uses with runoff being captured by local farm dams and irrigation channels during flow events.

A review of the *Water Management (General) Regulation 2018* (NSW) hydroline spatial data (NSW Government, 2025h) has been undertaken to determine Strahler stream orders applying to watercourses in proximity to the development site and the application of waterfront land. A map of surrounding watercourses, including Strahler stream order's is provided in **Figure 6**.

3.3.2 WATERFRONT LAND

Waterfront land is managed under the WM Act and is defined as including the bed of rivers, lakes, or estuaries, as well as land on each side within 40 metres. The WM Act details that controlled activity approvals are required for actions undertaken on waterfront land unless the activity is subject to an exemption. Pursuant to section 4.41(1) of the EP&A Act, an activity approval under section 91 of the *Water Management Act 2000,* is not required for State Significant Development.

Notwithstanding, it is recognised that the SEARS for the project include a requirement to consider works within waterfront land and how activities would be designed and implemented in accordance relevant guidelines including the *DPI Guidelines for Controlled Activities on Waterfront Land* (2018) and (if necessary) *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003), and *Policy & Guidelines for Fish Habitat Conservation & Management* (DPE, 2013).

The assessment of available hydroline data and satellite imagery of the development site has indicated that surrounding the surface water environment is generally characterised by farm dams and irrigation channels. The proposed transmission easement notably transects the alignment of Mulwala No. 19 Channel, which is mapped as a hydroline via the *Water Management (General) Regulation 2018 hydroline spatial data.* Irrigation channels, however, are considered to have an undefined Strahler classification ('zero strahler order channel'), in accordance with NSW Webmapping tools (Mitry, 2020). Consistent with advice previously provided by the NSW Government for other projects in proximity to irrigation channels, controlled activity approvals are not required for zero order channels. The proposed development including the electrical easement is therefore not considered to be situated on waterfront land for the purposes of the WM Act.

3.3.3 RIPARIAN LAND

A review of available riparian land, waterway maps and wetland maps provided via the LEP (BSC, 2025), has been undertaken to determine surface water environments applying to the development site. For the avoidance of doubt:

- The development site does not contain any land mapped as riparian land or waterways mapped via the LEP.
- The development site does not contain any land mapped as wetlands mapped via the LEP.

3.3.4 KEY FISH HABITAT

A review of the Fisheries NSW Spatial Data Portal (DPIRD, 2025) was undertaken to identify Key Fish Habitat with the potential to be impacted by the development. The development site does not contain any land mapped as KFH. The closest KFH is situated approximately 18 km south of the development site along the Murray River.

3.3.5 WETLANDS

A review of RAMSAR wetland mapping was undertaken via the SEED portal (NSW Government, 2025i). The closest RAMSAR site to the development, the 'NSW Central Murray State Forests', is situated approximately 27 km south-west of the development site along the Murray River.

Legend

- Development Site
- Road
- Water Body
- Strahler Stream Order

Groundwater Dependent Ecosystems

- Terrestrial

Groundwater Bore

- Exploration
- Irrigation
- Monitoring
- Stock and Domestic
- Unknown
- Water Supply

Premise

Finley BESS

Figure 6:
Watercourses and Groundwater Bores

3.4 Flooding

3.4.1 APPROACH

A detailed review of flooding constraints impacting the development site, in its undeveloped state was undertaken with the implementation of flood modelling and is detailed in **Section 5**. The methodology implemented for flood modelling is summarised as follows:

> Review of available flood studies
> Develop of a hydrological model to determine rainfall patterns for design flood event
> Develop a hydraulic model to assess flooding patterns for design flood event.
> Run the hydraulic model for a 1% Annual Exceedance Probability (AEP) flood without the proposed development as the existing case (Pre-development).
> Update and run the hydraulic model to incorporate the proposed development (Post-development completion).
> Prepare mapping for the pre-development and post-development scenarios for the 1% AEP flood and report on flood pattern changes.

3.4.2 FLOOD PLANNING AREA

The development site is not identified within a Flood Planning Area via the LEP (BSC, 2025). The closest flood planning area is situated approximately 13 km south-west of the development site along Tuppal Road.

3.4.3 REVIEW OF PREVIOUS FLOOD STUDIES

The Tocumwal and Barooga Flood Study prepared by WMA Water Pty Ltd was recently published by BSC in February 2025 (BSC and WMA Water, 2025). The flood study characterises flooding within the urbanised townships of Tocumwal and Barooga, together with intervening reaches of the Murray River. The flood study considers several other flood studies in the Murray region and identifies a longstanding history of flooding along the Murray River with more recent flood events occurring in 2016 and 2022.

The flood study developed and calibrated hydrologic and hydraulic models to simulate flood behaviour for a range of design events from the 20% AEP to extreme events approximating the Probable Maximum Flood (PMF).

The design hydrographs together with rainfall losses and hydraulic roughness values provided within the Tocumwal and Barooga Flood Study have been considered in the development of flood modelling for the purpose of this WIA and the evaluation of potential flood impacts associated with the proposed Finley BESS.

3.4.4 EXISTING FLOOD BEHAVIOUR

A flood model has been developed as a component of this WIA to determine flooding constraints and hazards associated with the proposed development. Further detail on the model, including maps of existing flood behaviour, are provided in **Section 5** and **Appendix C.**

The modelling results indicate that the site is currently impacted by a 1% Annual Exceedance Probability (AEP) event with the relatively flat landscape of the development site and surrounding region, subject to inundation by overland sheet flow. Existing flood behaviour across the development site is generally characterised by relatively slow and shallow moving sheet flow.

3.5 Groundwater

3.5.1 HYDROLOGEOLOGICAL CONTEXT

A review of spatial mapping datasets provided via the eSpade website (DPIE, 2024) and SEED portal (NSW Government, 2025i) has identified the following with respect to the hydrological setting of the development site:

> The site is mapped with a Hydrologic Soil Group (HSC) of 'C – Slow infiltration' which is provided with the following description:

  "Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission."

> The current extent of mapping for Hydrogeological Landscape (HGL) boundaries, accessible via the eSpade website, does not identify a specific HGL unit for the location of the development site. Derivative maps, however, identify the following:

  - A high overall salinity hazard
  - A high land salinity hazard
  - A moderate salt export and
  - A high instream electrical conductivity.

As detailed in **Section 2.2**, for the purpose of groundwater management, the development site is located within the Murray Alluvium (GW8) WRPA – Groundwater and the NSW Murray Darling Basin Fractured Rock WRPA (GW11) WRPAs. SDLs are provided under the Basin Plan to limit the extraction and quantity of water that can be obtained from the Murray Darling Basin.

The development site is impacted by the following Groundwater SDLs resource areas:

> The Lower Murray Shallow Alluvium (GS27a);

> The Lower Murray Deep Alluvium (GS27b); and

> The Lachlan Fold Belt MDB (GS20).

Groundwater Resource Descriptions (GRDs) published for the *Murray Alluvium WRP* (DPIE, 2023a) and *NSW Murray Darling -Basin Fractured rock WRP* (DPIE, 2022a), further characterise the groundwater resources within each WRPA. Details on groundwater resource areas and SDLs applying to the development site under the Murray Alluvium WRP, as outlined within the Murray Alluvium GRDs, are summarised in **Table 5**.

The Lachlan Fold Belt MDB resource area is characterised by the NSW Murray Darling -Basin Fractured Rock WRP GRD (DPIE, 2022a) as the most extensive groundwater system in the Murray Darling Basin WRPA, ranging from the Great Dividing Range through to the western rangelands around Cobar. Groundwater from this system is stored and supplied via fractures joints, bedding plains faults and cavities within underlying rock units. The geology of the Lachlan Fold Belt MDB SDL varies across its extent, however, is described as consisting of strongly deformed/metamorphosed marine sedimentary rocks, cherts, siltstones and mafic volcanic basalts and rhyolites, and plutonic granitic intrusions (DPIE, 2022a). The majority of the Lachlan Fold Belt MDB SLT fractured rock system is buried and forms the basement for the overlying porous rocks and alluvial groundwater resource units covered in other water resource plans (i.e. Shallow and Deep alluvial systems of the Lower Murray addressed via the Murray Alluvium WRP).

Table 5 –Characteristics of Sustainable Diversion Limit (SDL) Resource Areas (DPIE, 2023a)

SDL	Aquifer System	Corresponding Geology	Description and Characteristics
Lower Murray Shallow Alluvium (GS27a)	Shallow aquifer system up to approximately 70 m deep	Shepparton Formation	> Clay and silty clay interbedded with sand layers > Groundwater within the uppermost 20 m of the Shepparton Formation aquifer is mostly saline although low salinity and high yielding groundwater supplies can be obtained from the coarser sediments associated with prior streams. > Groundwater within the upper portion of the Shepparton Formation is unconfined. > The Lower Murray Shallow Alluvium corresponds to the sand and clay sediments of the upper portion of the Lachlan Formation to a depth of 20 m below the ground surface.
Lower Murray Deep Alluvium (GS27b)	Deeper aquifer system approximately 350 m deep that incorporates the Calivil Formation and the Renmark Group	Calivil Formation	> Overlies the Renmark Group occupying depths between 40 m and 140 m below ground surface and consists of sand and gravel, inter-bedded with clay layers > Dominated by sand and gravel beds with individual layers up to 12 m thick > An important source of groundwater and efficiently constructed bores within these formations can yield up to 15 ML/day.
		Renmark Group	> Overlies the basement rock occurring at depths between 140 m to 350 m below ground surface. > Consists of sand and gravel layers up to 40 m thick inter-bedded with carbonaceous clay and lignite layers. > Sand and gravel layers typically constitute important aquifers where low salinity groundwater is available. > Typically form very transmissive aquifers although in some areas the poorly sorted nature of the sands and gravel mixed with clay reduces the transmissivity resulting in lower yields.

A regional groundwater level contour map generated from 2015-2016 data is provided in the Murray Alluvium GRD (DPIE, 2023a) and is reproduced as **Figure 8**. Based on the groundwater contour map, groundwater levels within the WRPA are anticipated to be approximately 125 m AHD along the south-eastern boundary WRPA and 50-60 m AHD along the WRPA's western boundary. With respect to the location of the development site near Finley, Groundwater levels shown in **Figure 8** are estimated at approximately 90 m AHD with groundwater generally flowing west toward Deniliquin.

Three geological cross sections have been published for the Murray Alluvium WRPA and are presented within the Murray Alluvium GRD (DPIE, 2023a) (Refer to **Figure 9**). The east to west cross transects section illustrates the arrangement of the shallow aquifer, deep aquifer and bedrock layers. The east to west cross section of the Murray Alluvium WRPA transects Finley and further illustrates the arrangement of the shallow aquifer, deep aquifer and bedrock layers near the development site (Refer to **Figure 10**).

Figure 7 –Murray-Darling Basin, Groundwater SDL Resource Units

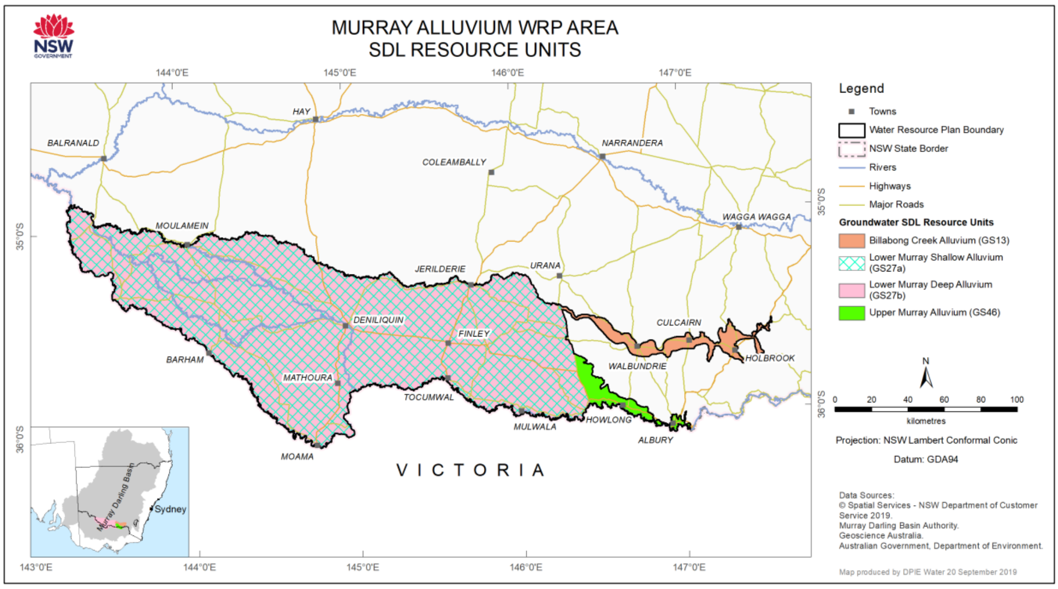


Figure 1. GW8 Murray Alluvium WRP area

Figure 8 –Lower Murray Alluvium - Regional Groundwater Level Contour Map

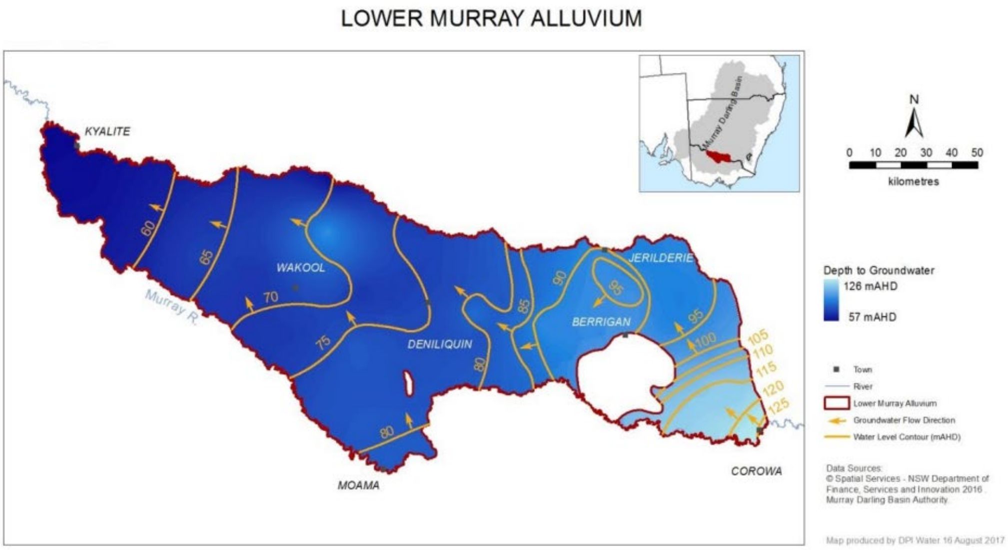


Figure 9 –Lower Murray Alluvium - Cross Section Layout

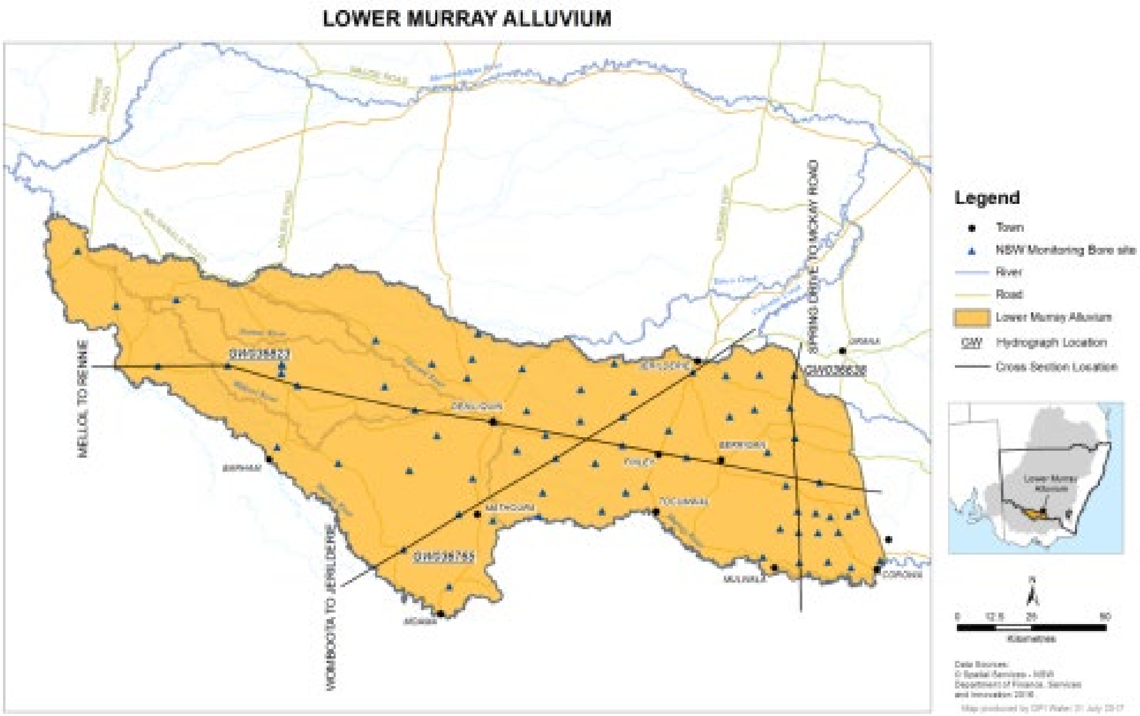
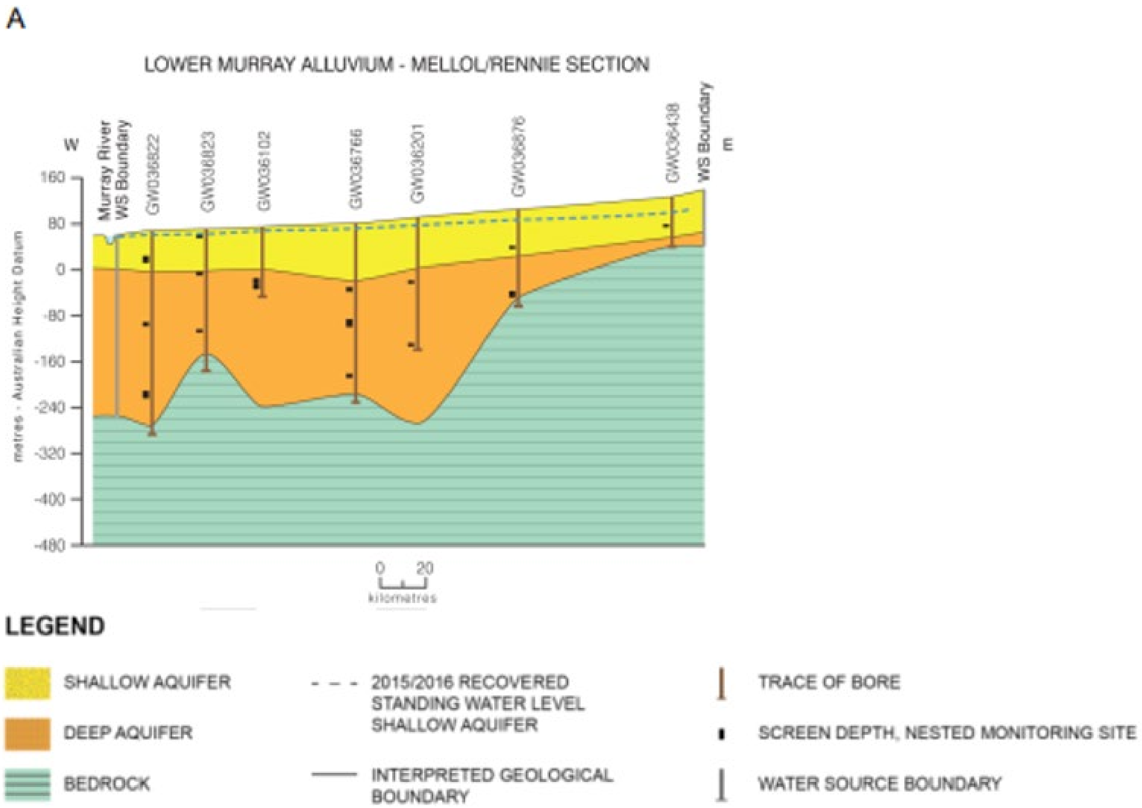


Figure 10 –Lower Murray Alluvium - Cross Section East to West



3.5.2 GROUNDWATER USERS

Groundwater information (bore identification, purpose use, geology, levels, yields and salinity of were collated from the WaterNSW Realtime Data Web Portal (WaterNSW, 2025b) and the Bureau of Meteorology (BoM) Australian Groundwater Explorer tool (BoM, 2025b).

A review of available groundwater mapping on 25 March 2024 did not identify any bores within the extent of the development site. The closest bore, GW502918, is situated approximately 470 m west of the development site at its closest point. Groundwater bores in proximity to the development site are shown in **Figure 6**. Details on the use of surrounding groundwater bores, their locations relative to the development site and depths (where available) are presented in **Table 6**.

Table 6 – Groundwater Bores

Bore ID	Drill Date	Purpose	Licence+	Status	Owner Type	Drill Depth (m)	Water Bearing Zones (WBZ) (m)	WBZ Details	Drillers Log Details	Graph	Direction from site	Distance from site (m)
GW501012	27/02/2000	Irrigation	50BL197608 (Cancelled)	Unknown	N/A	6.00	2.0-6.0m.	S.W.L 2.50m, D.D.L 3.80m, Yield 5.00L/s, Salinity 780mg/L	0-0.5m Red-Brown clay loam 0.5-1.5m Brown clay 1.5-2.0m Yellow Brown Sand clay 2.0-4.0m yellow brown fine sand 4-6.0m yellow brown coarse sand	N/A	North-west	870
GW502579	08/05/1995	Monitoring	N/A	Functioning	N/A	16.15	N/A	N/A	N/A	**Figure 46**	West	1900
GW502717	12/08/2000	Unknown	N/A	Functioning	N/A	9.33	N/A	N/A	N/A	**Figure 41**	North	1300
GW502727	12/08/2000	Unknown	N/A	Functioning	N/A	10.43	N/A	N/A	N/A	**Figure 42**	West	930
GW502741	12/08/2000	Unknown	N/A	Functioning	N/A	16.3	N/A	N/A	N/A	**Figure 47**	North east	2800
GW502752	12/08/2000	Unknown	N/A	Functioning	N/A	6.25	N/A	N/A	N/A	**Figure 43**	North-east	1400
GW502753	12/08/2000	Unknown	N/A	Functioning	Murray Irrigation	13.0	N/A	N/A	N/A	**Figure 44**	North-west	1500
GW502754	12/08/2000	Unknown	N/A	Functioning	N/A	6.00	N/A	N/A	N/A	**Figure 45**	North-west	2400
GW502918	12/08/2000	Unknown	N/A	Functioning	N/A	2.73	N/A	N/A	N/A	N/A	East	470
GW504340	27/02/2000	Irrigation	50BL199170 (Converted)	Functioning	Private	6.00	2.0-6.0m	S.W.L 2.50m D.D.L 3.80m,	0-0.5m clay loam, red brown	N/A	North-west	900

Bore ID	Drill Date	Purpose	Licence+	Status	Owner Type	Drill Depth (m)	Water Bearing Zones (WBZ) (m)	WBZ Details	Drillers Log Details	Graph	Direction from site	Distance from site (m)
								Yield 5.00L/s, Salinity 780mg/L	0.5-1.5m clay, brown 1.5-2.0m sandy clay, yellow brown 2.0-4.0m fine sand, yellow brown 4.0-6.0m sand, coarse, yellow brown			
GW504992	14/09/2009	Irrigation	50WA506640 (Current)	Functioning	Private	161.00	112.00-114.00 m,	S.W.L 2.50m D.D.L 3.80m, Yield 5.00L/s, Salinity 780mg/L	0-20 – clay 20-24 – sand 24-70 – clay 70-73 – sand 73-112 – clay 112-114 – sand 114-120 – silt 120-134 – sand 134-138- silt 138-161 – sand	N/A	North-west	1200
							129.00-134.00 m	N/A				
							138.00-161.00 m	N/A				

3.5.3 GROUNDWATER LEVELS

A review of driller logs accessible via the WaterNSW real-time water data website (WaterNSW, 2025b) and Groundwater levels available via the Australian Groundwater Explorer website (BoM, 2025b) was conducted on 7 April 2025 to identify groundwater levels and quality measurements in the vicinity of the development site.

Available information, including from register works approvals associated with driller logs, is presented in **Table 6**. Available groundwater level monitoring data, including water level charts, are presented throughout **Appendix E** for the following bores in the vicinity of the development site:

- GW502717, North of Development Site (Refer to **Figure 41**);
- GW502727, West of Development Site (Refer to **Figure 42**);
- GW502752, North-east of Development Site (Refer to **Figure 43**);
- GW502753, North-west of Development Site (Refer to **Figure 44**);
- GW502754, North-west of Development Site (Refer to **Figure 45**);
- GW502579, West of Development Site (Refer to **Figure 46**); and,
- GW502741, North-east of Development Site (Refer to **Figure 47**).

The shallowest recorded depth to water for each groundwater bore timeseries provides an indication on potential future depths for the water table and is significant for the consideration of potential contamination risks.

The analysis of available bore data collected between 1980 up until 2010 indicates that recorded groundwater levels within vicinity have historically ranged from approximately 0.40 m (GW502752) northeast of the development site to approximately 6.5 m (GW502753) north-west of development site.

The latest recorded water levels for groundwater bores in proximity to the development site are summarised in **Table 7**. The latest data for each bore in proximity, implies that surrounding water levels for the period between 2000 and 2010 have remained generally greater than 1 metre.

More recent data up until 26 February 2025 is available at groundwater bore GW036876 (refer to **Figure 48**). While this bore is situated outside of the immediate vicinity of the development site and features greater depths to groundwater, historical trends indicate that the depth to groundwater has generally decreased from 2010, with current levels for 2025 comparable to 2000. There is therefore the potential for the latest depth to water recorded for bores in vicinity of the development site to have also decreased from 2010 to 2025.

The comparison of depth to water across from bores in vicinity of the development site and GW036876 additionally indicates that the depth to groundwater is generally greater in the west, detailing that groundwater generally flows in a westerly direction which is consistent with the overall groundwater flow direction observed for the WRPA (refer **Section 3.5.1** and **Figure 8**).

Table 7 – Latest Groundwater Depth Data

Groundwater Bore	Last Date Recorded	Recorded Depth to Water (m)
GW502717	15/08/2005	2.00
GW502727	15/08/2005	2.87
GW502752	15/08/2005	1.78
GW502753	08/03/2011	6.52
GW502754	15/08/2005	1.67
GW502579	15/08/2005	3.55
GW502741	15/08/2005	4.29
Average		**3.24**

3.5.4 GROUNDWATER EXTRACTION

As detailed in **Section 2.2**, the development site is situated within the Murray Darling Basin and is subject to two WSP in NSW, including:

- Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020; and,
- Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020.

As detailed via the Groundwater Resource Descriptions (DPE, 2023a; DPE, 2022a) together with current WRPs and WSPs (DPE, 2023a; 2022a and NSW Government, 2025j; 2025k; 2025l; 2025m), different annual extraction limits previously applied to water sources identified within WSPs and SDL resource units. Extraction limits, however, have since been aligned to ensure the consistency between WSPs and SDLS limits. Current annual extraction limits for the defined water sources in applicable Water Sharing Plans are identified in **Table 8**.

Table 8 – WSP – Groundwater Extraction Limits

Applicable Plan	Water Source / Aquifer	Equivalent Groundwater Source under Basin Plan[2]	Extraction Limits (ML/year)[1]
Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020	Lower Murray Groundwater Source	Lower Murray Deep Alluvium (GS27b) Groundwater SDL Resource Unit	88,900
	Lower Murray Shallow Groundwater Source	Lower Murray Shallow Alluvium (GS27a) Groundwater SDL Resource Unit	81,893
Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	Lachlan Fold Belt MDB Groundwater Source	Lachlan Fold Belt MDB (GS20)	253,788
[1]Extraction limits have been gathered from 'Part 6 Limits to the availability of water' under the applicable water sharing Plan			
[2]The extraction limits adopted in WSPs (where applicable) equate to SDLs specified under equivalent groundwater SDL resource units of the Basin Plan.			

Annual Extraction data (excluding Basic Landholder Rights) is monitored by the NSW Government for groundwater sources across NSW. Historical water usage, across different regions within NSW presented by water source, licence category and river section, is publicly accessible via the NSW Government Usage Dashboard (NSW Government, 2025f).

Table 9 provides groundwater extraction data from identified groundwater sources between 2010 and 2025. In 2024 the water extraction from the Lower Murray shallow aquifer was 3,244 ML and the water extraction from the Lower Murray deep aquifer was 30,153 ML. The average annual extraction for the period between 2011 and 2025 indicates that extraction from the Lower Murray shallow aquifer was 4,782 ML is typically considerably less that the average annual extraction provided for the Lower Deep Aquifer at 55,754 ML.

Table 9 – WSP – Groundwater Extraction

Year	Water Source / Aquifer Extraction (ML)		
	Lower Murray Deep	Lower Murray Shallow	Lachlan Fold Belt MDB
2010	86,625	-	-
2011	17,095	-	-
2012	29,353	-	1,429
2013	54,650	1,275	4,198
2014	43,661	3,115	5,422
2015	66,097	4,922	4,627
2016	83,967	4,413	4,681
2017	35,173	4977	3,786
2018	77,723	7,476	6,202
2019	10,9171	11,142	6,351
2020	88,157	7,966	8,291
2021	60,818	5,608	3,179
2022	30,129	3,253	2,116
2023	12,793	2,432	4,192
2024	30,153	3,244	6,251
2025*	32,315	2,345	1,800
Average 2013-2025	**55,754**	**4,782**	**4,700**

3.5.5 GROUNDWATER VULNERABLE LAND

The development site does not contain any land identified via groundwater vulnerability mapping (BSC, 2025).

3.5.6 GROUNDWATER DEPENDENT ECOSYSTEMS

Groundwater Dependent Ecosystem's (GDEs) as defined by NSW Government (2025n) refer to:

> *'ecosystems that need access to groundwater to meet all or some of their water requirements to maintain their communities of plants and animals, ecological processes and ecosystem services.''*

Impacts to surface and groundwater resources resulting from a development, including changes to water quantity and quality, have the potential to cause changes to the community structure of GDEs and present threats to their ecological processes.

A review of GDE mapping available via the BoM website and SEED portal was undertaken on 28 March 2025 to determine potential risks to GDE's resulting from the proposed development. The search identified:

> no Aquatic GDEs impacting the development site. The closest mapped aquatic GDE is situated approximately 12.7 km southwest of the development site north of the Murray River and is attributed as a low potential GDE, wetland ecosystem supplied by Floodplain water body.

> no Terrestrial GDEs impacting the development site. The closest mapped terrestrial GDE is situated approximately 1.23 km east of the development site and is attributed as a low potential GDE, vegetation ecosystem associated with PCT 76 - Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.

> no Subterranean GDEs impacting the development site. No subterranean GDEs have been analysed within the state of NSW.

3.6 Water Quality and Flow Regimes

The following subsections provide an overview of existing water quality and flow regimes associated with the receiving environment based on publicly accessible data.

3.6.1 NSW STATE OF THE ENVIRONMENT REPORT

The 2021 NSW State of the Environment report (EPA, 2021) identifies the following water quality with respect to the Murray-Riverina Catchment:

> A river condition index between 0.2-0.3 which is considered as 'Poor' to 'Very Poor'.

> An extremely poor fish condition index for the Upper Murray and Very Poor index for the Central Murray and Lower Murray between 2018-2020.

> Exceedances of the water quality targets for total nitrogen and total phosphorus for samples collected between 2018-2020 along the Edward River. Subsequent review of the 'SoE_RiverNitrogenPhosphous' dataset available via the NSW State of Environment Map viewer (EPA, 2025) identifies exceedances of:

- Total Nitrogen by 8.33% by 43% along the Edward River at Deniliquin.
- Total Phosphorus by 27.78% along the Edward River at Deniliquin.

> An increase in mean daily salinity levels from July 2007 to June 2020 at selected mid and end of catchment sites including the following sites identified along the Macquarie River, including:

- An increase from 84 to 133 (μS/cm) at Station number 409005 Murray River at Barham within the 'cMum' water quality zone.
- An increase from 141 to 233 (μS/cm) at Station number 414216 Murray River d/s Mildura Weir within the 'cMI' water quality zone.

3.6.2 WATER QUALITY AND RIVER FLOW OBJECTIVES

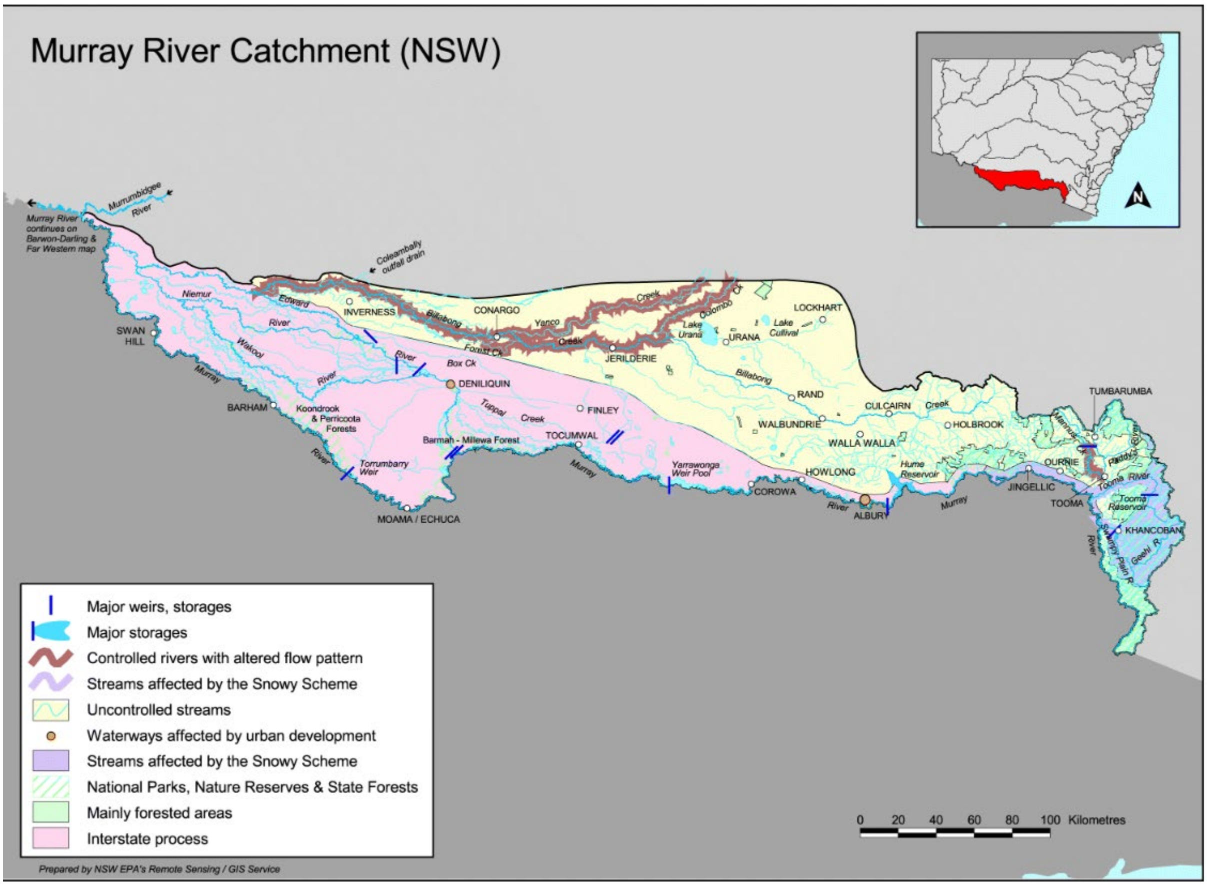
The *NSW Water Quality and River Flow Objectives* (NSW WQ&RFOs) (DECCW, 2006) set out targets for ensuring that surface waters in NSW are effectively managed and maintained. The objectives are separated into Water Quality Objectives (WQOs) and River Flow Objectives (RFOs).

This section has been prepared to address NSW WQOs and RFOs with reference to the Department of Environment and Conservation (DEC) document titled '*Using the ANZECC Guidelines and Water Quality Objectives in NSW*' (DEC, 2006).

The development site is located within the Murray River Catchment (NSW) (refer to **Figure 11**) and is identified within an area subject to interstate processes. The management of water within this interstate region, including the Murray Edward, Wakool and Niemour rivers together with all creeks. wetlands and watercourses in floodplains, is affected by interstate agreements to meet water needs in Victorica, South Australia and NSW.

As a result, no environmental WQOs or RFOs have been developed by the NSW Government for the interstate region in which the development site is located (DECCW, 2006).

Figure 11 –NSW WQ&RFOs – Catchment Map



3.6.3 AUSTRALIAN AND NEW ZEALAND GUIDELINES FOR FRESH AND MARINE WATER QUALITY

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG) (2018), otherwise referred to as the 'revised Water Quality Guidelines', have been prepared to progressively supersede the previous *Australia and New Zealand Environment and Conservation Council* (ANZECC) and *Agriculture and Resource Management Council of Australia and New Zealand (*ARMCANZ) *Water Quality Guidelines* (ANZECC & ARMCANZ, 2000). The revised 2018 ANZG is available as an online resource and provides authoritative guidance on the management of water quality for natural and semi natural water resources in Australia and New Zealand (Australian Government, 2025a).

The ANZGs currently provide high level guidance on the management context, ecological descriptions, biological indicator selection, regional Default Guideline Values (DGVs) for physical and chemical (PC) stressors and other advice for three of Australia's 12 inland water drainage divisions (including the Gulf of Carpentaria, the Indian Ocean and Timor Sea)

The current ANZGs do not include guidance for the remaining 9 drainage divisions, identified in **Figure 12**, including the Murray Darling which applies to the development site.

DGVs are included within the ANZG for assessing water quality and ensuring that PC stressors in waterways do not exceed harmful levels. Several draft DGVs addressing toxicants for water and sediment are currently on exhibition via the ANZG website.

The ANZG guidelines, however, details that DGVs are recommended for generic applications in the absence of more relevant guideline values including jurisdictional and/or site-specific thresholds. This is consistent with the preferred hierarchy of guideline values for PC stressors presented in the guidelines as reproduced in **Figure 13.**

As detailed in **Section 2.1**, the development site is within the New South Wales Murray and Lower Darling, WRPA (Surface Water - SW8) and the Murray Alluvium, WRPA (Groundwater - GW8). Water quality targets within the WRPAs are managed under dedicated WQMPs. Finer scale water quality targets therefore apply to the development site under the jurisdiction of the Basin Plan and have been used to determine background quality data (refer to **Section 3.6.4**).

Figure 12 –Drainage Divisions of Australia (ANZG, 2018)

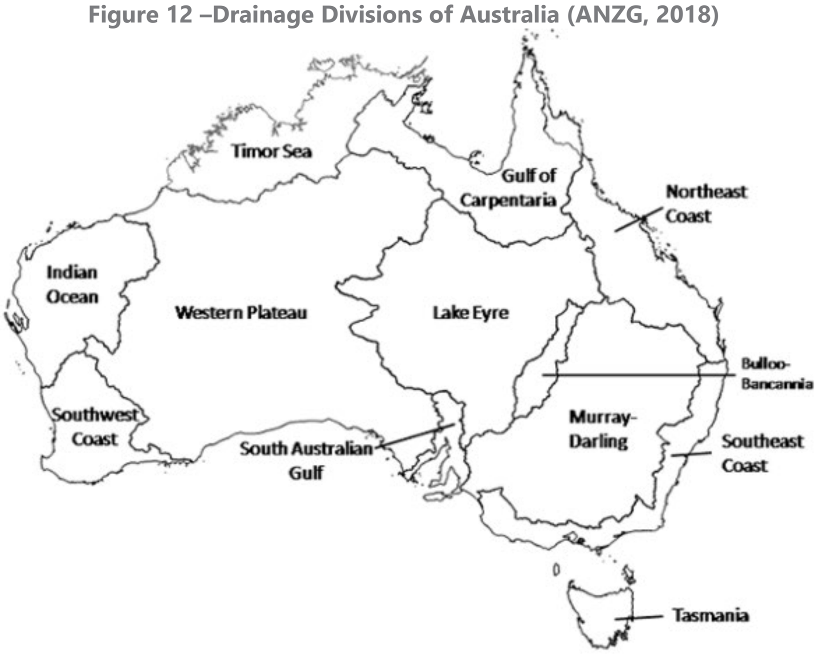
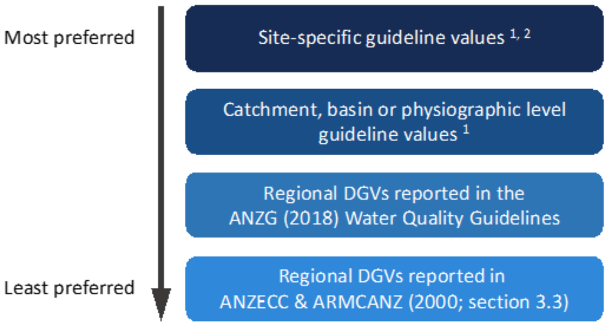


Figure 13 –Preferred hierarchy of guideline values for physical and chemical stressors (ANZG, 2018)



[1] Check if your local jurisdiction has derived these types of guideline values for your site/region
[2] Site-specific guideline values derived by proponents/operators will typically require review by the relevant jurisdiction before adoption.

3.6.4 BACKGROUND WATER QUALITY

Water Quality Management Plans (WQMPs) are provided as components of WRPs and seek to contribute to the sustainable and integrated management of water resources within WRPAs. WQMPs aim to provide frameworks to protect, enhance and restore water quality that is fit for purpose for a range of outcomes that:

- *Fulfil First Nation peoples spiritual, cultural customary and economic values*
- *Protect and improve ecological processes and health aquatic ecosystems*
- *Provide Essential and recreation amenities for rural communities*
- *Assist agriculture and industry to be productive and profitable*

Existing groundwater and surface water quality conditions presented in this Section have been informed based on data presented in WRPs and WQMPs applying to the development site

3.6.4.1 Surface Water Quality

The WQMP for the New South Wales Murray and Lower Darling WRPA (DPE, 2022) outlines water quality targets applying to surface water located in the WRPA, including targets for:

- water dependent ecosystems,
- long-term salinity planning and management,
- irrigation water,
- raw water for treatment for human consumption, and
- recreational water.

Water quality targets for the 'cMum' water quality zone applying to the development site (refer to **Figure 24**) and within the NSW Murray and Lower Darling WRPA, as sourced from the WQMP, are reproduced in **Table 10**.

Table 10 – NSW Murray and Lower Darling WQMP, Water Quality Targets

Water quality targets for other water dependent ecosystems (not including RAMSAR sites)

Water Quality Zone	Ecosystem Type	Turbidity (NTU)	Total P (µg/L)	Total N (µg/L)	Dissolved Oxygen (mg/L; or saturation (%)	pH	Salinity	Temperature	Toxicants
cMum (Murray Valley Central; Upper and middle zones)	Streams, rivers, lakes and wetlands	15	40	500	>7.7 mg/L Or 90-110%	6.5-7.5	End of Valley targets for Salinity (see Section 5.1.2)	Between the 20th and 80th percentile of natural monthly water temperature	The protection of 95% of species (must not exceed values in 3.4.1 of the ANZECC guidelines.)

Water quality targets for water dependent ecosystems (Declared RAMSAR wetlands)

Water Quality Zone	Ecosystem Type	Turbidity (NTU)	Total P (µg/L)	Total N (µg/L)	Dissolved Oxygen (mg/L; or saturation (%)	pH	Salinity	Temperature	Toxicants
cMum (Murray Valley Central; Upper and middle zones)	Streams and rivers	15	40	500	>7.7 mg/L Or 90-110%	6.5-8.0	N/A	Between the 20th and 80th percentile of natural monthly water temperature	The protection of 99% of species (must not exceed values in 3.4.1 of the ANZECC guidelines.)
	Lakes and wetlands	20	10	350	90-110%	6.5-8.0	N/A		

Water quality targets for long term salinity planning

Water Quality Zone	Ecosystem Type	End of valley targets		
		Salinity (EC µS/cm)		Salt Load (t/yr)
		Median (50%ile)	Peak (80%ile)	Mean
cMum	Streams, rivers, lakes and wetlands	N/A	412	N/A

Water quality targets for irrigation water

Water Quality Zone	Ecosystem Type	Electrical conductivity (µS/cm)	Sodium Absorption ratio
All	Streams, rivers, lakes and wetlands	833	Undetermined

Water quality targets for human consumption

Drinking Water Management Systems are required for a water provider's operating licence issued under the *NSW Public Health Act 2010* and *Public Health Regulation 2012*.

The *Australian Drinking Water Guidelines 2011* (ADWG) prepared by the National Health and Medical Research Council (NHMRC, 2011) outline acceptable parameters for the quality of drinking water in Australia. Drinking water quality parameters from the ADWG are provided in **Table 11** below (Australian Government, 2025b).

Blue-green algae targets for recreational water

Water Quality Zones	Ecosystem Type	Guidelines
All	Recreational water bodies suitable for primary contact	≥ 10 µg/L total microcystins; or ≥ 50,000 cells/mL toxic Microcystis aeruginosa; or biovolume equivalent of ≥ 4 mm³/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or ≥ 10 mm³/L for total biovolume of all cyanobacterial material where known toxins are not present; or Cyanobacterial scums consistently present

Table 11 – Australian Drinking Water Guidelines

Parameters	ADWG - 2011
Hardness as CaCO3	200 mg/l
pH	6.5 – 8.5
Taste & Colour	Not Necessary
Total Dissolved Solids	600 mg/l
True Colour	Not Necessary
Turbidity	<5 NTU
Thermotolerant Coliforms	None in 100 ml
Total Coliforms	# No guideline value set
Chlorine (Max)	5 mg/l
Aluminium	<0.2 mg/l
Ammonia as NH_3	<0.5 mg/l
Antimony	<0.003 mg/l
Arsenic	<0.01 mg/l
Barium	<2.0 mg/l
Boron	<4.0 mg/l
Cadmium	<0.002 mg/l
Chloride	<250 mg/l
Chromium (as CR (VI))	<0.05 mg/l
Copper	<2.0 mg/l
Cyanide	<0.08 mg/l
Fluoride	<1.5 mg/l
Iron	<0.3 mg/l
Lead	<0.01 mg/l
Manganese	<0.5 mg/l
Mercury	<0.001 mg/l
Nitrate (as NO_3)	<50 mg/l
Nitrite (as NO_2)	<3 mg/l
Selenium	<0.01 mg/l
Sodium	<180 mg/l
Sulphate	<250 mg/l
Zinc	<3 mg/l
Hydrogen Sulfide	<0.05 mg/l
Iodide	<0.1 mg/l
Molybodenum	<0.05 mg/l
Nickel	<0.02 mg/l
Silver	<0.1 mg/l

The 'Water quality technical report for Murray Lower Darling surface water resource plan area' (DPIE, 2020) includes summary statistics in Appendix D for each monitoring location in the WRPA between 2007-2015. Historical water quality statistics at the closest monitoring location, Edward River at Deniliquin (Station ID: 409003; located approximately 57 km west of the development site) are reproduced in **Table 12** and provide an indication of existing water quality within the environment surrounding the development site. Recorded values are compared against relevant guideline water quality targets from the Basin Plan for the protection of aquatic ecosystems (not including Ramsar wetlands) and detail:

- Total Nitrogen values achieving the target of the WRPA'
- Elevated Total Phosphorous values which exceed the target of the WRPA;
- Dissolved Oxygen (% saturation) within the target range of the WRPA'
- Compliance with pH targets of the WRPA; and
- Compliance with the peak Electrical conductivity targets pf the WRPA.

Table 12 – Average Water quality, Edward River at Deniliquin (Site - 409003) (2007-2015)

Monitoring Location	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Turbidity (NTU)	Total Suspended Solids (mg/L)	Dissolved Oxygen (% saturation)	pH	Electrical conductivity (µS/cm)
Edward River at Deniliquin	0.389	0.049	32	35	93	6.94	66
Water quality targets for other water dependent ecosystems (not including RAMSAR sites) (Refer to Table 10)	0.5	0.040	15	N/A	90-110	6.5-7.5	Peak 412

An overview of all surface water quality monitoring locations in the WRPA is provided in **Figure 3** along with water quality index scores. The water quality index of closest downstream monitoring site, Edward River at Deniliquin, is identified as 'Fair' with a score of 63. Available water quality data suggests that surface water quality targets under the Basin Plan are only being partially achieved for the closest monitoring location to the development site.

Given the separation distance of the development site to surrounding watercourses, the limitations on water use arrangements and the implementation of mitigation measures, the development is not anticipated to significantly impact on existing water quality or the achievement of relevant surface water quality targets for surrounding watercourses.

Figure 14 –NSW Murray And Lower Darling WRPA, Water Quality Monitoring Locations and Index Scores

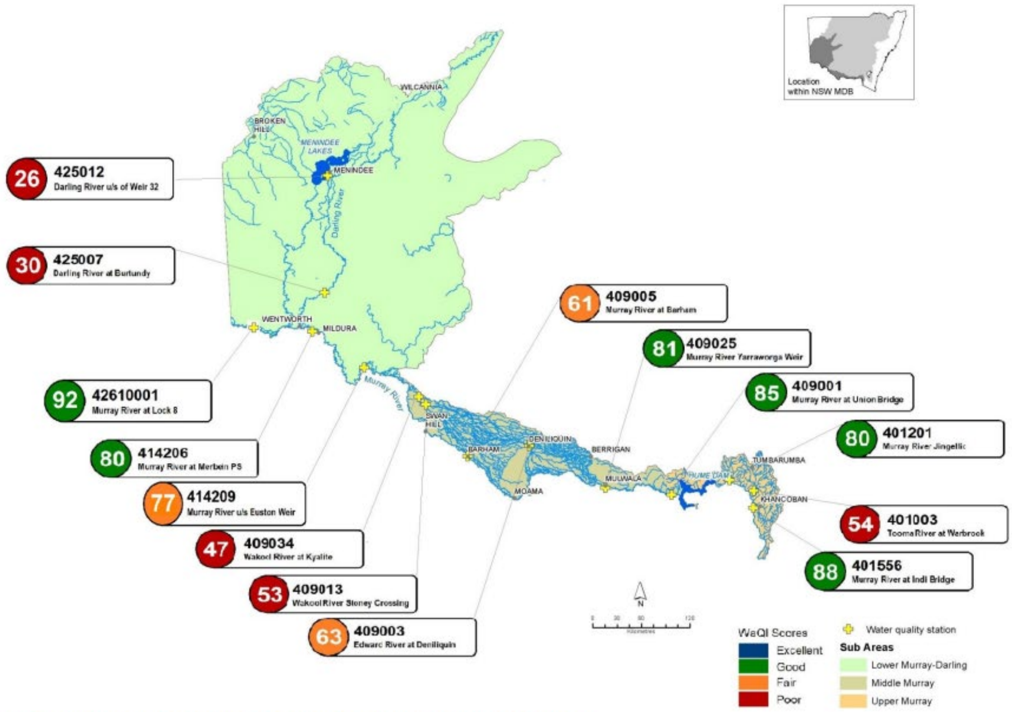


Figure 3-1. NSW Murray and Lower Darling water resource plan area WaQI scores.

3.6.4.2 Groundwater Quality

The WQMP for the Murray Alluvium WRPA (NSW DPE, 2022) outlines water quality targets applying to groundwater located in the WRPA, including targets for:

- water dependent ecosystems,
- irrigation water and,
- recreational water

Water quality targets applying to the Lower Murray Alluvium (Shallow and Deep) (refer to **Figure 7**), have been sourced from the Groundwater WQMP and are reproduced in **Table 13**.

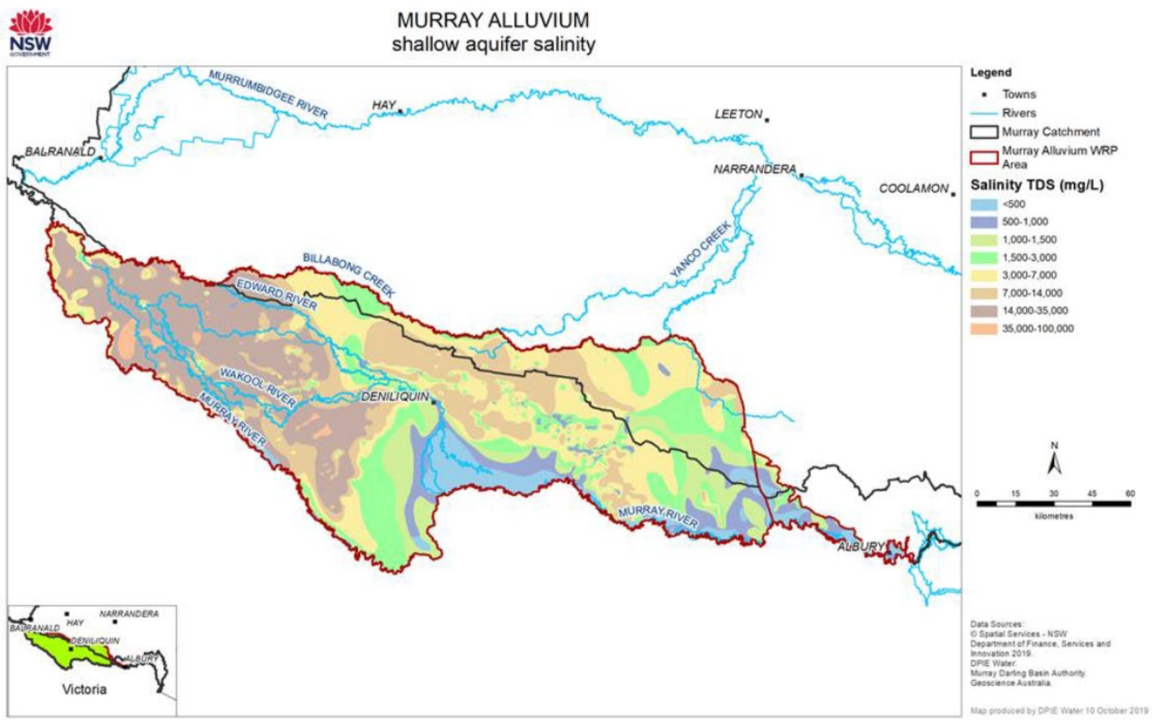
As detailed via the WQMP groundwater sampling has continued within the Lower Murray Alluvium water source since 2003 and indicated that Groundwater salinity is typically highly variable, with electrical conductivity ranging from 200 to 65,000 µS/cm. An overview of salinity across the Murray Alluvium WRPA is presented in **Figure 15**.

Further monitoring commissioned by the former NSW Office for Water in 2009 and undertaken by Parsons Brinckerhoff has continued to indicate high variability with salinity ranges within the Shepparton Formation (the shallow aquifer) ranging from fresh, 389 µS/cm to saline 7,010 µS/cm with the highest salinities situated in the irrigation area to the east of Deniliquin.

Table 13 – Murray Alluvium WQMP, Water Quality Targets

Water quality targets				
Water Use	**Location**	**Target Value (salinity mg/L)**		**Basin Plan Requirement and Justification**
Fresh water dependent ecosystems	Billabong Creek Alluvium Upper Murray Alluvium Lower Murray Alluvium (Shallow) Lower Murray Alluvium (Deep)	Zone 1	900	Alternative target value for 10.35B(2)(a) provided under s10.35B(3): Target values are consistent with objectives in Part 3 Chapter 9 and developed in accordance with ANZECC Guidelines procedures. The measures provided in Table 6 take account of the ANZECC Guidelines and the target values
		Zone 2	<3,000	
Irrigation water	-	Not relevant for Murray Alluvium WRP area		s10.35B(2)(b) s9.17 Not relevant in the Murray Alluvium WRP area as there is no irrigation infrastructure operator* present
Recreational water	-	Not relevant for Murray Alluvium WRP area		s10.35B(2)(c) s9.18 Not relevant in the Murray Alluvium WRP area (MDBA position statement 7A, 2017) groundwater is not used for recreational purposes in this WRP area.

Figure 15 –Murray Alluvium WRPA Shallow Aquifer Salinity (Shepparton Formation)



3.7 Soils

A review of Soil and Land Resource mapping via the eSpade website and the Australian Soil Classification (ASC) Soil Type Map via the SEED portal website has been undertaken to characterise soil with the study area. The study area is mapped as containing:

> Chromosols via the ASC Soil Type Map, (SEED Portal) and
> The Wait-A-While soil and land resource (eSpade)

An Agricultural Impact Assessment (AIA) has been prepared by Premise (2025a) to support the EIS. The AIA considers existing soil conditions within the development site including the potential for impacts to agriculture, erosion and sedimentation hazards. The AIA included the completion of a soil survey to verify the classification of soils within the study area. The AIA determines that soils within the development site must be classified as Brown Sodosols and has evaluated the Land and Soil Capability as Class 3 – Moderate Limitations.

A summary of key constraints and issues associated with soils types identified at and in proximity to the development site is provided in **Table 14.**

Table 14 – Soil Types and Landscapes, Key Constraints and Issues

Soil and Land Resource	Land Degradation	ASC Soil Type	ASC Description	ASC Constraints
Wait A While (wal) – Stagnant Alluvial	*Topsoils are prone to structural decline and loss by wind erosion. Low lying areas have poor drainage, soils deform easily and have poor trafficability when wet. Some scalding occurs where topsoils are lost exposing sodic subsoils. Localised salinity.*	*Brown Sodosol*	*Soils with a strong texture contrast between the A and B horizons, where the B horizon is sodic.*	> Sodic subsoil which contains a high proportion of sodium > Moderate to strongly alkaline subsoils

3.8 Geology

The hydrogeological context of the development site is detailed in **Section 3.5.1**. This includes the characterisation of aquifers within the Lower Murray Shallow Alluvium and Lower Murray Deep Alluvium resources together with corresponding geology of the Shepparton Formation, Calivil Formation and Renmark Group.

The surface geology for the development site was identified from seamless geology mapping provided via the NSW Seamless Geology Project (Version 2.4) mapping accessible via the MinView website. The development site is mapped as containing Alluvial Floodplain deposits within the Cenozoic Sedimentary Province (CZ_af) described to consist of *"Silt, very fine – to medium- grained lithic to quartz rich sand, clay"* (NSW Government, 2025o).

A review of simplified surface geology mapping identified from The NSW 1500K Simplified Surface Geology mapping (DRNSW, 2025) available via the SEED portal and eSpade website further identifies that the development site is within the Shepparton Formation (Czsws) geological unit which is attributed to consist of:

> *Unconsolidated to poorly consolidated mottled variegated clay, silty clay with lenses of polymictic, coarse to fine sand and gravel; partly modified by pedogenesis, includes intercalated red-brown paleosols.*

3.9 Land use

The development site is zoned part RU1 – Primary Production via the *Berrigan Local Environmental Plan 2013* (LEP).

A Land Use Conflict Risk Assessment (LUCRA) has been prepared by Premise (2025b) to support the EIS and conducted a review of the NSW Landuse 2017 v1.5 mapping from the DPIE SEED Portal. The LUCRA identifies that the development site and surrounding locality predominant consists of the irrigated cropping land use. The transport and communication land use transects the development site along the alignment of Broockmanns Road, Canalla Road and the Riverina Highway.

The extent of the development site occupied by Finley Substation is mapped as containing a 1.84 ha area of the residential and farm infrastructure land use. This area, however, has been occupied by Finley Substation since at least 1991 and is therefore considered to be more appropriately characterises under the Utilities land use.

Other notable features of the site and locality include:

- The closest residential dwelling is located approximately 250 m to the northeast of the development site at 384 Broockmanns Road.
- Mulwala No. 19 Channel which is located south of Broockmanns Road in the northern extent of Lot B DP961693. This channel forms part of the Berriquin Irrigation System managed by Murray Irrigation Pty Ltd and is transected by the proposed transmission easement.
- The Finley Solar Farm (SSD) is located approximately 400 m to the south of the development site, at 198 Canalla Road. The solar farm covers an approximate area of 385 ha, has been operational since 2019 and features a connection to Finley Substation.

4. PROPOSED WATER MANAGEMENT

4.1 Water Requirements and Supply Arrangements

Water supply for the development would be predominantly limited to the construction phase of the project (e.g. dust suppression, servicing to site office building and amenities and water tanks for firefighting purposes). It is anticipated that temporary arrangements would be established with a commercial supplier to truck water to the development site to support construction and operation of the development.

During construction it is anticipated that potable water would be supplied via temporary amenities for construction personnel. Construction activities with the potential to require a non-potable water supply include:

> Bulk earthworks,
> Environmental management (Dust Suppression)
> Maintenance of access arrangements
> Vehicle Washdown and
> Firefighting purposes.

The operation of the BESS and associated infrastructure would be conducted remotely and does not require a continuous water supply. No significant volumes of water are therefore anticipated during the operation of the development. Water arrangements for operation would be limited to occasional refilling of the static water supply for firefighting purposes, together with any ongoing commitments for landscaping maintenance.

Water supply requirements for the construction of the project would be finalised during the detailed design stage and are subject to variations in construction methods, staging, quantities, measurements and the attainment of a construction contract for the proposed development. A detailed water balance would be provided following the completion of detailed design prior to construction commencing.

Table 15, nevertheless, provides an estimate of total water demand (excludes static firewater demand) for each proposed construction phase of the development. Water demands were estimated based on following assumptions:

> Daily water requirement per person – 10 litres (L);
> 2 mm/day of dust suppression applied 30% of days on 20% of total construction footprint and 60% days on 15% of total construction footprint during phase 1 to 3;
> 2 mm/day of dust suppression applied 60% of days on 15% of total construction footprint during phase 4;
> 2 mm/day of dust suppression applied 60% of days on 10% of total construction footprint during phase 5;
> Vehicle washdown with a 20 L/min hose capacity with 5 minutes of washdown per vehicle;
> The daily vehicle counts during phases 1 through 5 will be as follows:
   - 5 vehicles in phase 1;
   - 10 vehicles in phase 2;
   - 20 vehicles in phase 3;
   - 15 vehicles in phase 4; and,
   - 10 vehicles in phase 5.

Table 15 – Estimated Water Requirements per Construction Phase

Phase	Expected Duration (Days)	Peak Workforce	Workforce Potable Water Required (kL)	Dust Suppression (kL)	Vehicle Washdown (kL)	Total Water Demand (ML)
Phase 1: Site establishment works	30	15	4.5	135	15	0.15
Phase 2: Establishment of temporary construction facilities	45	30	13.5	202.5	45	0.26
Phase 3: Main civil construction works	120	55	66	540	240	0.85
Phase 4: Equipment installation and grid connection	90	40	36	243	135	0.41
Phase 5: Testing, commissioning and demobilisation	45	15	6.75	81	45	0.13
Total	**330**	**-**	**126.75**	**1201.5**	**480**	**1.81**

5. FLOOD MODELLING

5.1 Model Development

5.1.1 HYDROLOGICAL MODELLING

The relatively flat terrain of the development site and lack of topographic definition within the surrounding region presents challenges to accurately define catchment boundaries and for subsequent representations of drainage pathways and areas prone to inundation.

To address the challenges presented by flat terrain, a rain-on-grid watershed bunded network model (WBNM) was developed using DRAINS software. Topographic maps and the Ulupna Channel, located near the site, were used to delineate the catchment boundary.

Catchments boundaries used in the Hydrological Model are depicted in **Figure 16** and include:

- Whole Catchment Area, encompassing both upstream and downstream regions; and
- Local Catchment Area, selected to account for local stormwater contributions and drainage.

A summary of the key model inputs and parameters used in the hydrological model is provided in **Table 16**.

Premise

Finley BESS

Figure 16: Catchment Boundaries

Legend

- Development Site
- Catchment Boundary
- Road
- Railway
- Runway
- Watercourse
- NPWS Reserve

0 2.5 5km

Sources: © State of NSW, Department of Customer Service, Spatial Services 2025
Gransolar Development 2024; ESRI 2025

File: P001993_01_MASTER.aprx Prepared By: zindia.nanver Date: 10/04/2025

Table 16 – Hydrological Model Parameters

Parameter	Details
ARR Hub Data	Extracted from the ARR online Data Hub on 03 November 2024 (ARR, 2024). The data hub extraction is provided in **Appendix B**.
Rainfall Intensity	Rainfall Intensity-Frequency-Duration (IFD) was downloaded from Bureau of Meteorology Portal website (BoM, 2024). The downloaded IFD data is presented in **Table 18**.
Areal Reduction Factors (ARF)	For the duration between 5 min and 48 hours the ARF's range for: > The whole catchment: between 0.2 to 0.89 in the 1% AEP; and, > The local catchment: between 0.93 and 0.99 in the 1% AEP.
Rainfall Losses	The initial and continuing loss for upstream and downstream catchment downloaded from the ARR Hub (ARR, 2024) are illustrated in **Table 17**. It is recommended that the initial loss is reduced using the proposed pre-burst depths and the continuous loss is multiplied by the factor of 0.4. The median pre-burst depths are provided in **Appendix B**.

Table 17 – Catchment initial and continuing loss figures (ARR, 2024)

Catchment	Storm Initial Losses (mm)	Storm Continuing Losses (mm/h)
Whole Catchment	24	0.1
Local Catchment	24	0.1

Table 18 – Rainfall Intensity-Frequency-Duration (BoM 2024)

Duration	2EY	50%	20%	10%	5%	2%	1%	1 in 500
5 min	3.95	6.08	8.74	10.6	12.6	15.2	17.3	21.7
10 min	5.9	9.19	13.1	15.9	18.7	22.5	25.5	31.9
15 min	7.21	11.2	16.1	19.5	22.9	27.5	31.2	39
20 min	8.2	12.7	18.2	22.1	26	31.3	35.6	44.5
25 min	8.99	13.9	20	24.2	28.5	34.4	39.1	49
30 min	9.66	14.9	21.4	26	30.6	37	42.1	52.8
45 min	11.2	17.2	24.7	30	35.5	43	49	61.6
1 hour	12.4	18.8	27.1	33	39	47.4	54.1	68
1.5 hour	14.2	21.3	30.6	37.3	44.2	53.7	61.3	77.1
2 hour	15.6	23.2	33.3	40.6	48	58.3	66.5	83.6
3 hour	17.7	26	37.3	45.4	53.6	65	74.1	92.8
4.5 hour	20	29.2	41.8	50.7	59.7	72.1	81.9	102

Duration	2EY	50%	20%	10%	5%	2%	1%	1 in 500
6 hour	21.7	31.7	45.2	54.7	64.3	77.4	87.8	109
9 hour	24.3	35.5	50.4	60.9	71.4	85.6	96.8	120
12 hour	26.2	38.4	54.4	65.6	76.9	91.9	104	129
18 hour	28.9	42.5	60.2	72.7	85.3	102	115	143
24 hour	30.7	45.4	64.5	78	91.7	110	123	155
30 hour	32.1	47.6	67.7	82.2	96.9	116	131	164
36 hour	33.2	49.3	70.3	85.6	101	121	137	173
48 hour	34.8	51.9	74.3	90.8	108	130	147	189

5.1.1.1 Critical Rainfall duration and temporal pattern

Ensemble hydrology using ARR 2019 methods and procedures has been adopted for the purpose of this hydrological assessment. The temporal patterns producing the maximum median flood for sub catchments have been adopted as representative temporal distributions for the critical storm durations.

The WBNM model was used for different storm events with rainfall durations between 1 and 72 hours and 10 rare temporal patterns. The 1% AEP storm event peak discharge ranges for each ensemble of temporal patterns are shown in **Figure 17** and **Figure 18**.

The hydrologic model results indicated the following critical rainfall duration and median temporal pattern for the catchments in 1% AEP flood events:

> Whole Catchment: Critical duration: 9-hour, Temporal pattern no.8 (TP.4055); and,
> Local Catchment: Critical duration: 1.5-hour, Temporal pattern no.2 (TP.3874).

Figure 17 – 1% AEP storm event peak discharge ranges for each ensemble of temporal patterns for the whole catchment

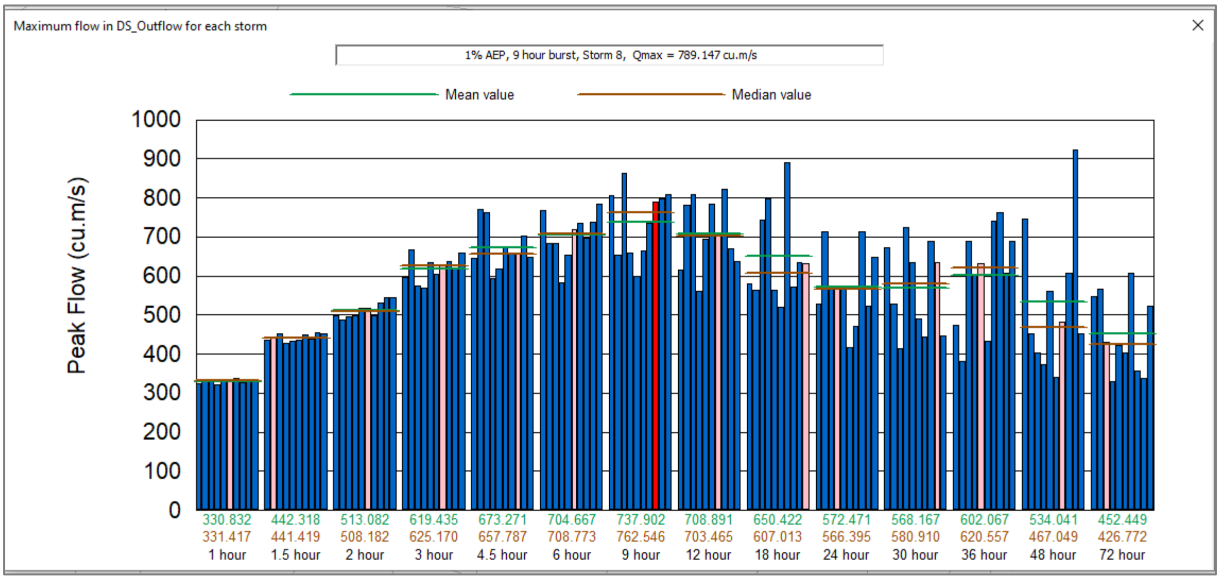
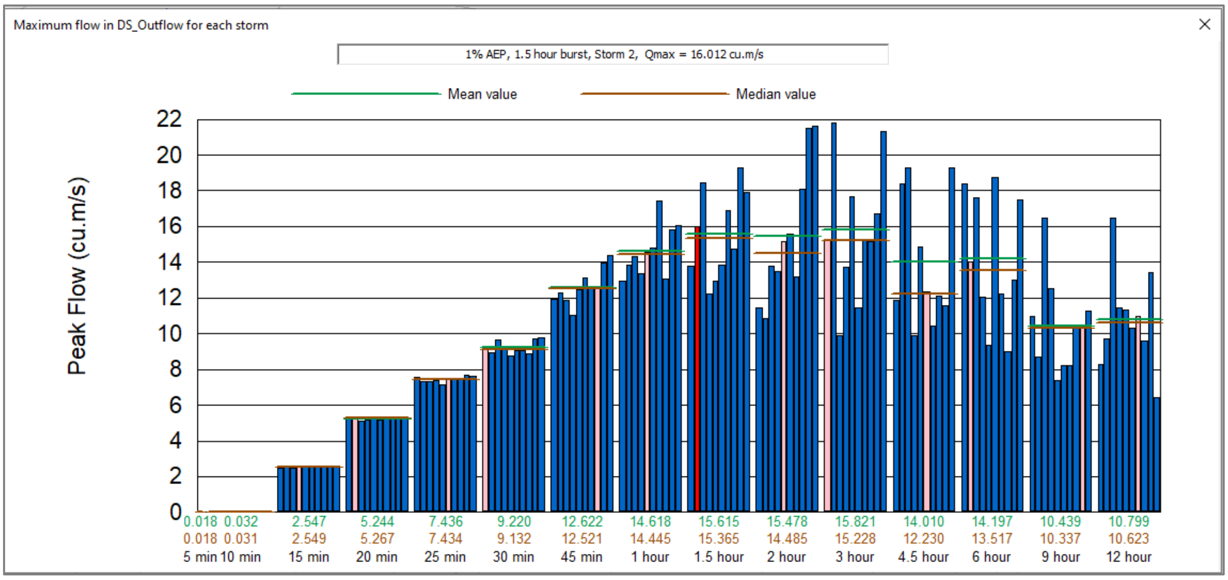


Figure 18 – 1% AEP storm event peak discharge ranges for each ensemble of temporal patterns for the local catchment



5.1.2 HYDRAULIC MODELLING

A 2-D hydraulic model was developed using the TUFLOW flood modelling software to assess the impacts before and after development. TUFLOW is a suite of advanced 1D/2D/3D computer simulation software for flooding, urban drainage, coastal hydraulics, sediment transport, particle tracking and water quality. A summary of the key model inputs and parameters is provided in **Table 19**.

Table 19 – Hydraulic Model Parameters

Parameter	Details
Model Domain	The hydraulic model covers a model domain with a surface area of 42,536 ha. The model domain extends beyond to approximately 4 km downstream and 34 km upstream of the project site
Grid Size	5m grid size was used for the hydraulic modelling.
DEM	Combination of the following LiDAR data downloaded from ELVIS website was used in the model > Berrigan (1m) ELVIS AHD DEM captured on 2021/08, > Berrigan (5m) ELVIS AHD DEM captured on 2015/01, > Tuppal (2m) ELVIS AHD DEM captured on 2017/03, and > Survey Lidar data 1m cell size around the development site in 2024.
Upstream Boundary Condition	No upstream boundary condition was defined to the model as a full rain-on-grid approach was used for the hydraulic model.
Outlet Boundary Conditions	Modelled as a water surface slope of 0.1% based on the slope of the terrain at the catchment downstream boundary. The outlet boundary was placed far enough downstream of the subject site to ensure it did not influence flood levels on the site.

Parameter	Details
Manning's Roughness	Manning's 'n' roughness layers were determined based on SIX map layers and Nearmap within the catchment area. Typical values adopted in the Hydraulic model are presented in **Table 20.**

Table 20 – Manning's Roughness Values Parameters

Land Use Type	Manning's 'n Value
Roads	0.022
Buildings	3
Farm/Pasture	0.04
Dense Vegetated	0.06
Ponds and Maintained open drains	0.03
Residential Areas	0.035

5.1.3 FLOOD HAZARD CATEGORISATION

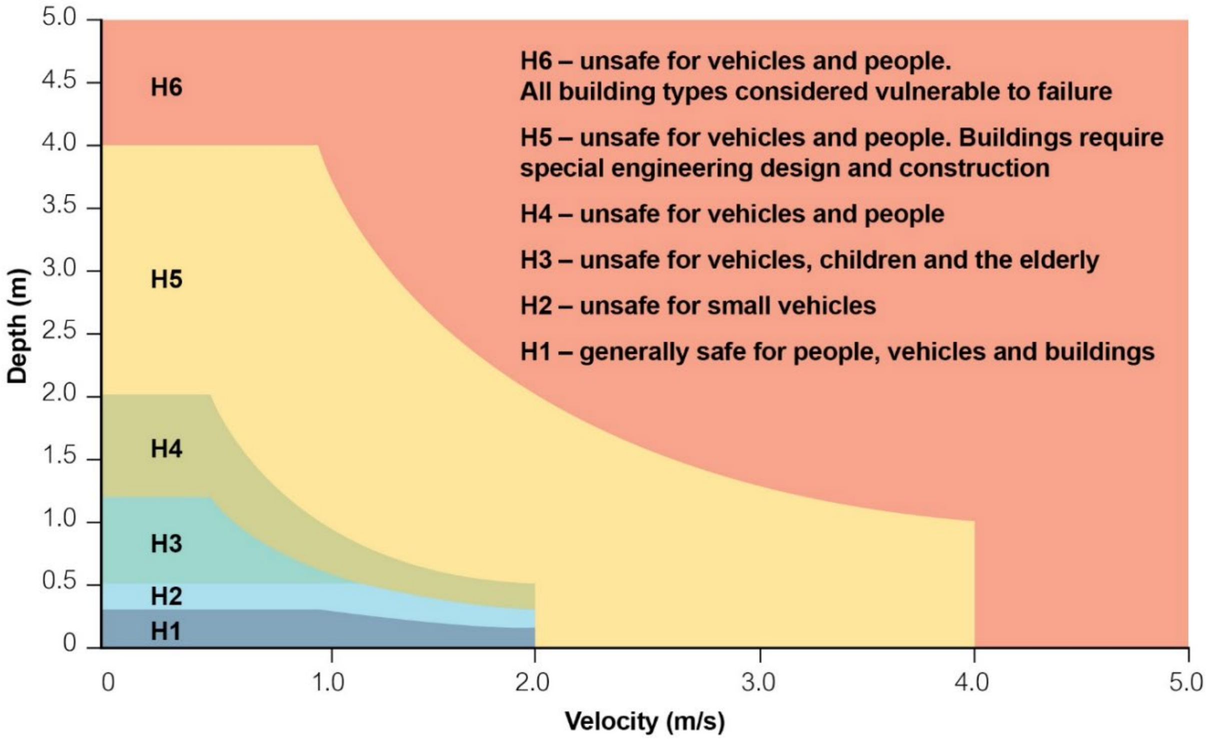
The general flood hazard vulnerability curves, as presented in ARR (Ball, et al., 2019), have been adopted to categorise flooding hazards for the proposed development.

The categorisation of flooding hazard in ARR is based on the *General Flood Hazard Classification provided by the Australian Disaster Resilience Handbook Collection* (Guideline 7-3) (AIDR, 2017) and is recommended via the *Flood risk management guideline* (FB03) (DPE, 2023b).

The flood hazard curve referenced is presented in **Figure 19** and uses flood depth (m) and velocity (m/s) to categorise flood hazards into one of six categories:

- H1 – generally safe for people, vehicles and buildings;
- H2 – unsafe for small vehicles;
- H3 – unsafe for vehicles, children and the elderly;
- H4 – unsafe for people and vehicles;
- H5 – unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure; and,
- H6 – unsafe for vehicles and people. All building types considered vulnerable to failure.

Figure 19 – General Flood Hazard Vulnerability Curves



5.2 Model Simulation and Results

Following two scenarios were considered during the study, including:

- Pre-development scenario; and,
- Post-development scenario.

The hydraulic model was simulated for two critical events, with rainfall durations of 1.5 hours and 9 hours, for both scenarios. The results indicated that the critical rainfall duration of 9 hours would lead to higher flood levels across the model area. Therefore, the model results for the 9-hour critical rainfall duration are outlined below.

5.2.1 PRE-DEVELOPMENT SCENARIO

Pre-development flood conditions were simulated in the hydraulic model to determine baseline flood conditions. Flood conditions were simulated for the 1% AEP event. Mapping of maximum flood depth, velocity, flood level and hazard categorisation for the pre-development scenario are provided in **Appendix C**. The results of flood modelling for the pre-development scenario are summarised as follows:

- The study area is currently impacted by the 1% AEP flood event.
- The average maximum modelled flood depth across the study area is 0.27 m (refer to **Figure 31**).
- The average maximum modelled flood velocity across the study area is 0.03 m/s (refer to **Figure 32**).
- The average maximum modelled flood level across the study area is 107.60 m (refer to **Figure 33**).

- The average maximum flood depth and velocity across the study area provide a flood hazard category of H1 which is considered low hazard and generally safe for people, vehicles and buildings (refer to **Figure 34**).
- The maximum modelled flood depth within the study area was obtained at 0.44 m (refer to **Figure 31**).
- The maximum modelled flood velocity within the study area was obtained at 0.07 m/s (refer to **Figure 32**).
- The maximum mapped flood level across the study area is 107.75 m (refer to **Figure 33**).
- The maximum flood depth and velocity within the study area provide a flood hazard category of H2 which is considered low hazard and unsafe for small vehicles (refer to **Figure 34**).

5.2.2 POST-DEVELOPMENT SCENARIO

Post-development flood conditions were simulated in the hydraulic model to determine flood conditions for the conceptual design of the development. Flood conditions were simulated for the 1% AEP event.

Mapping of maximum flood depth, velocity, flood level and hazard categorisation for the post-development scenario are provided in **Appendix D**. The results of flood modelling for the post-development scenario are summarised as follows:

- The study area will be impacted by the 1% AEP flood event.
- The average maximum flood depth across the study area is 0.28 m (refer to **Figure 35**).
- The average maximum flood velocity across the study area is 0.04 m/s (refer to **Figure 36**).
- The average maximum flood level across the study area is 108.40 m (refer to **Figure 37**).
- The average maximum flood depth and velocity across the study area provide a flood hazard category of H1 which is considered low risk and generally safe for people, vehicles and buildings (refer to **Figure 38**).
- The maximum modelled flood depth within the study area was obtained at 0.46 m (refer to **Figure 36**).
- The maximum modelled flood velocity within the study area was obtained at 0.14 m/s (refer to **Figure 37**).
- The maximum modelled flood level across the study area is greater than 109.00 m (refer to **Figure 37**).
- The maximum flood depth and velocity within the study area provide a flood hazard category of H2 which is considered low hazard and unsafe for small vehicles (refer to **Figure 38**).

5.2.3 FLOOD PATTERN CHANGES

A comparison of the pre-development and post development scenario was completed to determine potential changes to flood conditions resulting from the proposed development. The comparison was prepared using simulations for the 1% AEP event. Mapping detailing changes to flood levels and velocity are provided in **Appendix D**. The results of the comparison are summarised as follows:

- A relative maximum increase to maximum flood levels (afflux) across the study area of 0.04 m (refer to **Figure 39**). The model did not show any significant changes to flood levels on land surrounding the study area. Changes to flood levels on surrounding land have been modelled to be within the range of 0.002 m to 0.050 m.

- A relative maximum increase to maximum flood velocities across the study area of 0.07 m/s (refer to **Figure 40**). The model did not show any significant changes to flood velocities on land surrounding the development. Changes to flood velocities on surrounding land have been modelled to be within the range of -0.050 m to 0.050 m.

5.3 Conclusion

The flood modelling study evaluated the potential flood hazards associated with the proposed development. The modelling results indicate that the proposed development is unlikely to be significantly impacted by flooding hazards or result in a significant change to existing flood behaviour.

It, however, is recommended that standard flood mitigation measures be implemented, including proper site design and stormwater management infrastructure, to ensure the development aligns with best practices in flood risk management.

6. IMPACT ASSESSMENT

6.1 Surface Water Impact Assessment

6.1.1 FLOW REGIMES

The proposed development does not include any modification or realignment of existing watercourses.

Some minor disturbance to existing drainage patterns, including unnamed ephemeral streams transecting surrounding agricultural land, may result from the construction and operation of the development. Project infrastructure (i.e., roads, BESS units) and associated mitigation measures to minimise the potential for water impacts (i.e., bunding and roadside drainage), however, also have the potential to produce minor changes to existing drainage, including the redirection of overland flow. With the exception of minor changes to existing localised drainage, no significant impacts to existing flow regimes or stream ordering are anticipated to result from the proposed development.

Construction activities including clearing, earthworks, compaction of soils and the installation of impervious surfaces, have the potential to lead to temporary increases in runoff leaving the development site and impacting surrounding properties and receivers.

Potential increases to runoff, however, are considered capable of being managed through the implementation of stormwater and erosion and sediment control measures, implemented in accordance with relevant guidelines and standards. This is expected to include the preparation of soil and water management plan (SWMP) and Erosion and Sediment Control Plan (ESCP) as part of a Construction Environmental Management Plan (CEMP) to address risks to surface water and groundwater.

During operation the potential for significant impacts to surface water flow regimes, including hydrological changes due to increased runoff from site infrastructure, are considered negligible and capable of being managed through stormwater and erosion measures incorporated into the detailed design of the development.

6.1.2 WATERFRONT LAND AND SENSITIVE SURFACE WATER ENVIRONMENTS

As detailed throughout **Section 3.3**, no natural watercourses are located in proximity to the development. The surrounding region is dominated by artificial irrigation infrastructure, classified by state mapping as zero order strahler streams. Consistent with the classification of zero order channels, the proposed development is not considered to result in any significant impacts to waterfront land.

The development site does not contain any land mapped with a sensitive surface water environment including riparian land, key fish habitat or wetlands. Significant impacts to sensitive surface water environments resulting from the development are considered unlikely due to the nature of works proposed and the separation distance provided between the development and mapped sensitive surface water environments.

6.1.3 FLOODING

This WIA has included the preparation of a flood model to evaluated potential flood hazards associated with the proposed development. The flood model has identified that the development site in its existing state is impacted by a 1% AEP Flood Event. Existing flood behaviour across the development site is generally characterised by relatively slow and shallow moving sheet flow with localised inundation limited to a maximum flood depth of 0.46 m. The existing flood hazard has been classified as flood hazard category of H1 which is considered low hazard and generally safe for people, vehicles and buildings.

Modelling of the post development scenario was completed for a 1% AEP Flood Event. The results have indicated minor changes to existing flood behaviour including a relative maximum increase to maximum flood levels of 0.04 m and a relative maximum increase to the maximum recorded velocity of 0.07 m/s for Flood velocities. The flood hazard for the post development scenario has been classified as H2 which is considered low hazard and unsafe for small vehicles.

As indicated by the flood mapping provided in **Appendix C** and **Appendix D**, the proposed development is not considered likely to generate a significant change to flood patterns or to result in any significant external flooding impacts to the surrounding region. The comparison of flood hazard mapping indicates that the development is unlikely to generate a significant change to existing flood hazards.

It should be noted that portions of Broockmans Road and Canalla Road are identified with a hazard of H2 – unsafe for small vehicles. This, however, is consistent with existing flood conditions during a 1% AEP event and the development is not anticipated to result in any significant changes to flood patterns along Broockmans Road and Canalla Road. Responses to flooding events associated with light vehicle movements, nevertheless, should be considered as a component of management plans developed for the construction of the development.

The following recommendations are provided to minimise the potential for flood hazards to impact the development site:

> The maximum flood depth impacting the existing site during a 1% AEP flood event is 0.44 m (Flood level 107.75 m) and increases to a flood depth of 0.46 m (Flood level >109 mm) for the post development scenario. Sensitive infrastructure (i.e., inverters, batteries) should be located above the maximum modelled flood depth and levels for the post development scenario to minimise the potential for flooding impacts. Given the shallow depths across the site, raising this infrastructure is considered unlikely to result in any adverse flooding or drainage impacts offsite.

> Footings and hardstand areas of the development should be designed to accommodate the maximum flood velocities identified in this report. This includes the maximum flood velocity of 0.14 m/s identified for the post development scenario.

> Incorporate best practice measurement principles for the management of stormwater and sediment as a component of the detailed design for the construction and operation of the BESS. Subject to the attainment of development consent this is anticipated to include the preparation of a CEMP together with an ESCP and a SWMP.

> It is anticipated that heavy vehicles can safely access and egress the site via Canalla Road without significant risks associated with flood hazards. While hazards for small vehicles are identified along Canalla and Broockmanns Road, these relate to a 1% AEP Flood Event and are consistent with flood hazard mapping. No significant impacts to light vehicle access are therefore anticipated.

It is recommended that the implementation of the above mitigation measures and the results of flood modelling are reviewed in co-ordination with the findings of other specialist assessments. Further progression of the site design should consider the findings of all relevant investigations.

6.1.4 SURFACE WATER QUALITY

Impacts to water quality during the construction, operation and decommissioning of the development have the potential to result from:

- Soil erosion and transport of sediment into receiving watercourses;
- Accidental spills of fuel or other hazardous materials used to support construction and operation of the development;
- Discharge of stormwater contaminated with hydrocarbons from the development site; and,
- Ineffective wastewater management measures and practices.

In consideration of potential impacts to natural watercourses, publicly available surface water quality datasets have been reviewed. Water quality data for the closest monitoring location with publicly accessible data, Edward River at Deniliquin, situated approximately 57 km west of the development site, is presented in **Section 3.6.4.1**. Available data indicates partial compliance with the quality targets for the Basin Plan, with notable exceedances of Turbidity and Total Phosphorus. Given the separation distance of the development site to surrounding watercourses, the limitations on water use arrangements and the implementation of mitigation measures, the development is not anticipated to significantly impact on existing water quality or the achievement of relevant surface water quality targets for surrounding natural watercourses.

While the development site is not located in proximity to natural watercourses, localised impacts to surface water quality remain a potential risk. The construction, operational and decommissioning phases of the development may introduce potential risks to surface water quality, including:

- Soil erosion and sedimentation due to land disturbance activities such as excavation and earthworks, which can potentially affect downstream watercourses and agricultural land;
- The accidental release of pollutants such as hydrocarbons during transportation and installation activities, which could be carried into nearby watercourses;
- The discharge of concrete by-products, such as slurry, dust, or wastewater, into adjacent water bodies and surrounding agricultural areas; and,
- The disturbance of soil and vegetation during construction, leading to increased risk of sediment runoff into downstream watercourses.

These risks have the potential to degrade aquatic ecosystems, contaminate watercourses, and adversely affect surrounding agricultural productivity.

As identified via the AIA prepared by Premise (2025). the development site is classified with a very low erosion risk. It is therefore anticipated that erosion risks would be adequately managed through the implementation of an ESCP, detailing erosion control measures, sediment management strategies, and the use of appropriate pollution control practices, to minimise the potential for erosion and sedimentation impacts.

Subject to the implementation of best management practices including a CEMP supported by a SWMP and an ESCP, no significant impacts associated with surface water quality, erosion and sedimentation are anticipated.

6.1.5 IRRIGATION INFRASTRUCTURE

The construction, operational, and decommissioning phases of the project may introduce potential risks to irrigation infrastructure, including channels operated by Murray Irrigation Pty Ltd. These risks include:

- Disruption to irrigation canals and networks - during construction activities, potentially affecting water delivery to agricultural areas and disrupting the efficiency of irrigation systems;
- Damage to infrastructure - due to construction machinery, heavy equipment, or unintended alterations to land contours, which could impair the functionality of the irrigation network;
- Sedimentation and erosion - resulting from land disturbance, which could negatively affect water quality in nearby irrigation channels, leading to sediment build-up and reduced flow capacity; and
- Pollution from runoff - including hydrocarbons, wastewater, or other contaminants, that could enter Mulwala No. 19 or 19b canal, affecting water quality and the agricultural land dependent on this water supply.

The project has been designed and sited to minimise interaction with existing irrigation infrastructure. The construction of the project would incorporate mitigation measures outlined in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), including best practices for erosion and sediment control, to minimise potential impacts to irrigation infrastructure. These mitigation measures are intended to safeguard the functionality of the irrigation network and maintain water quality throughout the construction, operational, and decommissioning phases of the project.

Engagement with Murray Irrigation began on 11 April 2024 to discuss trenching under the Mulwala No. 19 Channel. Ongoing consultation with Murray Irrigation would occur throughout the duration of the project to identify risks and management managements as they arise. This is expected to include consideration of Murray Irrigation's Works Policy (Murray Irrigation, 2025), including requirements for minimum separation distances from irrigation infrastructure and underboring distances specific to the establishment of the proposed underground transmission cables transecting Mulwala No. 19 Channel. The design of the proposed development site would be finalised in consultation with Murray Irrigation to minimise the potential for impacts to surrounding irrigation infrastructure.

6.2 Groundwater Impact Assessment

6.2.1 GROUNDWATER QUALITY

As detailed via **Section 3.5**, the development site is mapped with a hydrological soil group of Class C which is associated with slow infiltration rates. The increase to impervious surfaces during the construction and operation of the development, including compaction of soils across the development footprint, additionally have the potential to reduce the infiltration of groundwater resources and result in increased surface runoff.

The release of potentially harmful chemicals, substances or contaminated stormwater from the development, nevertheless, may occur accidentally during construction and operation, and has the potential to contaminate groundwater resources (i.e., leakage or spill of petroleum, oils or other toxicants from construction machinery and plant equipment resulting from inappropriate storage of contaminated materials, refuelling and/or maintenance activities). Emergency events (i.e., fire, flooding) additionally may result in damage to plant and/or machinery and additionally have the potential to result in the release of harmful chemicals, substances or contamination stormwater that may adversely impact groundwater.

Potential risks to groundwater quality and anticipated to be capable of being managed through the implementation of the following mitigation measures and management plans:

- bunding of batteries and fuel storage areas;
- regular maintenance and inspection of bunded fuel, oil, and battery storage areas to ensure integrity;
- proper storage and bunding of chemicals, along with well-designed site drainage and sedimentation basins at key locations to manage site runoff effectively;
- maintenance and deployment of spill kits;
- removal of impacted soils, with appropriate testing and disposal; and,
- provisions for installing groundwater monitoring bores in case of unexpected leaks.

6.2.2 GROUNDWATER LEVELS AND INTERCEPTION

As detailed in **Section 3.5**, there are several bores in proximity to the development with historical measurements of groundwater levels.

The latest recorded data available indicates an average depth to water of approximately 3.24 m for groundwater bores situated in proximity of the development site. While exact details of the final layout and foundations for project infrastructure are to be finalised during detailed design, it is expected that that construction works will require excavation and trenching activities. It is considered unlikely that these works would exceed the average depth to water of 3.24 m recorded across surrounding bores.

Aquifer interference activities as defined by the WM Act refer to activities involving any of the following:

- *The penetration of an aquifer*
- *The interference with water in an aquifer*
- *The obstruction of the flow of water in an aquifer*
- *The taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations,*
- *The disposal of water taken from an aquifer as referred to in paragraph (d)*

With respect to the above definition and average depth to water of 3.24 m the development is not anticipated to result in an aquifer interference activity.

Notwithstanding the above, it is acknowledged that surrounding groundwater levels have previously been observed at less 1 m and that existing groundwater levels across the development site may vary considerably against historical averages for 2005 and 2011, particularly with recent trends indicating decreasing depths to groundwater between 2010 and 2025.

To minimise the potential for impacts to existing groundwater, it is therefore recommended, that several shallow bores and/or geotechnical drillholes be drilled across the development site prior to construction to verify existing lithology, depth to water and to attain baseline groundwater quality.

Subject to confirmation of groundwater depths via an on-site investigation during detailed design and the selection of an appropriate construction method (concrete footings or steel piling footings), no groundwater dewatering is anticipated as a requirement to facilitate construction of the development.

No ongoing monitoring of groundwater is anticipated as a requirement for the operation of the development. The implementation of groundwater monitoring bores, however, should be considered in consultation with regulators to respond to the release of any contaminated water or following an emergency event (i.e., flooding, fire). Groundwater bores established to respond to such events should be installed downgradient of the fuel storage, oil bund and the downgradient site boundary as well as upgradient to provide a 'clean' control site for evaluating potential impacts.

6.2.3 GROUNDWATER TAKE

As noted in **Section 4.1**, the water supply for the development would be predominantly limited to the construction phase as no continuous water supply is required for the operation of BESS infrastructure.

Water supply requirements for construction would be finalised during the detailed design stage and are subject to variations in construction methods, staging, quantities, measurements and the attainment of a construction contract for the proposed development. Preliminary estimates, however, have anticipated that approximately 1.81 ML will be required to facilitate the construction of the development.

No extraction of groundwater is currently proposed or anticipated as a requirement to facilitate the construction or operation of the development. It is anticipated that a secure water supply for the development is capable of being attained through temporary arrangements established with commercial water suppliers which are expected to include the transportation of water via trucks to the development site.

Notwithstanding the above, it is recognised that future extraction of groundwater has the potential to arise as a requirement subject to the completion of a detailed site water balance. A water sourcing strategy would be prepared as a component of the detailed site water balance in consultation with the existing landowner and commercial suppliers, to detail a suitable water supply is capable of being secured to facilitate construction of the development.

Any future extraction of groundwater, including from existing bores owned by associated landowners would be investigated to ensure compliance with existing use and licence entitlements.

Any future implementation of groundwater bores to facilitate monitoring or to provide a water supply for the development would be subject to consideration and compliance with approval and licencing requirements under the WM Act.

6.2.4 GROUNDWATER DEPENDENT ECOSYSTEMS

The development is considered unlikely to result in significant changes to groundwater quantity and quality. Significant impacts to GDEs resulting from the development are considered unlikely due to the nature of works proposed and the separation distance provided between the development and mapped GDEs.

7. MITIGATION AND MANAGEMENT MEASURES

Mitigation measures and recommendations proposed to control and minimise potential impacts to surface and groundwater arising from the construction, operation and decommissioning of the development are summarised in **Table 21**.

Table 21 – Summary of Mitigation Measures and Recommendations

Reference no.	Commitment
Detailed Design	
W1	Water supply arrangements are subject to variations in construction methods, staging, quantities, measurements and the attainment of a construction contract for the proposed development. A detailed site water balance will be prepared prior to construction to confirm water requirements and supply arrangements for the proposed development.
W2	To minimise the potential for impacts to existing groundwater, it is recommended, that several shallow bores and/or geotechnical drillholes be drilled across the development site prior to construction to verify existing lithology, depth to water and to attain baseline groundwater quality.
W3	Subject to confirmation of groundwater depths via an on-site investigation during detailed design and the selection of an appropriate construction method (concrete footings or steel piling footings), no groundwater dewatering is anticipated as a requirement to facilitate construction of the development.
W4	Excavations should be limited to depths above the observed groundwater levels. Where deeper excavation is required, the groundwater assessment will be reviewed.
W5	The progression of detailed design for the project should include: > Ongoing consultation with Berrigan Shire Council, Murray Irrigation and other relevant stakeholders to ensure appropriate measures are implemented to minimise localised water impacts, including risks to surrounding land and irrigation networks. > The design of controls to minimise the potential for water impacts (i.e., bunding of areas presenting contamination risks); and > The design of proposed infrastructure including the proposed method for underboring activities developed in ongoing consultation with Murray Irrigation Pty Ltd.
Construction / Operation	
W6	Prepare a Soil and Water Management Plan (SWMP) prior to construction to detail potential risks and appropriate measures designed in accordance with *Managing Urban Stormwater – Soils and Construction Volume 1 (Landcom, 2004).* The SWMP will be prepared as part of a Construction Environmental Management Plan (CEMP) to manage potential risks to soils, surface and ground water. Recommended measures for the construction SWMP include but are not limited to:

Reference no.	Commitment
	> Measures to minimise and manage the potential for erosion and sediment transport within and from the Project area. > Measures to manage accidental spills and waste storage. > Measures to manage stormwater and the potential for contaminated runoff from the Project site. > Measures to ensure that excavation activities and any stockpiling are managed to minimise the potential for downstream contamination. > Measures to ensure that areas of exposed soil and the time in which they are exposed are minimised as far as practical
W7	Stockpiling of any excavated material shall be managed in accordance with the SWMP to minimise the mobilisation and transport of dust, sediment and leachate into downstream environments. Recommended measures to manage stockpiling include but are not limited to: > Ensuring stockpiles are located away from drainage lines, waterways, and areas susceptible to erosion. > Minimising the number, size and duration of stockpiles used. > Ensuring stockpiles are stabilised and implementing dust suppression methods as required. > Ongoing review and inspection of the use of heavy vehicles and/or machinery, including transport tracks used, for erosion risk. > Ensuring that vehicles transporting waste and/or excavated material are appropriately covered to reduce the potential for dust.
W8	The SWMP shall include procedures to reduce and manage the risk of emergency events and the potential for wastes and spills to contaminate soils, surface and ground water. Recommended measures to manage the potential for contaminated discharge include: > The storage of all fuel chemicals and liquids in sealed bunded areas on level ground away from stormwater drainage lines and waterways. > Ensuring refuelling and maintenance activities are restricted to designated areas with appropriate bunding and spill capture controls. > Implementing controls as part of the construction SWMP that provide procedures to respond to emergencies and spills (e.g., Groundwater monitoring bore installation, regulator notification and provision of spill kits). > Ensuring visual inspections of drainage lines and disturbed areas are undertaken during construction to assess any potential soil or surface water issues. > The installation and maintenance of stormwater control measures including drainage networks and bunding that segregate stormwater runoff according to its potential for contamination.

Reference no.	Commitment
W9	During operation procedures shall be developed to reduce the potential water impacts including the contamination of soils, surface and ground water, resulting from wastes, spills and/or emergency incidents. Suggested measures to control the potential for water impacts and contamination during operation include: > The appropriate storage of equipment and hazardous substances during operation. > Ensuring that plant and stormwater control measures are maintained to prevent contamination of soil. > Preparation of appropriate procedures to response to emergency incidents (i.e., floods, fires), spills and leaks from the development site, including operational equipment and maintenance activities (e.g., Groundwater monitoring bore installation, regulator notification and provision of spill kits).

8. CONCLUSION

The construction and operation of the proposed development presents a range of potential water related impacts. It however is expected that the range of impacts can be suitably managed through the detailed design process and the effective implementation of management plans and standard erosion and sediment controls.

Subject to the implementation of appropriate mitigation measures, no significant impacts to flow regimes or water quality are anticipated to occur as a result of the development. The project does not require a significant ongoing use of water and sensitive infrastructure would be designed to achieved clearance above the 1% AEP flood level.

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Appendix A

WRP and WSP Mapping

Figure 20 –Murray-Darling Basin, Water Resource Plan Areas – Surface Water

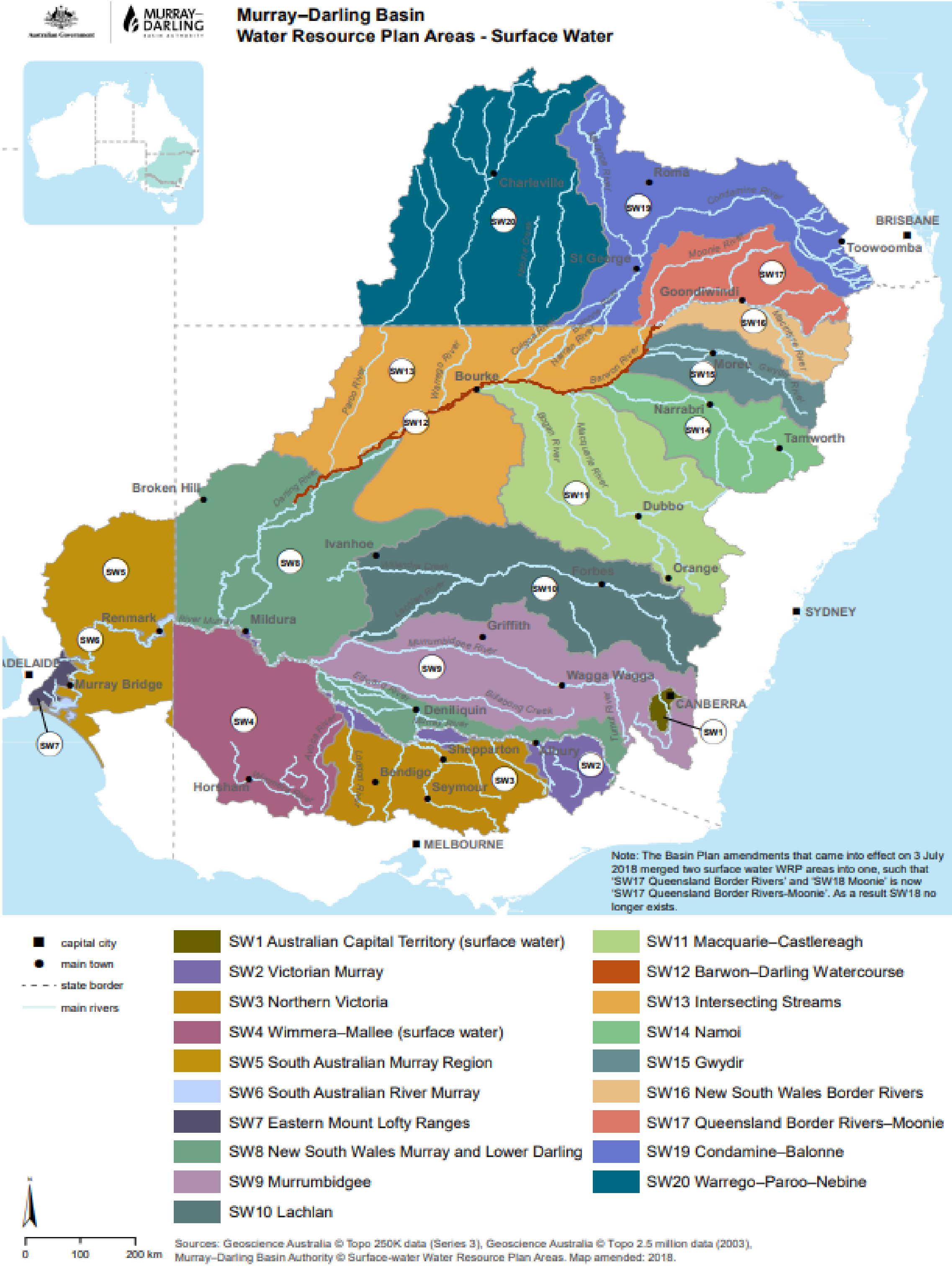


Figure 21 –Murray-Darling Basin, Surface Water SDL Resource Units

Figure 22 –Murray-Darling Basin, Water Resource Plan Areas – Groundwater

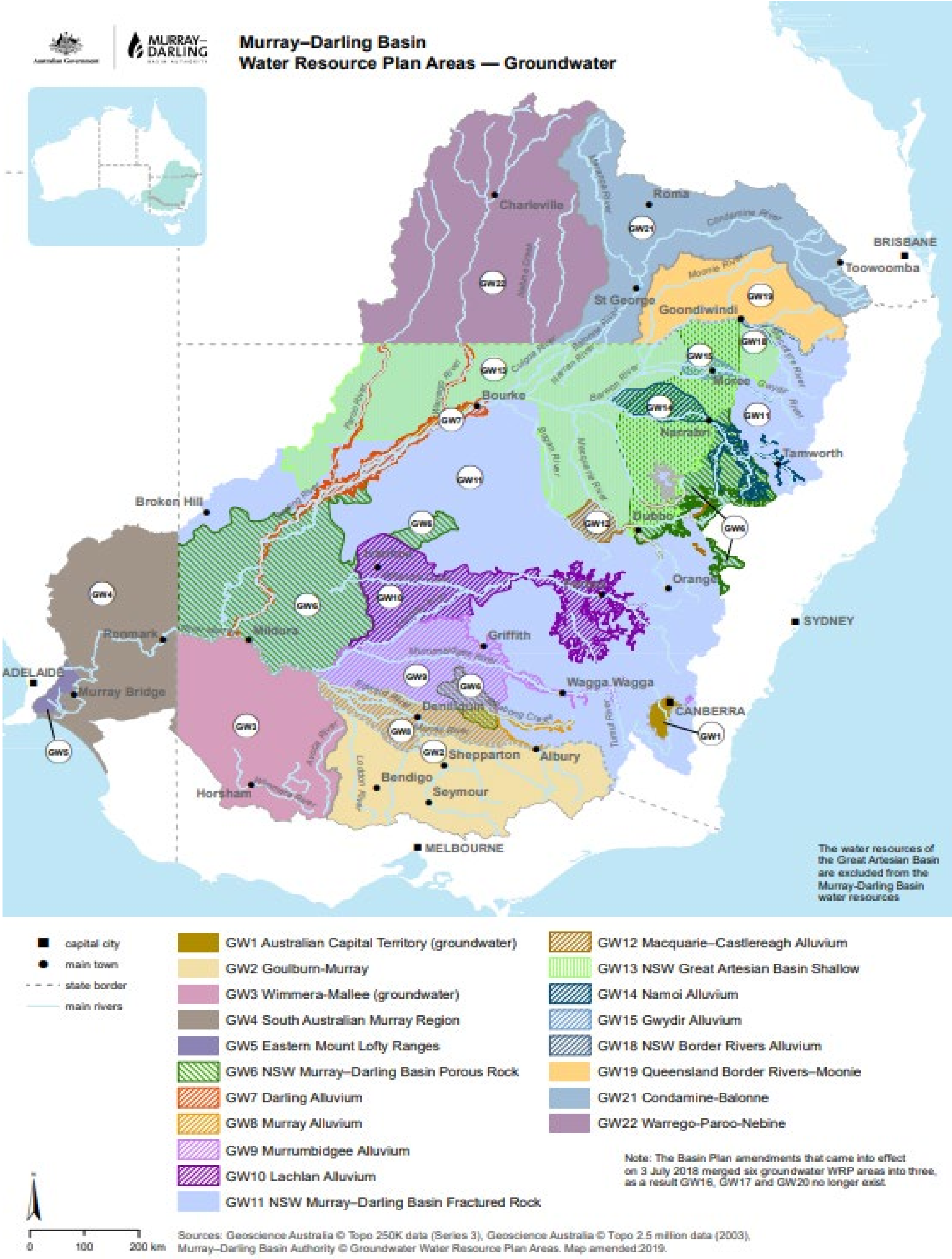
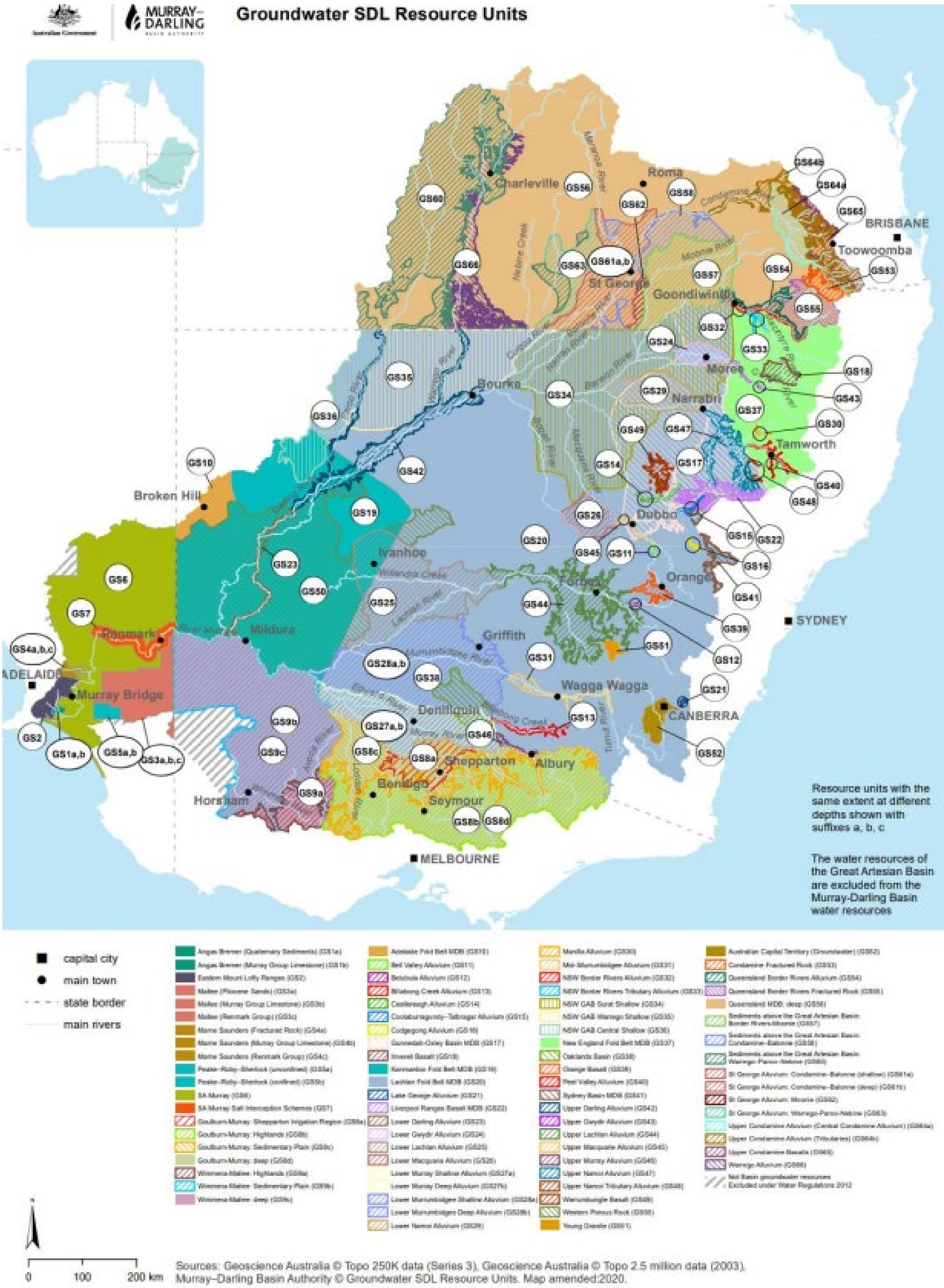
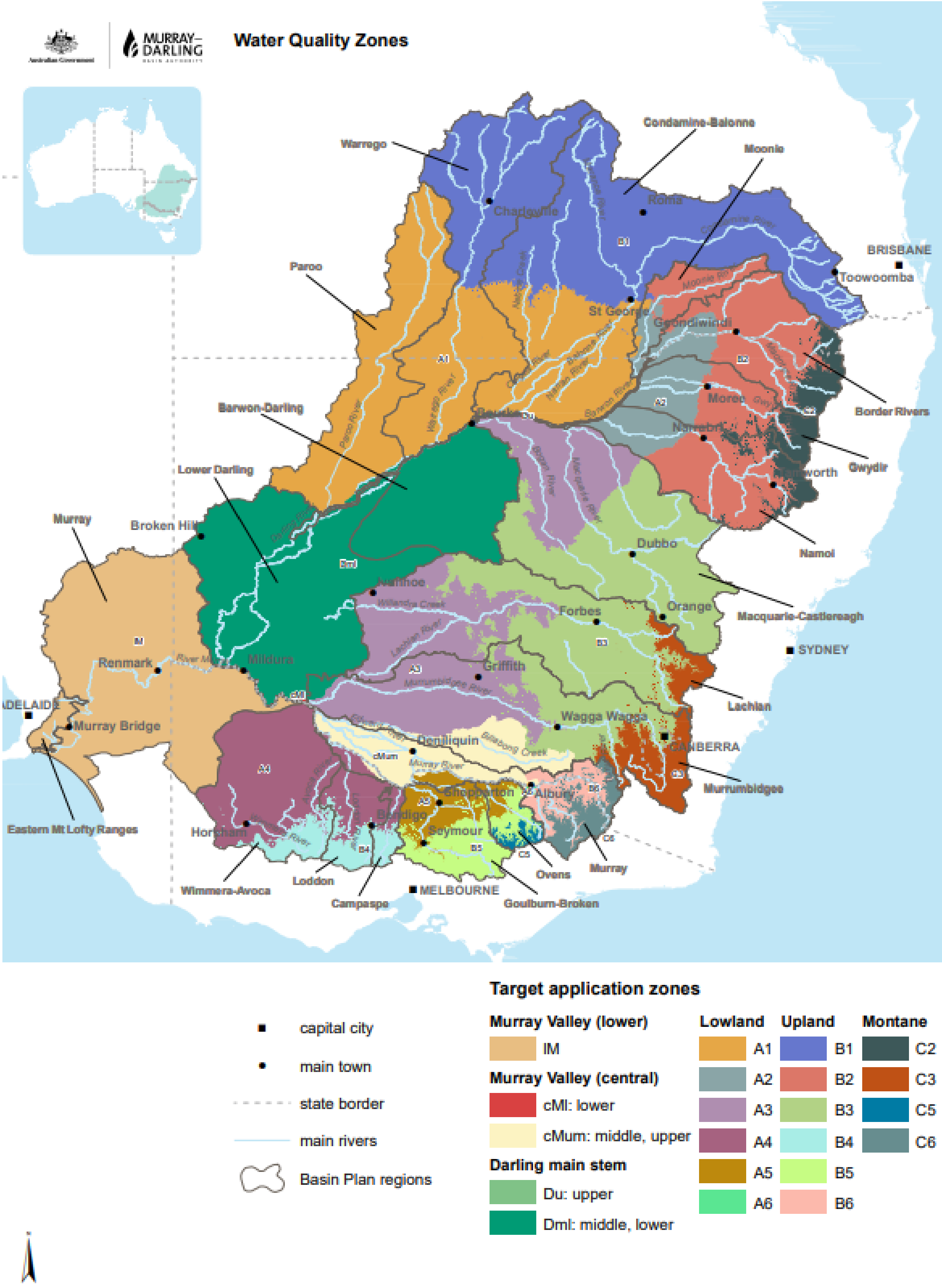


Figure 23 –Murray-Darling Basin, Groundwater SDL Resource Units



Sources: Geoscience Australia © Topo 250K data (Series 3), Geoscience Australia © Topo 2.5 million data (2003), Murray–Darling Basin Authority © Groundwater SDL Resource Units. Map amended 2020.

Figure 24 –Murray-Darling Basin, Water Quality Zones



Sources: Geoscience Australia © Topo 250K data (Series 3), Geoscience Australia © Topo 2.5 million data (2003), Murray–Darling Basin Authority © Water Quality Zones. Map amended:2017.

Figure 25 –Water Sharing Plan Regions

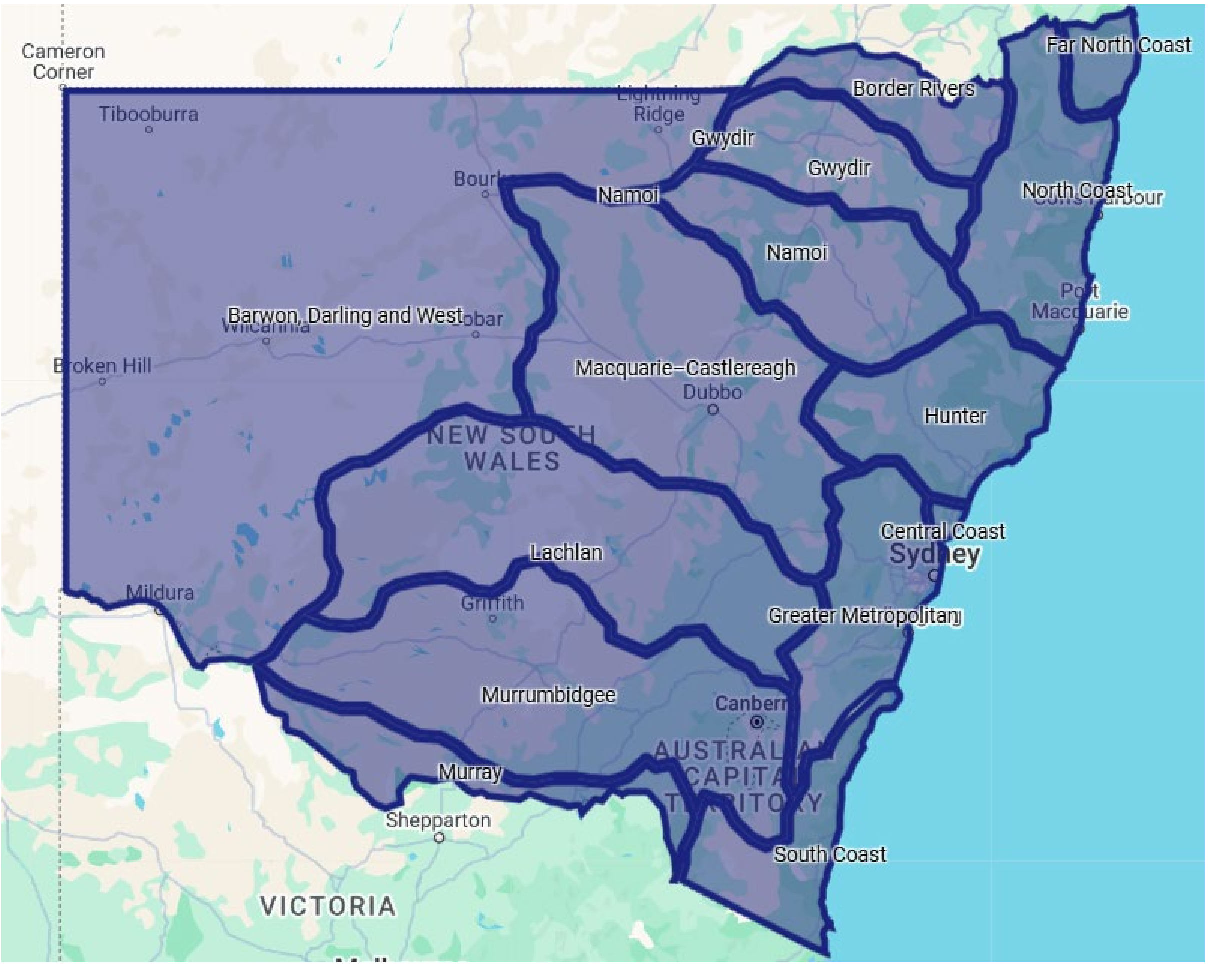


Figure 26 –Water Sharing Plan for the Murray Unregulated River Water Sources 2024

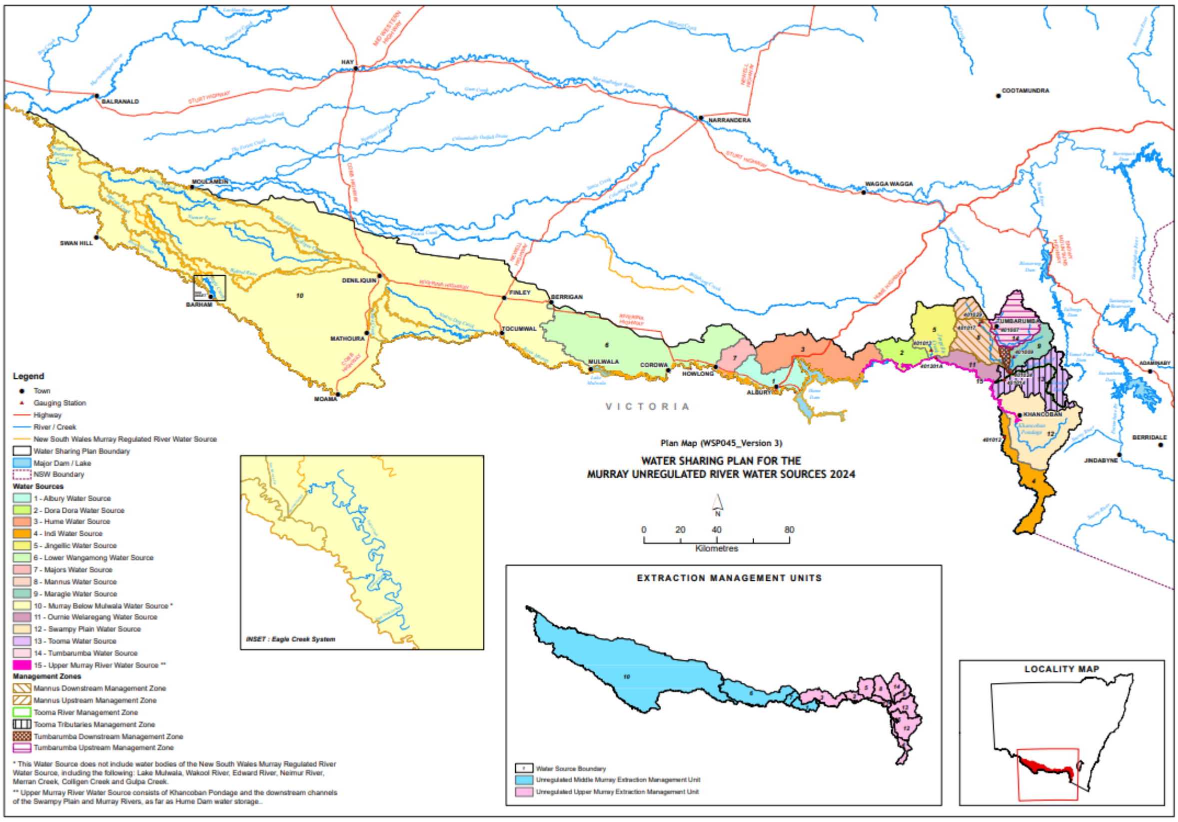


Figure 27 –Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020

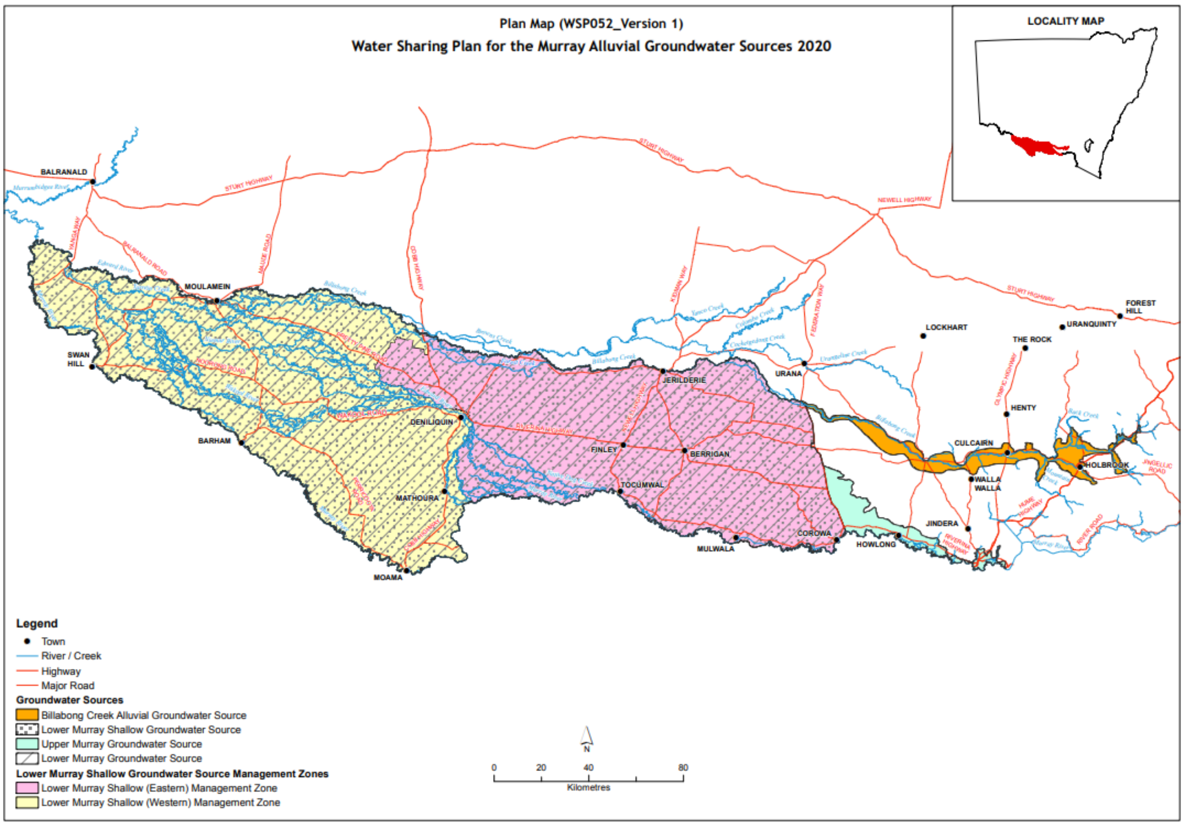


Figure 28 –Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020

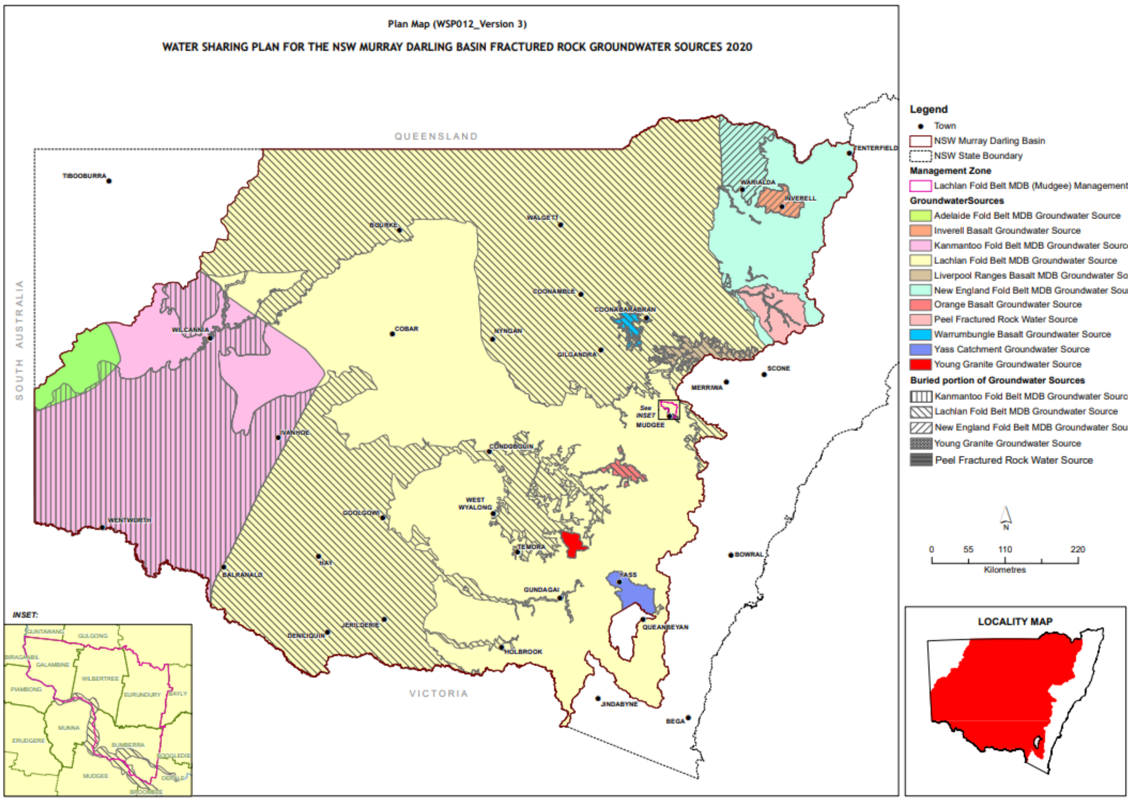


Figure 29 –Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2020

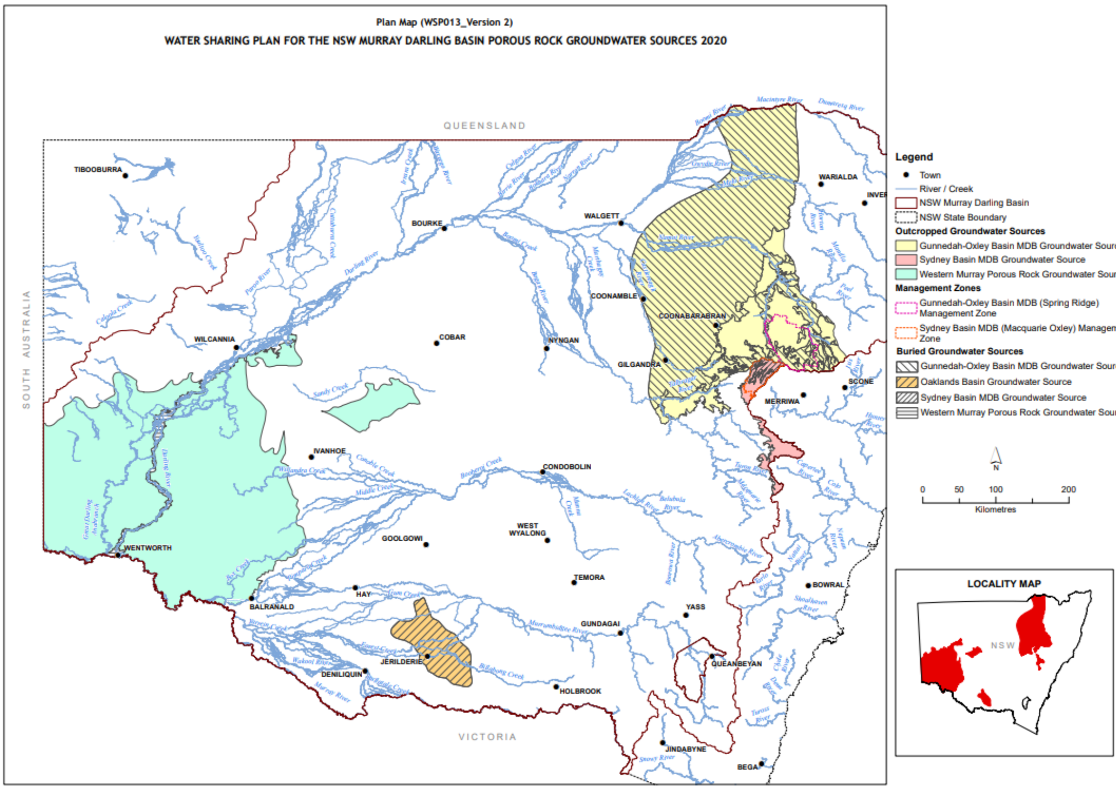
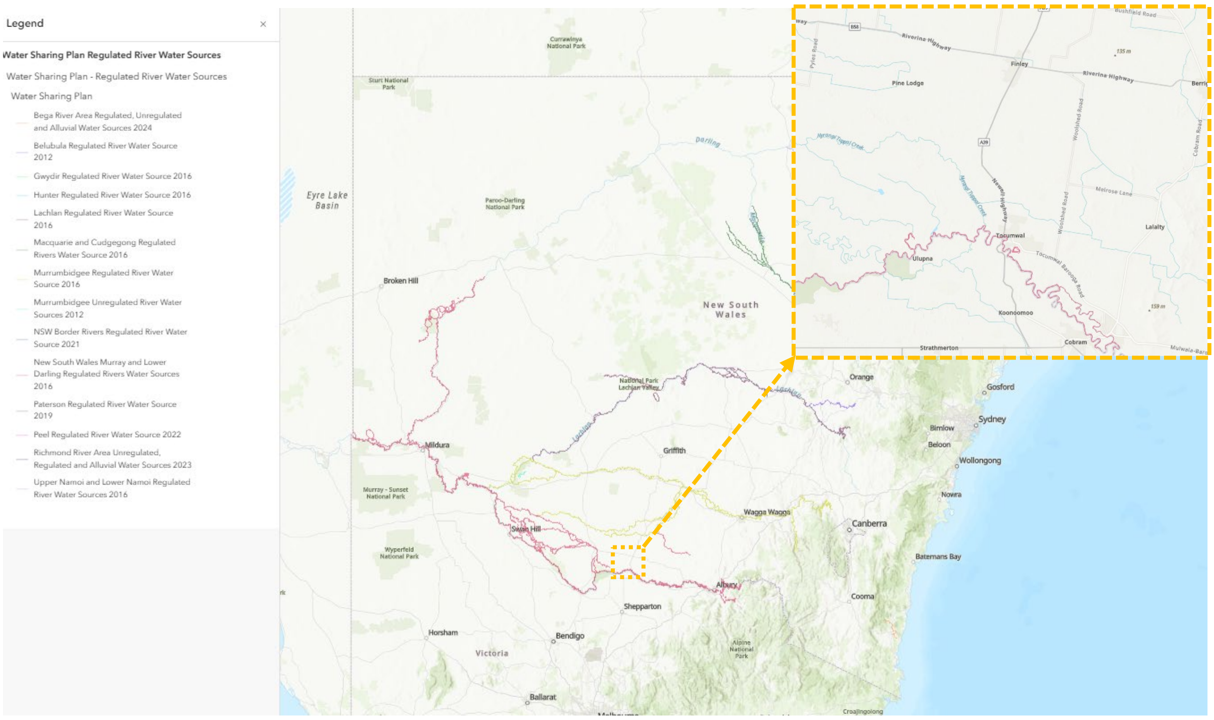


Figure 30 –Water Sharing Plans- Regulated River Water Sources



Appendix B

ARR Data Hub

ARR Data Hub

- Time Accessed: 03 November 2024.
- Latitude:- 35.636987°, Longitude: 145.516570°
- River Region: Murray-Darling Basin (River Number,10), River Name, Murray Riverina
- Storm Losses (ID 5746.0) Storm Initial Losses,24.0 mm, and Storm Continuing Losses: 0.1 mm/h.
- Median Preburst Depths and Ratios:

Duration (min)	Median Pre-burst Depths and Ratios for different AEP											
	50%		20%		10%		5%		2%		1%	
	mm	Ratio	mm	Ratio	mm	Ratio	mm	Ratio	mm	Ratio	mm	Ratio
60	1.8	0.093	1.5	0.055	1.3	0.04	1.2	0.03	1.2	0.026	1.3	0.024
90	2.9	0.137	2.2	0.072	1.7	0.046	1.3	0.028	1	0.019	0.9	0.014
120	3	0.13	2.9	0.086	2.8	0.068	2.7	0.056	1.3	0.022	0.2	0.003
180	2.7	0.104	2.9	0.076	3	0.065	3.1	0.057	2.7	0.042	2.5	0.034
360	1.5	0.048	1.7	0.038	1.9	0.034	2	0.031	3.9	0.05	5.3	0.06
720	0	0.001	1.2	0.022	2	0.03	2.8	0.036	5.2	0.057	7.1	0.068
1080	0	0	0.5	0.008	0.8	0.011	1.1	0.013	2	0.02	2.7	0.023
1440	0	0	0	0	0	0	0	0	0.3	0.003	0.5	0.004
2160	0	0	0	0	0	0	0	0	0	0	0	0
2880	0	0	0	0	0	0	0	0	0	0	0	0
4320	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C

Pre-Development Scenario – Flood Mapping

Sources: © State of NSW, Department of Customer Service, Spatial Services, 2025
© ESRI 2025

File: P001993_01_MASTER.aprx Prepared By: zindia.nanver Date: 10/04/2025

Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Maximum Flood Depth

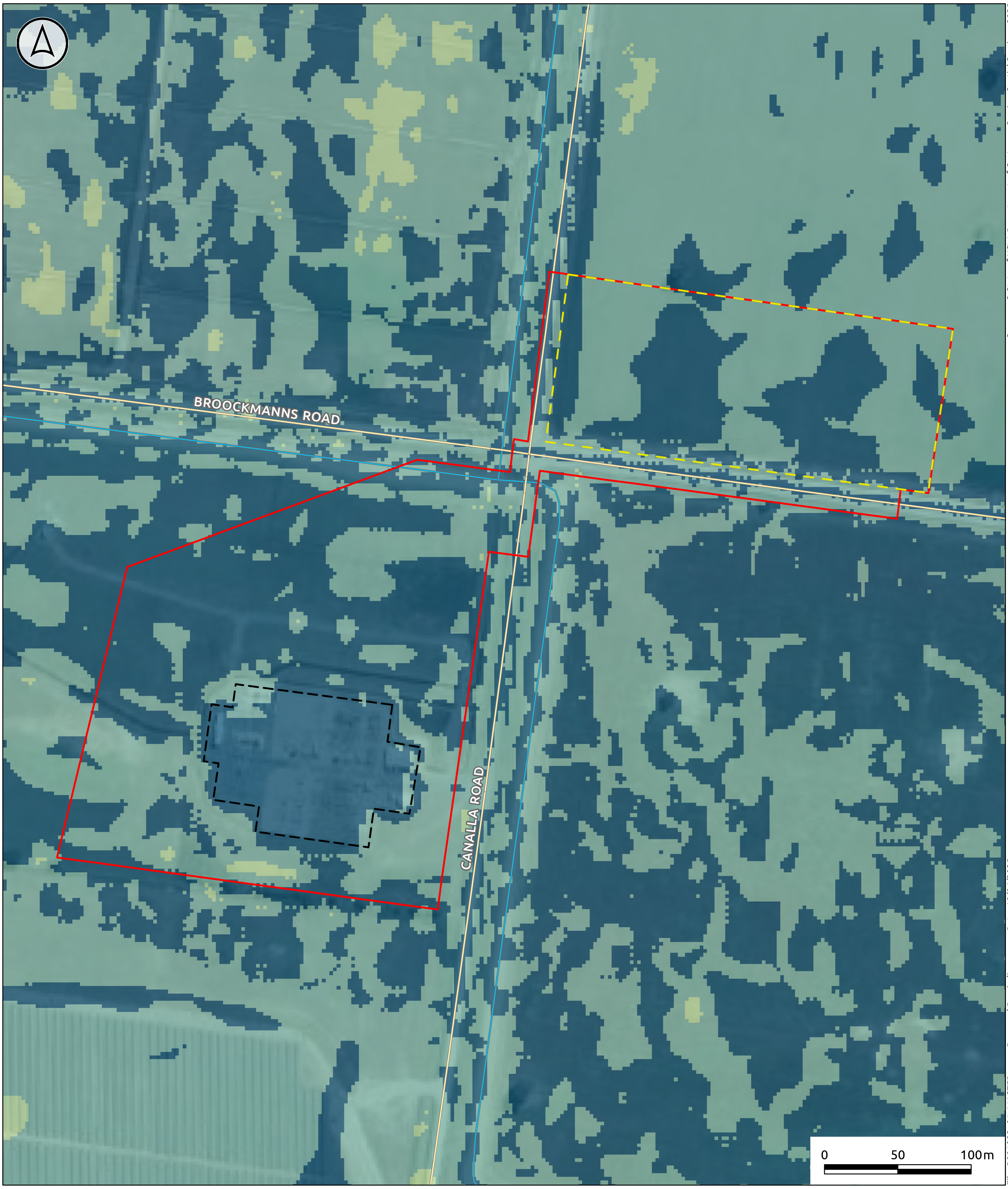
dmax

- <= 0.025
- 0.025 - 0.100
- 0.100 - 0.250
- 0.250 - 0.500
- 0.500 - 1.000
- 1.000 - 2.000
- 2.000 - 3.000
- > 3.000

Premise

Finley BESS

Figure 31: Pre-Development Scenario – Maximum Flood Depth, 1% AEP Event



Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Maximum Flood Velocity

vmax

- <= 0.025
- 0.025 - 0.100
- 0.100 - 0.250
- 0.250 - 0.500
- 0.500 - 1.000
- 1.000 - 2.000
- 2.000 - 3.000
- > 3.000

Premise

Finley BESS

Figure 32: Pre-Development Scenario – Maximum Flood Flow Velocity, 1% AEP Event

Sources: © State of NSW, Department of Customer Service, Spatial Services, 2025
© ESRI 2025

File: P001993_01_MASTER.aprx Prepared By: zindia.nanver Date: 10/04/2025

Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Maximum Flood Level

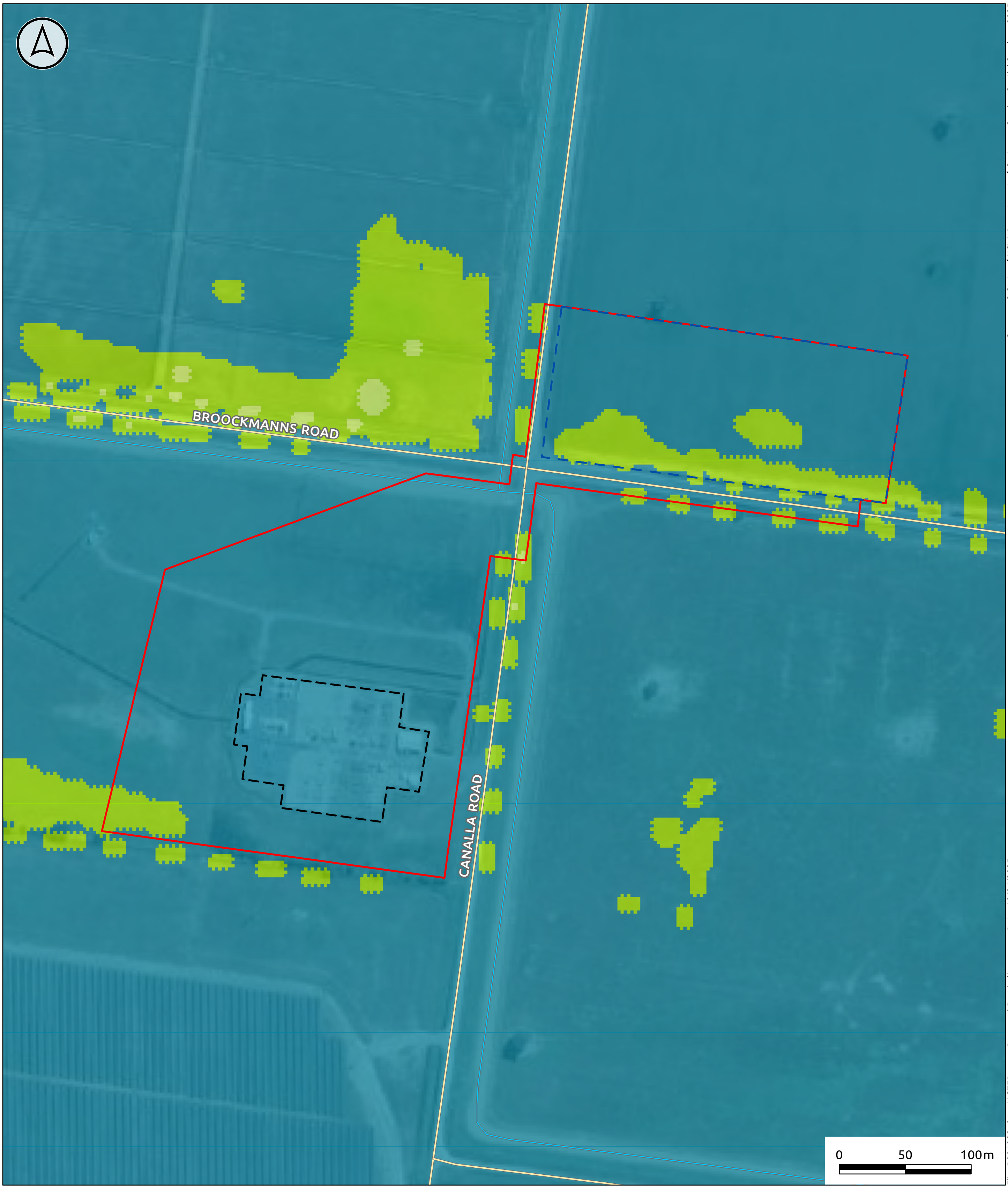
Level

- <= 106m AHD
- 106.00 - 107.25
- 107.25 - 107.50
- 107.50 - 107.75
- 107.75 - 108.00
- 108.00 - 108.25
- 108.25 - 108.50
- 108.50 - 109.00
- > 109.00

Premise

Finley BESS

Figure 33:
Pre-Development Scenario – Maximum Flood Level, 1% AEP Event



Sources: © State of NSW, Department of Customer Service, Spatial Services, 2025 © ESRI 2025

File: P001993_01_MASTER.aprx Prepared By: zindia.nanver Date: 10/04/2025

Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Flood Hazard Map

Hazard Class

- H1
- H2
- H3
- H4
- H5
- H6

Premise

Finley BESS

Figure 34: Pre-Development Scenario – Flood Hazard, 1% AEP Event

Appendix D

Post-Development Scenario Flood Mapping

Sources: © State of NSW, Department of Customer Service, Spatial Services, 2025
© ESRI 2025

File: P001993_01_MASTER.aprx Prepared By: zindia.nanver Date: 10/04/2025

Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Maximum Flood Depth

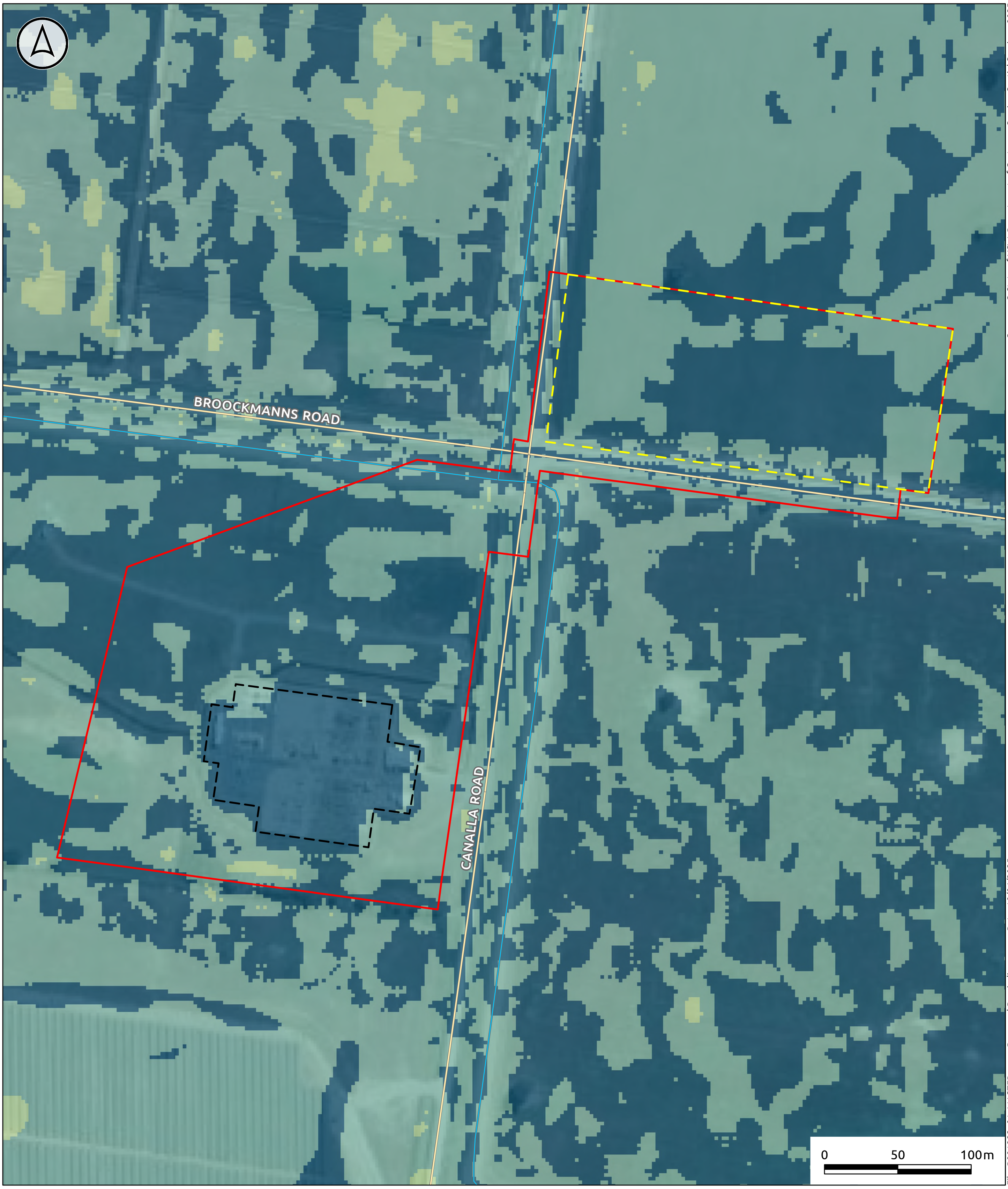
dmax

- <= 0.025
- 0.025 - 0.100
- 0.100 - 0.250
- 0.250 - 0.500
- 0.500 - 1.000
- 1.000 - 2.000
- 2.000 - 3.000
- > 3.000

Premise

Finley BESS

Figure 35: Post-Development Scenario – Maximum Flood Depth, 1% AEP Event



Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Maximum Flood Velocity

vmax

- <= 0.025
- 0.025 - 0.100
- 0.100 - 0.250
- 0.250 - 0.500
- 0.500 - 1.000
- 1.000 - 2.000
- 2.000 - 3.000
- > 3.000

Premise

Finley BESS

Figure 36: Post-Development Scenario – Maximum Flood Flow Velocity, 1% AEP Event

Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

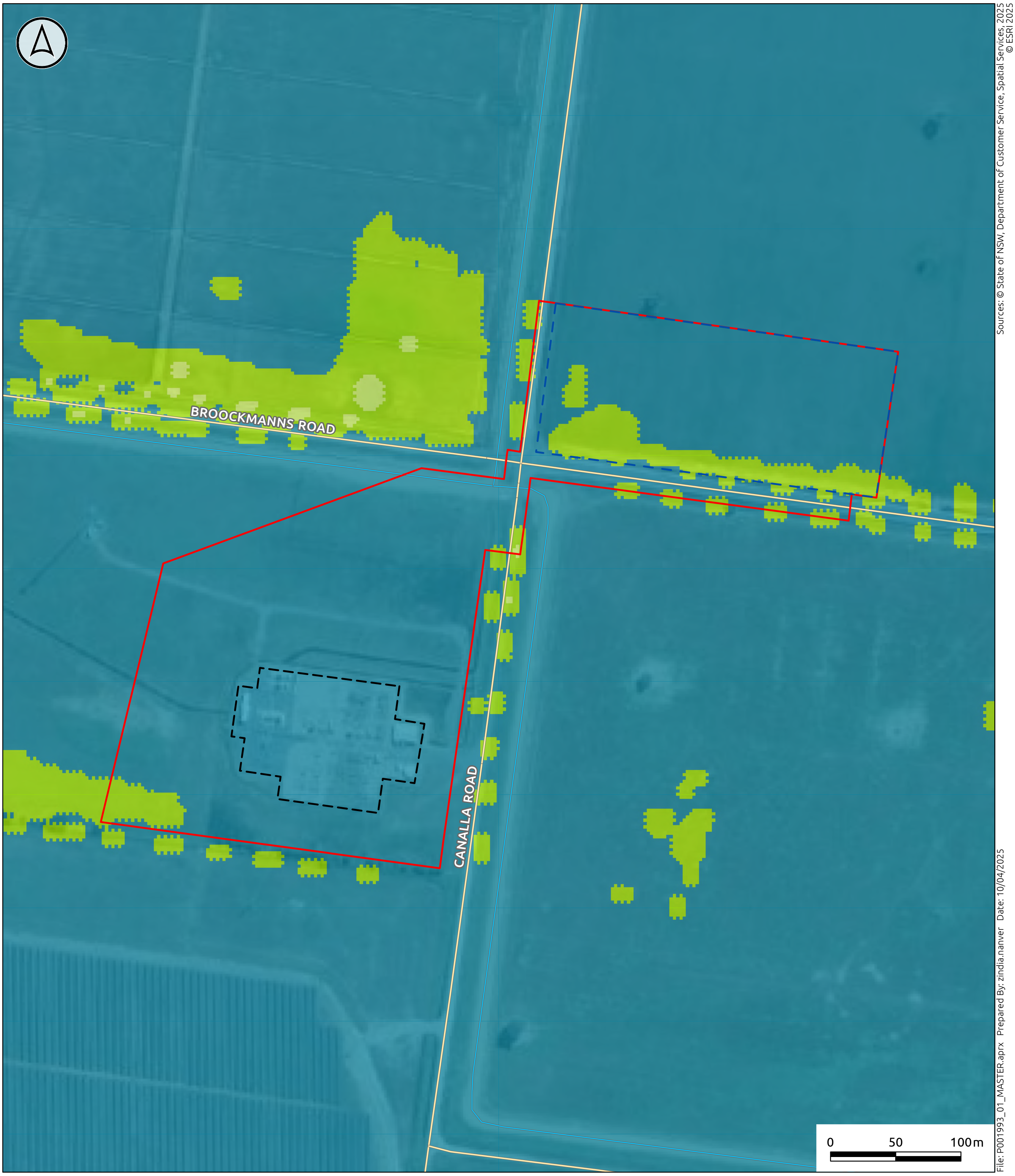
1%AEP Maximum Flood Level

Level
<= 106m AHD
106.00 - 107.25
107.25 - 107.50
107.50 - 107.75
107.75 - 108.00
108.00 - 108.25
108.25 - 108.50
108.50 - 109.00
> 109.00

Premise

Finley BESS

Figure 37: Post-Development Scenario – Maximum Flood Level, 1% AEP Event



Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Flood Hazard Map

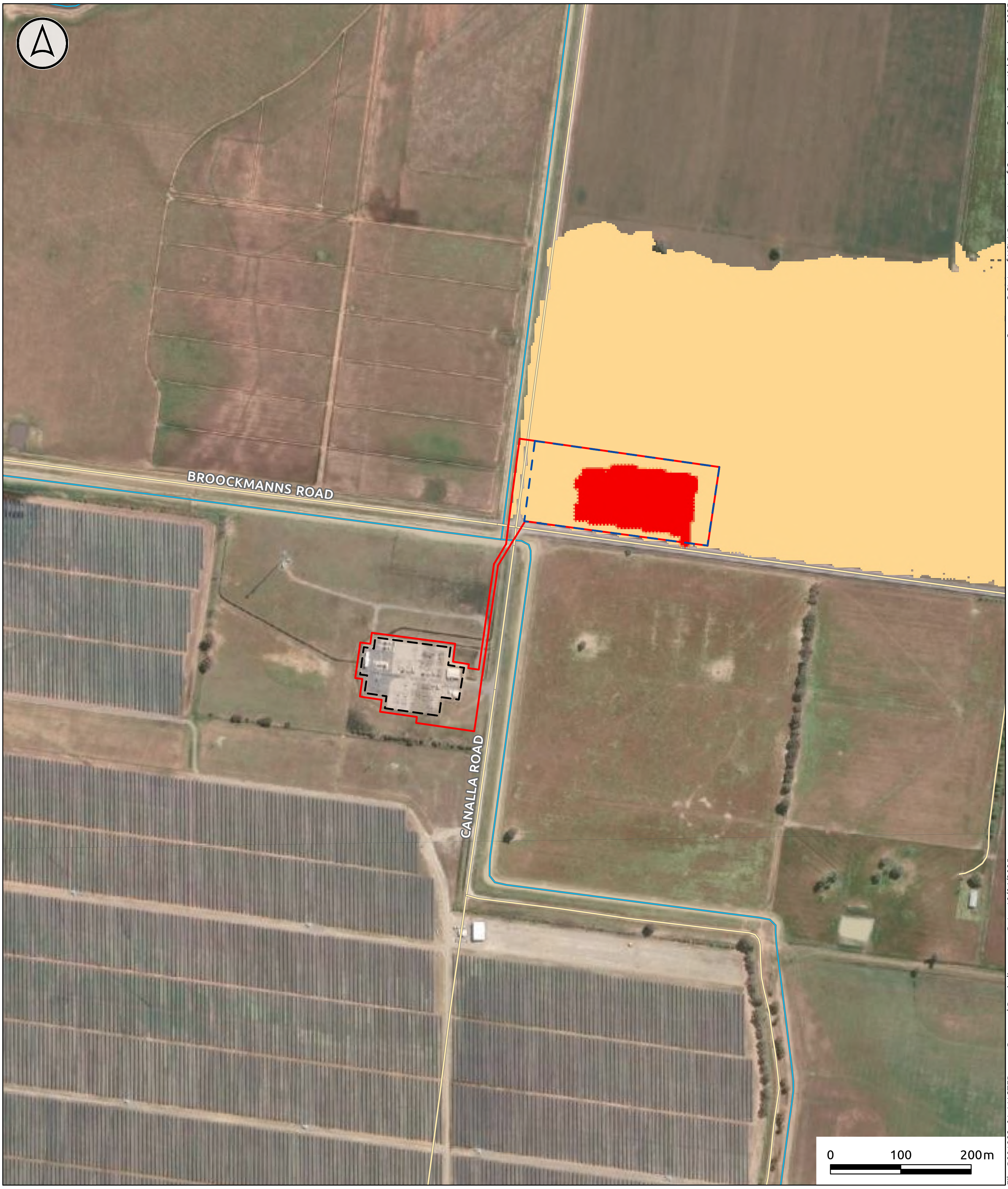
Hazard Class

- H1
- H2
- H3
- H4
- H5
- H6

Premise

Finley BESS

Figure 38: Post Development Scenario – Flood Hazard, 1% AEP Event



Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Flood Level Change (Afflux)

Afflux

- <= -0.200m
- -0.200 - -0.100
- -0.100 - -0.050
- -0.050 - -0.002
- -0.002 - 0.002
- 0.002 - 0.050
- 0.050 - 0.100
- 0.100 - 0.250
- > 0.250

Premise

Finley BESS

Figure 39:
Pre vs Post-Development Scenario – Maximum Flood Level Change (Afflux), 1% AEP Event

Legend

- Development Site
- BESS Lease Area
- Substation
- Road
- Watercourse

1%AEP Maximum Velocity Change (m/s)

- <= -0.200m
- -0.200 - -0.100
- -0.100 - -0.050
- -0.050 - -0.002
- -0.002 - 0.002
- 0.002 - 0.050
- 0.050 - 0.100
- 0.100 - 0.250
- >0.250

Premise

Finley BESS

Figure 40: Pre vs Post-Development Scenario - Maximum Flood Velocity Change, 1% AEP Event

Appendix E

Groundwater Level Monitoring Charts

Figure 41 –Groundwater Depth Monitoring Data – GW502717, North of Development Site

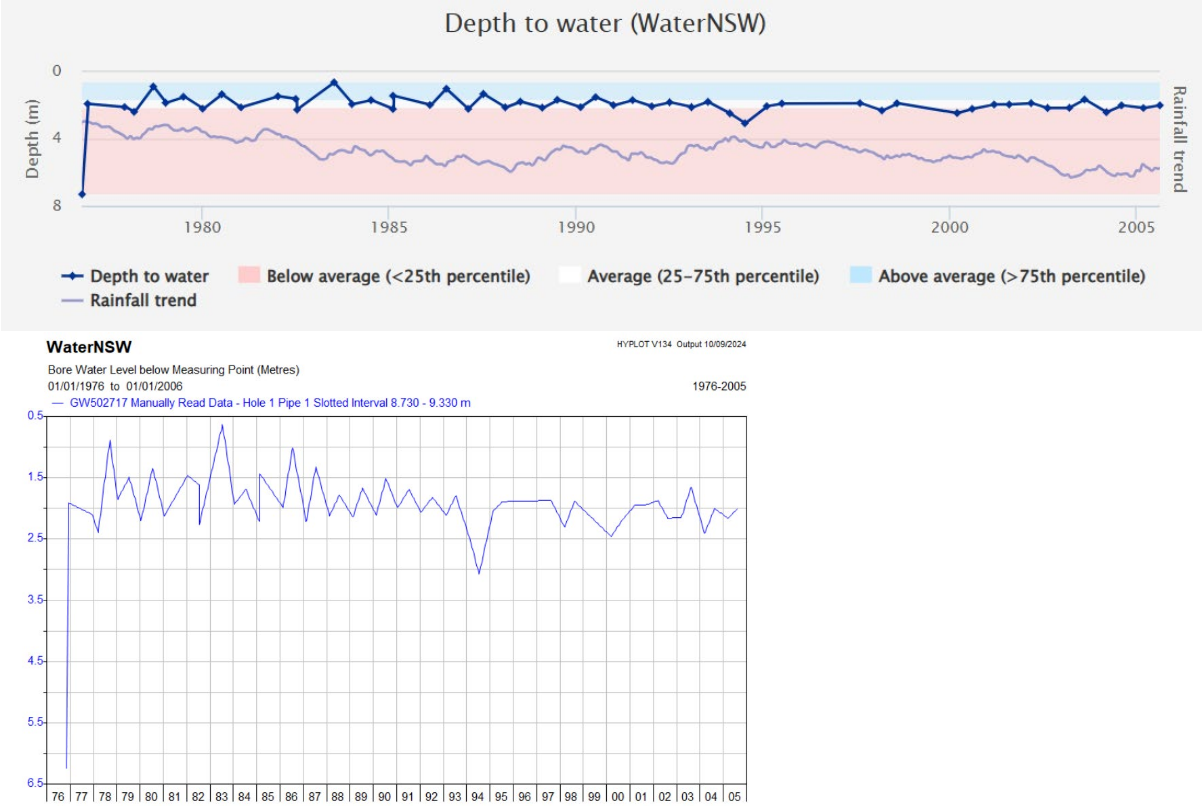


Figure 42 –Groundwater Depth Monitoring Data – GW502727, West of Development Site

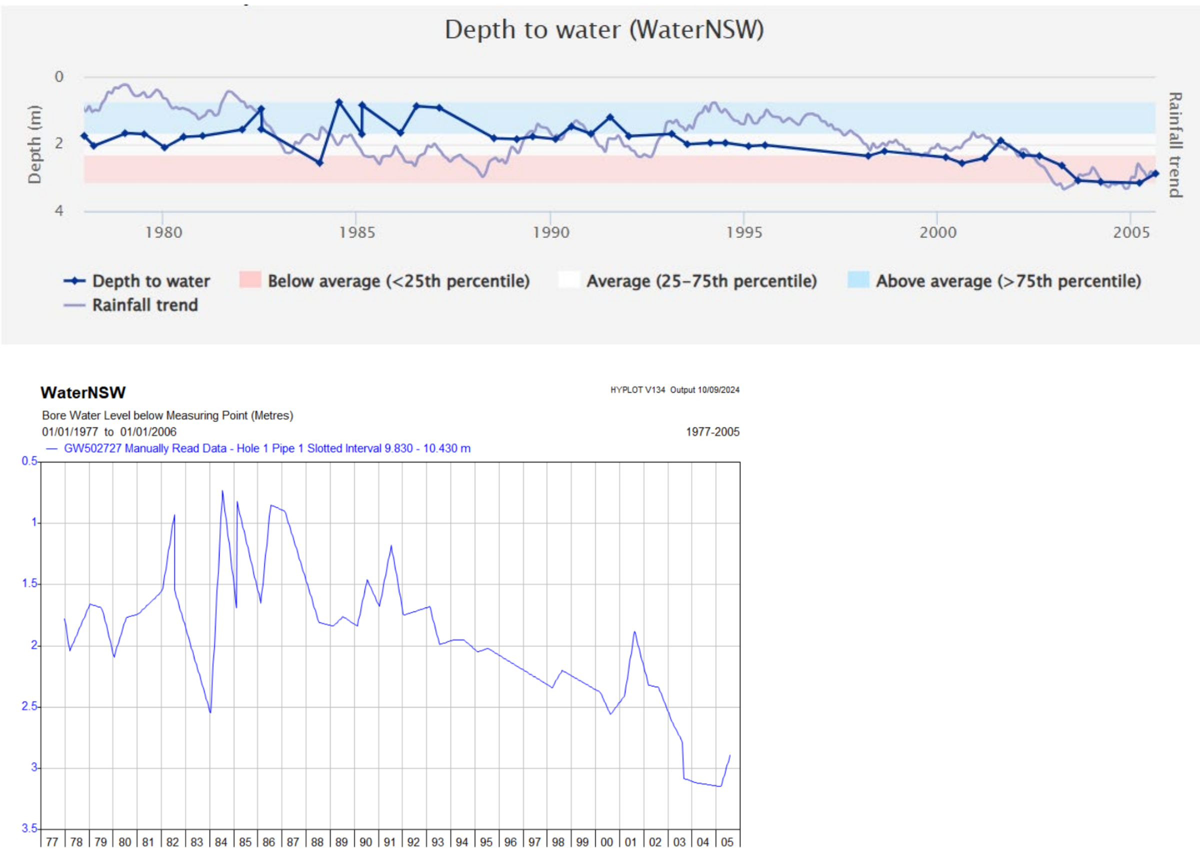


Figure 43 –Groundwater Depth Monitoring Data – GW502752, North-east of Development Site

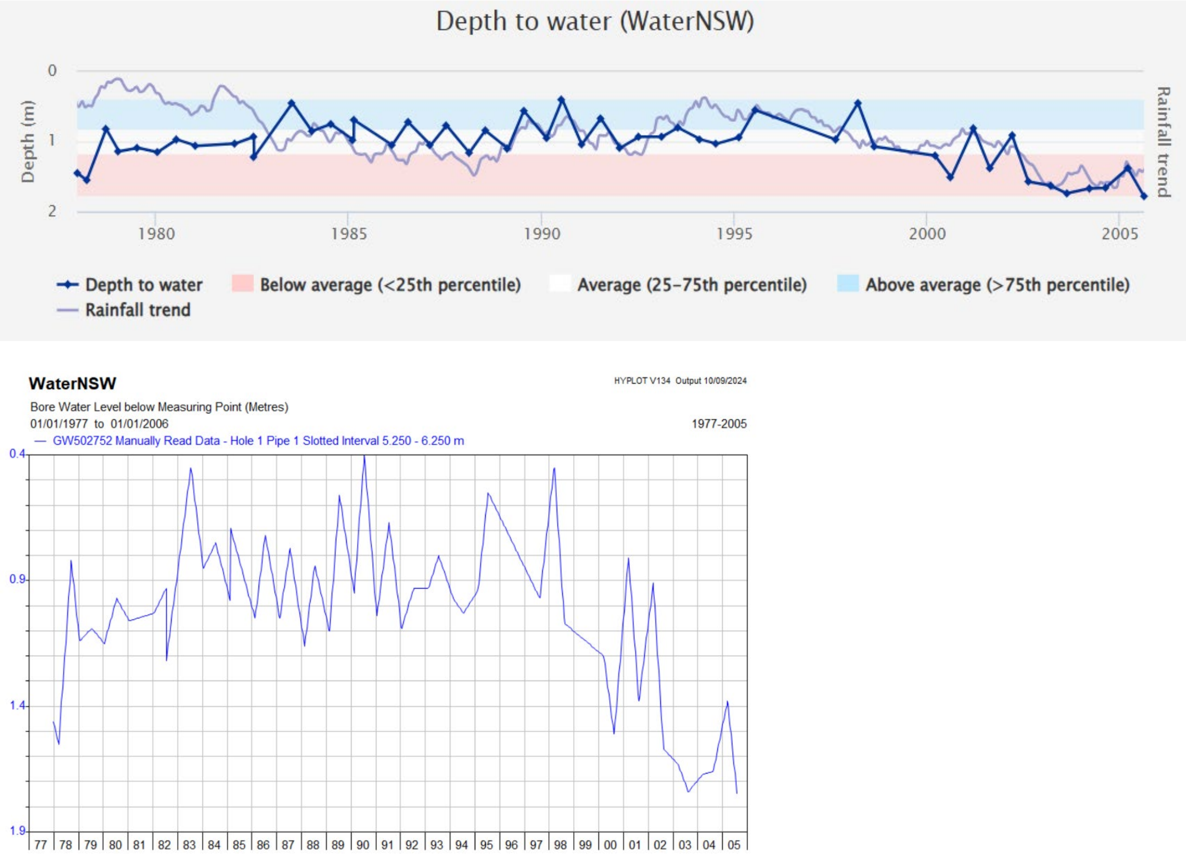


Figure 44 –Groundwater Depth Monitoring Data – GW502753, North-west of Development Site

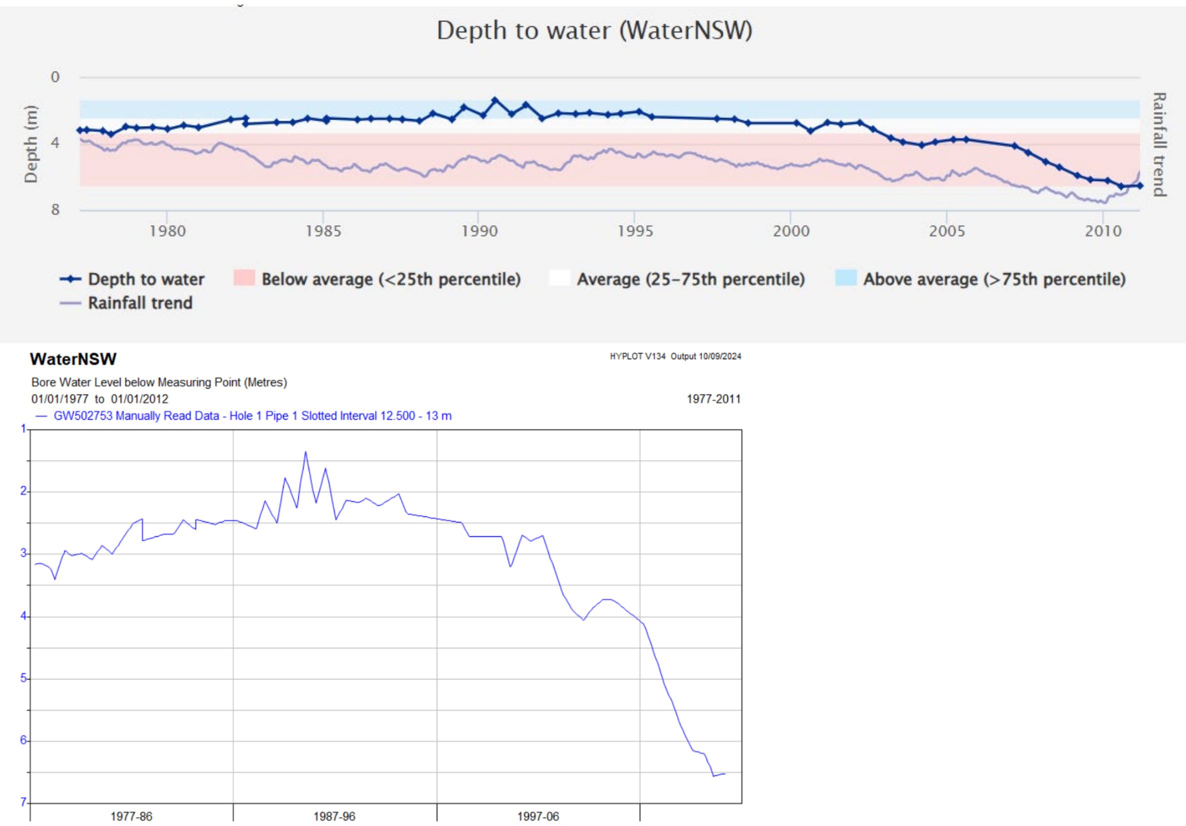


Figure 45 –Groundwater Depth Monitoring Data – GW502754, North-west of Development Site

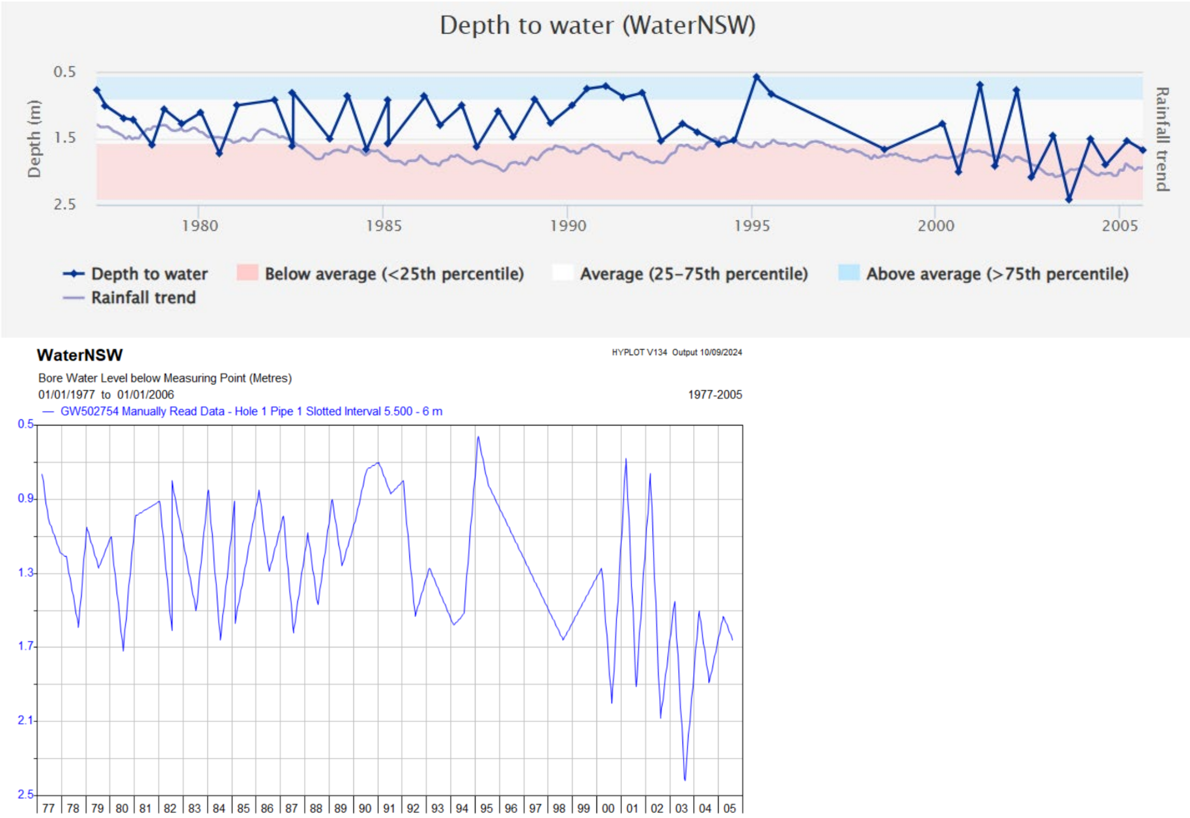


Figure 46 –Groundwater Depth Monitoring Data – GW502579, West of Development Site

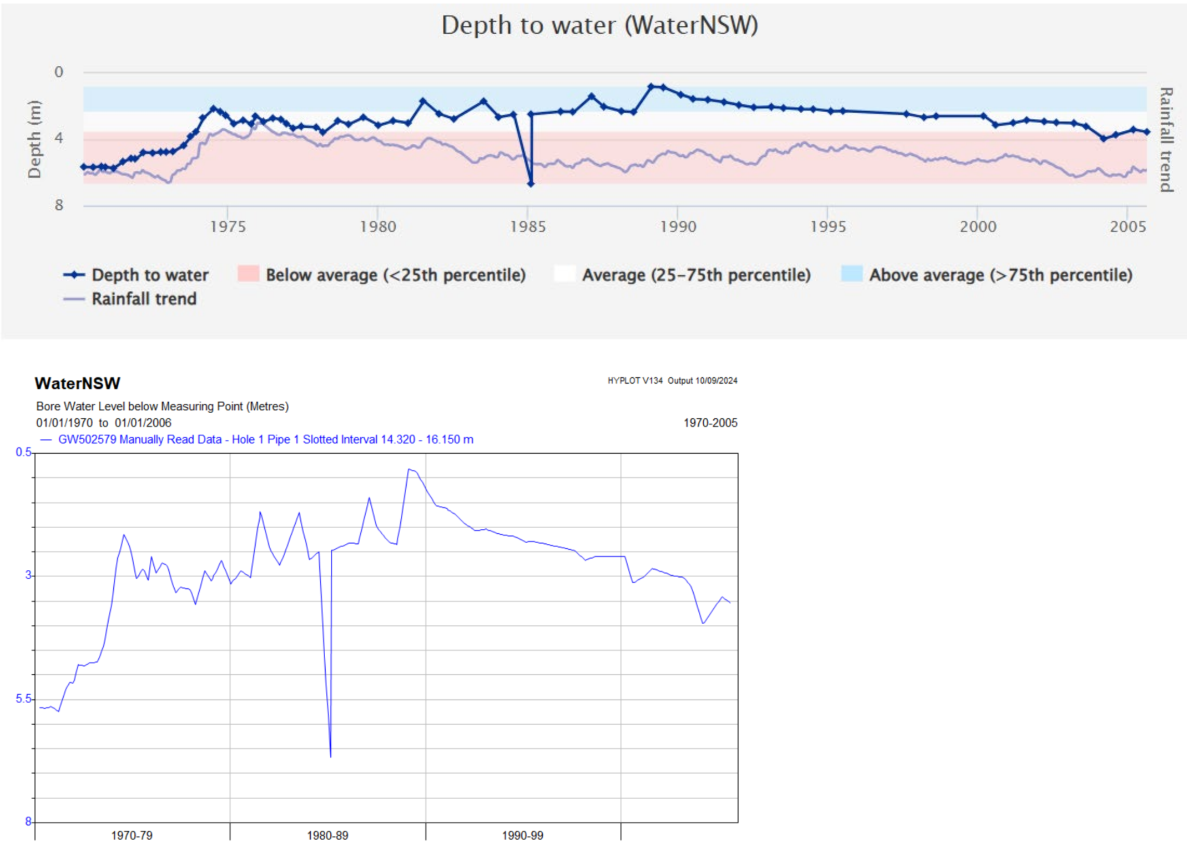


Figure 47 –Groundwater Depth Monitoring Data – GW502741, North- East of Development Site

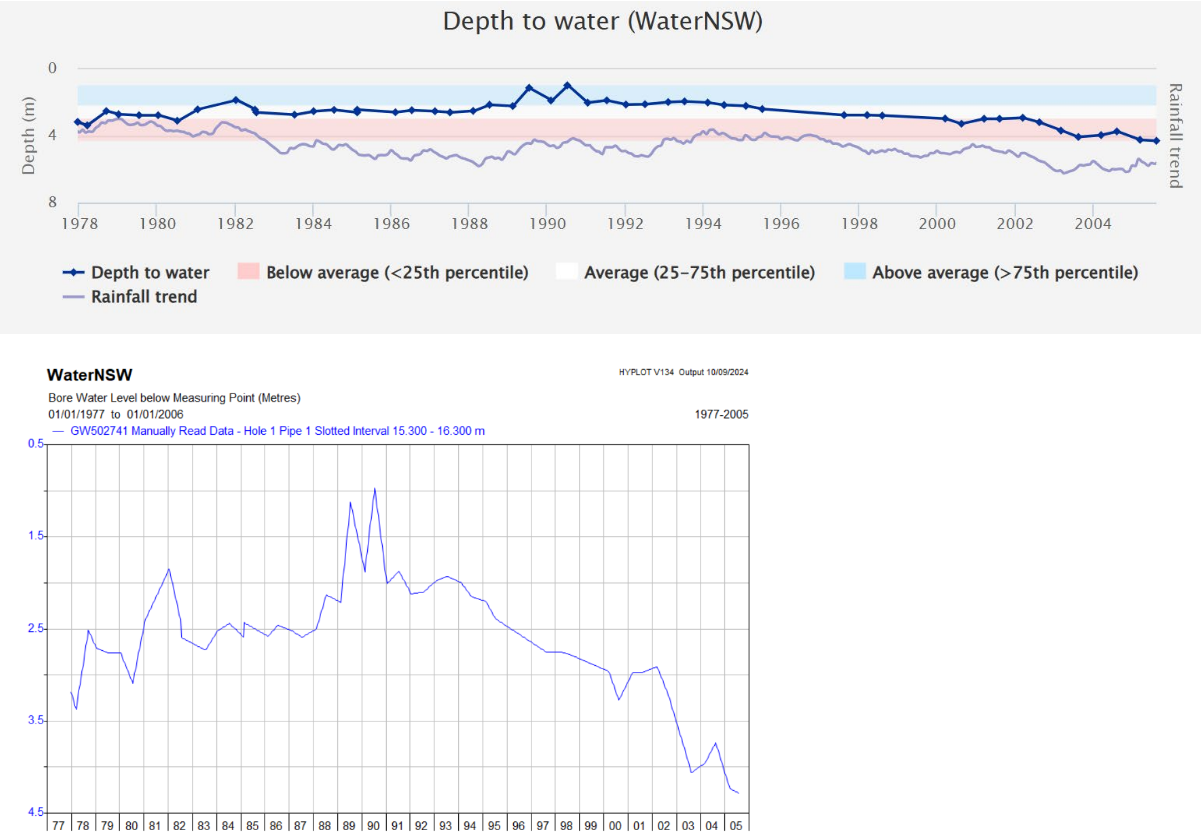
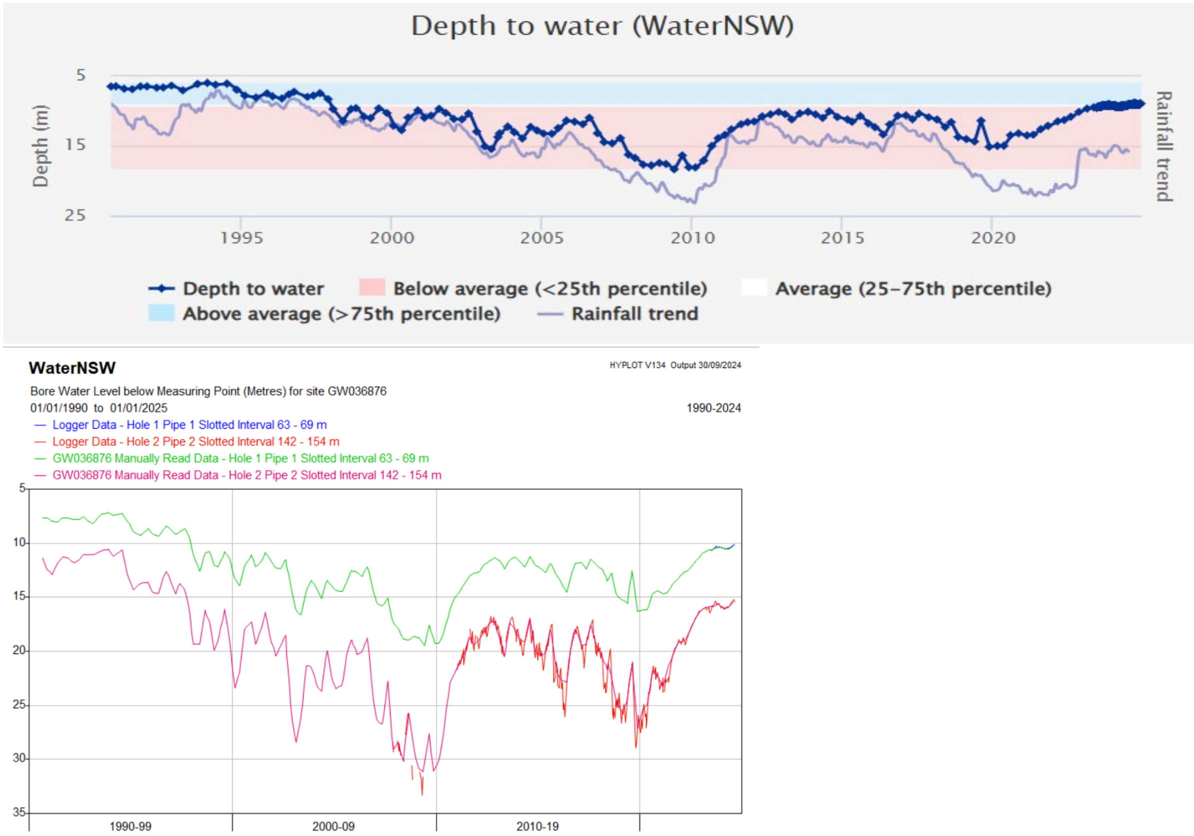


Figure 48 – Groundwater Bore Monitoring Data – GW36876



Premise