APPENDIX M

Water assessment

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Wellington South Battery Energy Storage System

Water Assessment

Prepared for AMPYR Energy

October 2022

Wellington South Battery Energy Storage System

Water Assessment

AMPYR Energy

J210534 RP9

October 2022

Version	Date	Prepared by	Approved by	Comments
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Executive Summary

ES1 Introduction

AMPYR Australia Pty Ltd (AMPYR) and Shell Energy Operations (Shell) proposes to develop and operate the Wellington South Battery Energy Storage System (the project). This involves the development of a large-scale battery energy storage system (BESS) with a discharge capacity of 500 megawatts (MW) and a storage capacity of 1,000 megawatt hours (MWh). The project also incorporates an on-site substation and connection infrastructure to facilitate transfer of energy to and from the electrical grid, and ancillary infrastructure.

EMM Consulting Pty Limited (EMM) has been engaged by AMPYR to prepare a development application for the project under Part 4, Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This Water Assessment (WA) has been prepared by EMM to support an Environmental Impact Statement (EIS) for the project.

ES2 Regulatory context

The regulatory framework and context established for the site and project with respect to water management includes:

- the NSW *Protection of the Environment Operations Act 1997* (POEO Act) and NSW *Water Management Act 2000* (WM Act);
- the *Wellington Local Environmental Plan 2012* (Wellington LEP) and *Wellington Development Control Plan 2013* (Wellington DCP); and
- a range of applicable industry guidelines.

ES3 Existing surface water environment

The project site lies predominantly within the catchment of an ephemeral second order watercourse, referred to as Watercourse A. Minor portions of the development lie on the catchment boundaries of a neighbouring, ephemeral second order watercourse to the west (Watercourse B) and Wuuluman Creek to the north. All watercourses are tributaries to the Macquarie River, immediately upstream of the township of Wellington. Upstream of the Macquarie River lies Burrendong Dam, a major online gated structure which provides irrigation and municipal water supply, hydroelectric power generation and flood mitigation, controlling downstream flood levels in the Macquarie River.

ES4 Existing groundwater environment

The project site falls within the Lachlan Fold Belt geological structure. Bedrock within the structure consists of felsic volcanics, shales and sandstone fractured rocks which are overlain by colluvial deposits and shallow alluvium. Two groundwater systems are present near the project site, a shallow system residing in the shallow colluvium and unconsolidated sediments; and a deeper system associated with the underlying fractured rock. Groundwater levels within the fractured rock aquifer range from 10–30 metres Below Ground Level (mBGL) and levels within the colluvium/alluvium are likely to vary depending on the depth to bedrock. Flow direction of both systems are expected to be southerly toward the Macquarie River.

Several low potential terrestrial Groundwater Dependant Ecosystems (GDEs) surround the site with no aquatic GDEs mapped within reasonable proximity to the development.

ES5 Proposed water management approach

A conceptual approach to water management for the site has been developed to inform this WA. This will be subject to further design development as part of future detailed design. The proposed water management approach has been developed with consideration of several key objectives that are consistent with best practice water management. This comprises a comprehensive suite of measures including:

- appropriate licencing arrangements for any groundwater take to supplement construction and operational water use;
- discharge from the site at an appropriate receival point, and avoiding uncontrolled discharge;
- minimising the extent of new hardstand/impervious areas;
- promotion of stormwater infiltration, subject to feasibility;
- provision of water quantity controls to ensure peak flow rates discharging from site are not increased;
- provision of water quality controls that collectively meet industry standard pollutant load reduction targets;
- provision of specific stormwater management measures for the substation area;
- minimising site water requirements; and
- monitoring and maintenance of water management infrastructure.

Prior to construction, temporary soil and water management measures would be detailed and documented as part of the overall construction environmental management plan (CEMP) to address temporary risks to water quality and drainage during the construction phase. This will also reflect industry best practice.

ES6 Residual impacts and mitigation measures

No impacts to groundwater resources are anticipated for the project due to limited ground disturbance and minor licenced groundwater take during construction. Predicted residual impacts to surface water resources are described in terms of stormwater flow management, water quality, and impacts to watercourses and the downstream receiving environment. This assumes implementation of the proposed water management approach.

During construction the key risks to surface water are associated with clearing, ground disturbance, earthworks, compaction of soils and installation of infrastructure. This may lead to an increase in site runoff potential and exposure of soils and potential erosion and mobilisation of sediment into receiving watercourses. Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality. Potential impacts during construction are considered minor and manageable with implementation of temporary water and soil management measures that will form part of the CEMP.

During operation the key risks to surface water are associated with an increase in site runoff potential and stormwater pollutant loads. This may lead to an increase in peak flow rates leaving the site and reduction in water quality in receiving watercourses. However, a range of measures to mitigate potential increases in peak flow rates and pollutant loads form part of the proposed water management approach for the project. On this basis, potential adverse impacts during operation are not anticipated.

Any flood impacts associated with the development are anticipated expected to be localised and remain within the project site. Potential adverse impacts to watercourses further downstream of the site, including the Macquarie River, are not anticipated.

TABLE OF CONTENTS

Executive Summary **ES.1**

1 Introduction **1**

1.1 Background 1

1.2 Location and context 1

1.3 Assessment framework 2

2 Project description **5**

2.1 Project overview 5

2.2 Concept design 5

2.3 Construction 6

2.4 Potential sources of impact 7

3 Regulatory framework and context **8**

3.1 NSW regulatory framework 8

3.2 Dubbo Regional Council requirements 8

3.3 Relevant guidelines 10

3.4 Water quality and river flow objectives 12

3.5 Previous studies 13

4 Existing environment **15**

4.1 Overview 15

4.2 Land use 15

4.3 Topography and vegetation 15

4.4 Soils 15

4.5 Climate 15

4.6 Hydrology 16

4.7 Hydrogeology 18

5 Proposed water management **22**

5.1 Overview 22

5.2 Proposed water management approach 22

5.3 Flood management 25

6 Impact assessment **27**

6.1 Overview 27

6.2 Surface water impacts 27

6.3 Groundwater impacts 28

6.4 Assessment against WQOs and RFOs 28
7 Water licencing and approvals 31
7.1 Water licensing 31
7.2 Water approvals 31
8 Summary of mitigation measures 34
References 36
Abbreviations 37

Tables

Table 1.1 SEARs for the assessment of water 2
Table 3.1 Compliance with relevant Wellington DCP provisions 9
Table 3.2 Application of water quality and river flow objectives 12
Table 4.1 Key climate statistics 16
Table 4.2 Registered groundwater bores within 1 km 19
Table 5.1 Water management objectives and approach 24
Table 6.1 Assessment of water quality and river flow objectives 29
Table 7.1 Assessment of riparian corridor impacts to Watercourse A 32
Table 8.1 Summary of proposed mitigation and management measures 34

Figures

Figure 1.1 Regional context 3
Figure 1.2 Local context 4
Figure 4.1 Average daily rainfall and evaporation rates 16
Figure 4.2 Hydrologic context 20
Figure 4.3 Existing site drainage 21
Figure 5.1 Proposed water management concept 26
Figure 7.1 Impacts to waterfront land 33

Photographs

Photograph 4.1 Existing bed level crossing at Watercourse A 17
Photograph 4.2 Existing culvert crossing at Watercourse A 17

1 Introduction

1.1 Background

AMPYR Australia Pty Ltd (AMPYR) and Shell Energy Operations (Shell) propose to develop the Wellington Battery Energy Storage System (the project). The project involves the development of a large-scale battery energy storage system (BESS) with a discharge capacity of 500 megawatts (MW) and a storage capacity of 1,000 megawatt hours (MWh). The project also incorporates an on-site substation and connection infrastructure to facilitate transfer of energy to and from the electrical grid, and ancillary infrastructure.

The project will be developed within privately owned land (Lot 32 DP 622471) and will incorporate either an overhead or underground transmission line and upgrade works to Wellington substation in the adjoining TransGrid owned landholding (Lot 1 DP 1226751). Physical infrastructure associated with the BESS will occupy an area of up to 13 ha, however during construction, the project will require a disturbance area of up to 19 ha. A study area has been adopted for this assessment which is larger than the disturbance boundary associated with the project.

The site is located within the New South Wales (NSW) Government declared Central-West Orana Renewable Energy Zone and will complement nearby existing and proposed renewable energy generation assets in the region by smoothing out fluctuations in electricity supply from these new intermittent power sources, providing system security and other network services. In operation, the project will be one of the largest battery storage projects in NSW and will contribute to the overall storage capacity and reliability of the National Electricity Market.

1.2 Location and context

The site proposed to be developed is located within the Dubbo Regional Council local government area (LGA) at 6773 Goolma Road (battery energy storage system and transmission line) and 6909 Goolma Rd (transmission line and Wellington Substation upgrade) at Wuuluman. It will be located directly adjacent to the TransGrid owned Wellington Substation and is approximately 2.2 km north-east of the township of Wellington and 44 km south-east of the township of Dubbo.

The regional setting is presented in Figure 1.1 and the site and its surrounding local context is shown in Figure 1.2. The 'project site' referenced throughout this report comprises the development boundary as shown in Figure 1.2.

The locality surrounding the project contains a variety of landscapes within an agricultural setting. Most of the local and sub-regional setting has been cleared for grazing and/or cultivation. There are no major National Parks, nature reserves, conservation areas or State forests close to the project. Key land uses surrounding the site include:

- cropping and grazing activities;
- correctional centres including the Macquarie Correctional Centre and Wellington Correctional Centre north of the site;
- renewable energy generating facilities including the Wellington Solar Farm immediately north of the site;
- electricity infrastructure including the TransGrid Wellington Substation and associated transmission lines; and
- residences along Goolma Road, Twelve Mile Road, Cadonia Drive, and Cadia Place.

Land surrounding the project is relatively flat, apart from a hill approximately 600 m east of the project, which rises about 100 m above the majority of the site. The project is directly south of the Wellington Solar Farm and adjacent to the eastern boundary of the TransGrid Wellington substation.

The site is within the Macquarie River catchment and Macquarie River is approximately 2 km south-east of the site.

1.3 Assessment framework

The project is State significant development (SSD) pursuant to Schedule 1 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP). Accordingly, approval for the project is required under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This water assessment (WA) supports the Environmental Impact Statement (EIS) for the project, and describes the existing surface water and groundwater environment, water management approach, proposed mitigation and management measures and residual impacts. The assessment has been prepared in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs) for the project, issued 1 October 2021, and considers relevant government and industry guidelines. Table 1.1 lists requirements for the project relevant to this assessment and references where they are addressed in this report or in the Environmental Impact Statement (EIS).

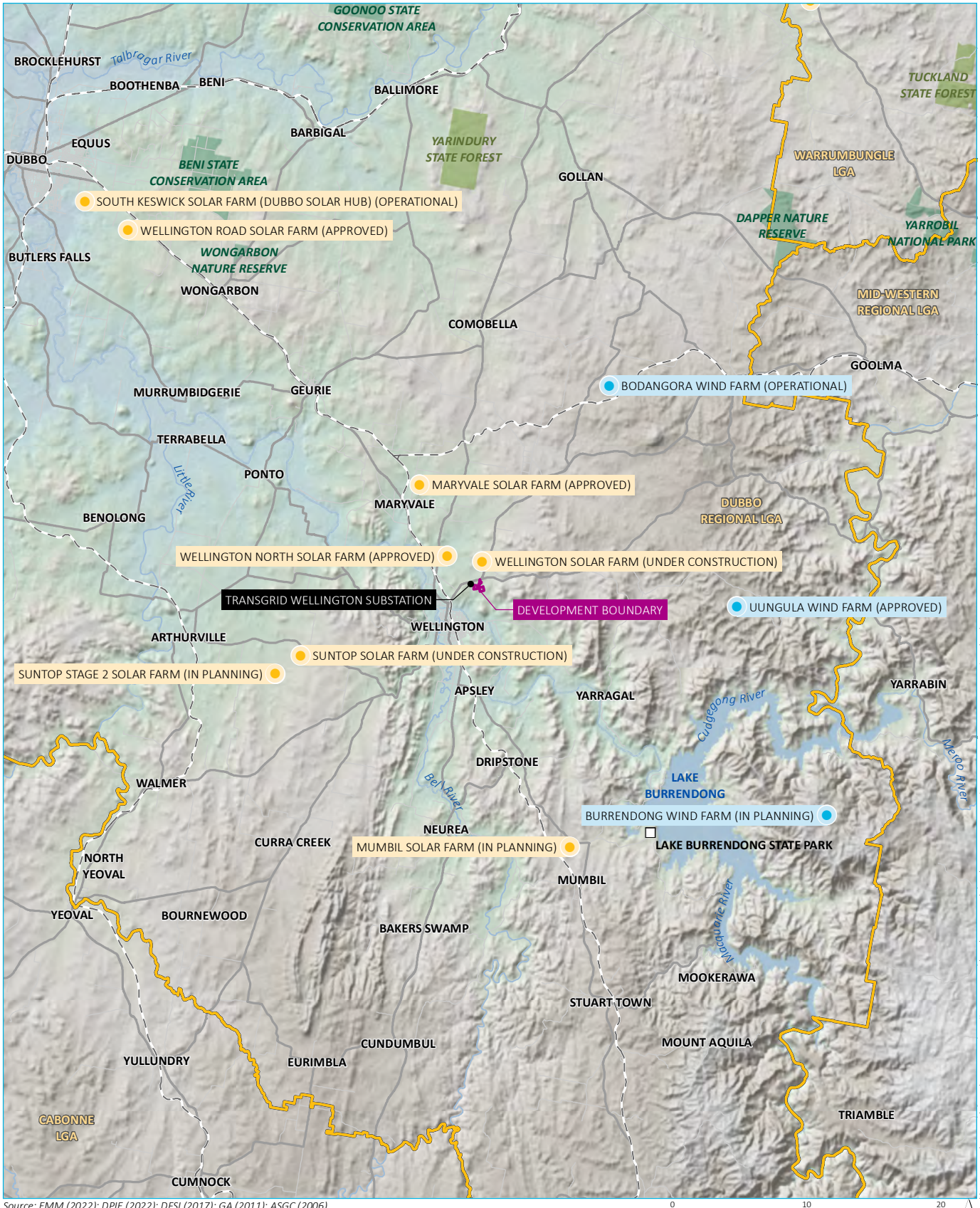
Table 1.1 SEARs for the assessment of water

Requirement	Section addressed
Water	
An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources and measures proposed to monitor, reduce and mitigate these impacts.	Chapter 5 references the proposed approach to water management and Chapter 6 provides an assessment of impacts.
Details of water requirements and supply arrangements for construction and operation.	Section 2.3.2 identifies water requirements during construction and Section 7.1 identifies water licensing requirements.
A description of the erosion and sediment controls that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004).	Section 5.2.1 identifies the proposed approach for erosion and sediment control.

This WA has been prepared generally in accordance with the following guidelines:

- the *NSW Floodplain Development Manual* (DIPNR 2005);
- the *Guidelines for controlled activities on waterfront land – riparian corridors* (DoI 2018);
- the *Guidelines for watercourse crossings on waterfront land* (DoPI 2012);
- the *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom 2004);
- Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation (DECC 2005);
- *Storing and Handling Liquids: Environmental Protection: Participant's Manual* (DECC 2007);
- *Australian Rainfall and Runoff, 2019 edition* (Ball et al 2019) (ARR 2019); and
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018).

These guidelines and how they have been applied are described in Section 3.3.



Source: EMM (2022); DPIE (2022); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 55

N

KEY

- Development boundary
- Lake Burrendong State Park
- Rail line
- Major road
- Minor road
- River
- Named waterbody
- Local government area
- NPWS reserve
- State forest

Renewable energy project

- Solar farm
- Wind farm

Regional context

Wellington Battery Energy Storage System
Water assessment
Figure 1.1

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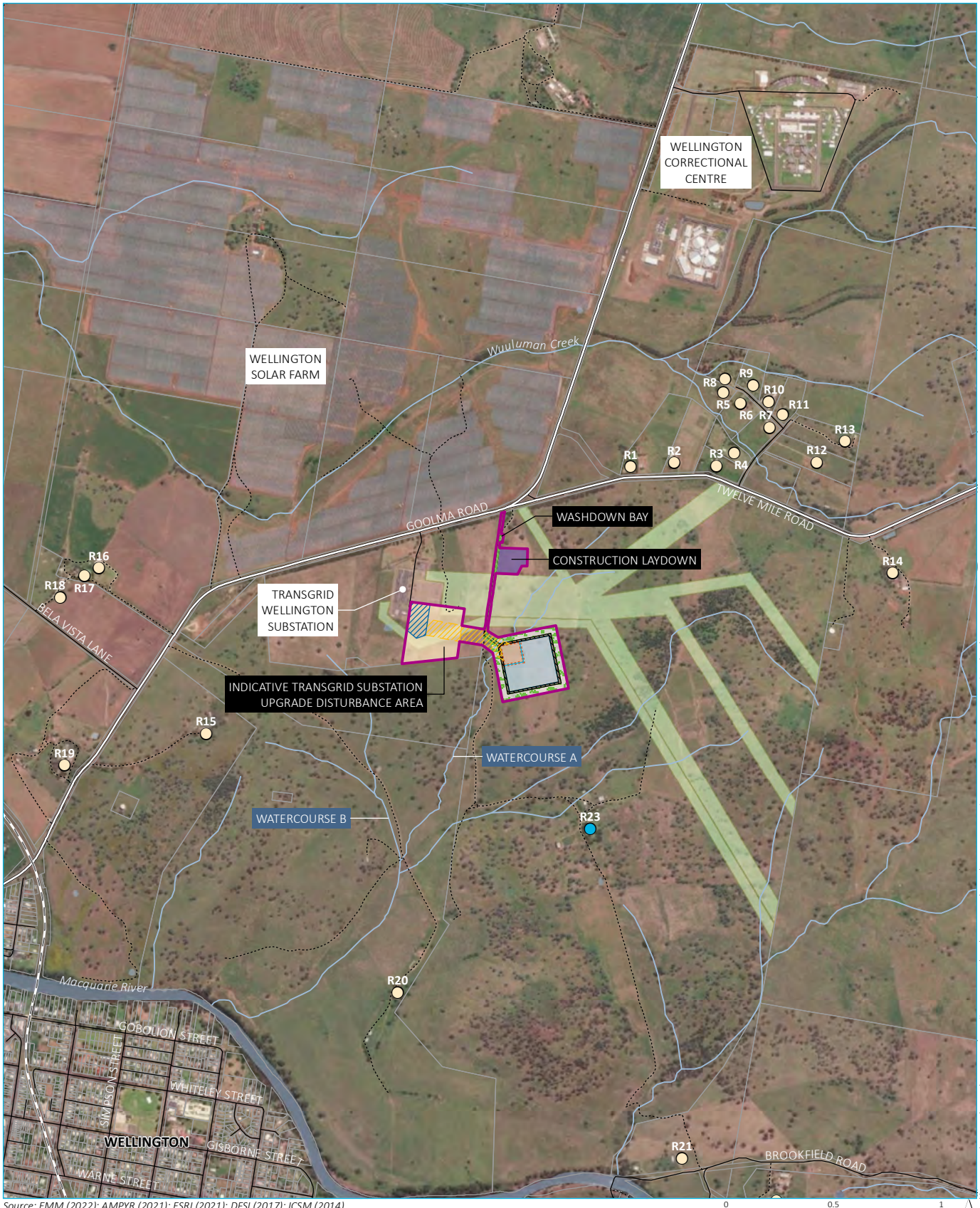

Source: EMM (2022); AMPYR (2021); ESRI (2021); DFSI (2017); ICSM (2014)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

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KEY

- Development boundary

Project components

- Indicative asset protection zone (10 m)
- Indicative transmission connection corridor
- Indicative TransGrid substation upgrade core infrastructure area
- Indicative TransGrid substation upgrade disturbance area
- Battery Energy Storage System (BESS) (battery rows offset at 6 m spacing and setback from substation)
- Substation
- Washdown bay
- Construction laydown
- Indicative landscaping (post construction)
- Access road

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- Waterbody
- Cadastral boundary
- Freehold easement

Receivers

- Non-project residential receivers
- Project participating landowner

Local context

Wellington Battery Energy Storage System
Water assessment
Figure 1.2

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2 Project description

2.1 Project overview

The project consists of the construction and operation of a major grid-scale battery project immediately adjacent to the Wellington substation. The project will have a power output of 500 MW and an energy storage capacity of 1,000 MWh. The project will comprise:

- lithium-ion (Li-ion) batteries inside battery enclosures;
- power conversion systems (PCS) incorporating inverters and transformers;
- an aboveground or underground transmission line to the Wellington Substation;
- an on-site substation comprising two 330 kilovolt (kV) transformer bays and ancillary infrastructure;
- cabling and collector units;
- upgrade of the TransGrid Wellington Substation with an additional 330 kV switch bay with power transformers, including switchyard bench extensions to the south of the existing bench and relocation of security fencing;
- ancillary infrastructure (eg control and office building, washdown bay, lighting and fencing); and
- an Asset Protection Zone (APZ).

A full description of the project is provided in Chapter 3 of the EIS.

Construction of the project is expected to commence in May 2023, subject to labour and equipment availability. Construction may be undertaken as a single stage, or over two stages. Construction of the project will be undertaken over a minimum of 8 months and up to a maximum of 12–18 months under normal circumstances. For the staged construction scenario, Stage 1 would likely include 300 MW installed discharge capacity, all civil and enabling works, installation of batteries, one transformer and switchgear and associated structural, mechanical and electrical works, and connection to the substation. Stage 2 would consist of 200 MW, including installation of a second transformer and associated switchgear and batteries. It is anticipated that construction of Stage 2 would commence approximately 6–12 months following completion of Stage 1 works.

Operation of the project is expected to commence from 2024 for a period of approximately 20 years, at which point the project will be extended or decommissioned. Throughout its operational life, certain components and technologies may be replaced and/or upgraded, however such works are unlikely to be intensive. The BESS will operate 24 hours a day, 7 days a week and be operated remotely, with regular infrastructure maintenance undertaken onsite.

2.2 Concept design

The project is subject to detailed design which will be undertaken post-approval. Aspects of the project (including the siting of project elements and construction methodology) are subject to change during the detailed design process; however, all disturbance and works will not lie beyond the development boundary identified on Figure 1.2.

2.3 Construction

2.3.1 Physical disturbance

During construction, the project will require a disturbance area of approximately 19 ha. Vegetation clearing, cut and fill and bulk earthworks will be required to establish desired design levels to facilitate project infrastructure. Gravel cover will be established to allow for a managed surface that is partially permeable. Project infrastructure and equipment will either be established on concrete pads or mounted on skids affixed to the concrete pads. The existing access track will be improved (road base) and extended to the project infrastructure area.

Limited ground disturbance may also be required to facilitate a temporary construction compound/laydown area and washdown area at the site entrance. The siting of this area will be clear of established trees and located mostly within previously disturbed areas.

Areas disturbed during construction and not required for the operation of the project will be rehabilitated following completion of construction. This will include restoration of existing vegetated land covers and drainage paths. An asset protection zone will be established and maintained on an ongoing basis for bushfire protection purposes.

2.3.2 Water use

Water used directly on site for construction is estimated at 10 megalitres (ML), used predominantly for dust suppression purposes. Water sources will be confirmed during detailed design but are likely to include a combination to be sourced from bore water located on the participating landholder's land, municipal water supply (in agreement with the relevant authority) and/or imported water in portable tanks.

2.3.3 Disturbance and activities

Permanent project infrastructure will occupy an area of up to 13 ha. Operational activities will involve periodic maintenance and cleaning of equipment, general office activities and waste removal.

2.3.4 Ancillary infrastructure and utilities

The BESS compound will be supported by ancillary infrastructure, including a control and office building and associated parking for occasional operational staff and visitors. The site will be connected to utilities including communications, electricity and town water supply. Upgrades to the TransGrid Wellington Substation with an additional 330 kV switch bay with power transformers, including switchyard bench extension to the south of the existing bench and relocation of security fencing.

Operational water use will be serviced by a combination of potable water and/or rainwater and licenced groundwater take. Wastewater generated by on-site amenities will be discharged to a septic holding tank, which will be pumped out by an approved licensed contractor when required.

2.3.5 Drainage

A stormwater drainage system, along with other utilities, will be operated for the site. The stormwater drainage system for the site will discharge to Watercourse A, a second order unnamed watercourse to the west of the site (refer Figure 1.2). Watercourse A ultimately drains to the Macquarie River approximately 2 km to the south of the site. Refer to Chapter 5 for a detailed description of the proposed water management system.

2.4 Potential sources of impact

Key potential sources of impact to water resources comprise the following:

- Construction stage impacts, including:
  - ground disturbance during bulk earthworks and installation of site infrastructure, leading to exposure of soils and potential erosion and mobilisation of sediment into receiving drainage systems and watercourses;
  - interception of shallow groundwater if construction earthworks are significant, inducing local drawdown and resulting in reduced availability of water for environmental and third-party users;
  - extraction of groundwater for construction purposes, if significant, leading to local drawdown of the aquifer;
  - contamination of surface waters as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities;
  - disturbance of watercourses and associated riparian zones to support construction activities, leading to instability and/or other poor health outcomes and associated downstream impacts to water quality;
  - increase in site runoff potential as a result of clearing, earthworks, compaction of soils and installation of impervious surfaces, leading to additional runoff leaving the site and impacting downstream properties; and
  - partial blockage or redirection of site runoff as a result of poorly considered construction activities, fencing or storage/stockpile areas, leading to potential stormwater inundation of construction areas or downstream properties, damage to plant and equipment, and potential work health and safety risks.
- Operational stage impacts, including:
  - potential ongoing erosion of soils and mobilisation of sediment into receiving drainage systems and watercourses;
  - contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support operational site activities, or through poor site and vegetation management practices;
  - infiltration of potentially contaminated stormwater to the underlying groundwater resource affecting water quality;
  - increase in site runoff potential as a result of proposed site infrastructure and installation of impervious surfaces leading to additional runoff, or changes in the proportional distribution of drainage contributions, leaving the site and impacting downstream properties; and
  - partial blockage or redirection of floodwaters as a result of poorly considered permanent facilities resulting in inundation of facilities or downstream properties, damage to plant and equipment, and potential work health and safety risks.

These potential sources of impact are described and assessed in Chapter 6.

3 Regulatory framework and context

3.1 NSW regulatory framework

3.1.1 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) establishes the NSW environmental regulatory framework and includes licensing requirements for certain activities. Environment protection licences (EPLs) are administered by the NSW Environment Protection Authority (EPA) under the *Protection of the Environment Operations Act 1997* (POEO Act).

The project is a scheduled activity pursuant to Schedule 1, clause 17 of the POEO Act and an EPL will therefore be required to operate the project.

3.1.2 Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act) is the relevant statute for the regulation of water take from surface and alluvial water sources. The WM Act provides for water sharing between different water users, including environmental, basic rights or existing water access holders and provides security for licence holders. The licensing provisions of the WM Act apply to those areas where a water sharing plan (WSP) has commenced.

WSPs are statutory documents that apply to one or more water sources. They define the rules for sharing and managing water resources within water source areas. WSPs describe the basis for water sharing and document the water available and how it is shared between environmental, extractive and other uses. The WSPs outline the water available for extractive uses within different categories, such as local water utilities, domestic and stock, basic landholder rights, irrigation and industrial uses.

The following WSPs are relevant to the site:

- *Water Sharing Plan for Macquarie-Bogan Unregulated River Water Sources 2012* – the Maryvale Geurie Creek Water Source applies to the surface water in the vicinity of the site; and
- *Water Sharing Plan for NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011* – the Lachlan Fold Belt MBD Groundwater Source applies to the groundwater resource in the vicinity of the site.

No take from the surface water resource is proposed as part of the project, however, water extracted from the participating landholder's existing bore may be utilised to supplement potable water and imported water for construction use and operational irrigation. To use water from bores onsite, a Water Access Licence (WAL) would need to be obtained (refer Section 7.1).

3.2 Dubbo Regional Council requirements

The *Wellington Local Environmental Plan 2012* (Wellington LEP) and *Wellington Development Control Plan 2013* (Wellington DCP) guide planning decisions through zoning and development controls and include considerations for stormwater management, flood risk management and protection of the local Karst groundwater environment. These local planning instruments have been considered in the preparation of this WA.

3.2.1 Wellington Development Control Plan 2013

i Relevant provisions

This WA considers and addresses relevant provisions of the Wellington DCP. The purpose of the Wellington DCP is to provide specific requirements for certain types of development (or locations) and thus support the objectives of the Wellington LEP.

The following development control requirements are specified within the Wellington DCP and are considered relevant to this WA (refer Table 3.1):

- Potable water and stormwater – Section B6;
- Protection of the Karst Environment – Section B7; and
- Flood hazard – Section C2.

Relevant provisions under Section B1 of the Muswellbrook DCP in relation to soil and water management are to be addressed separately via erosion and sediment control plans which will be prepared for the construction stage of the development as part of the detailed design process.

Table 3.1 Compliance with relevant Wellington DCP provisions

Development provision	Relevant controls	Assessment	Compliance
B6 - Potable water and stormwater			
Section 6.3 – Development requirements	• Developments are to incorporate the principles of water sensitive urban design. These include minimisation of impervious surfaces, and use of integrated systems that are used for collecting, reusing, flood controlling and applying treatment to stormwater runoff. Internally, incorporation of water minimisation measures that reduce the demand on potable supplies.	The development design will minimise impervious surfaces and incorporate water sensitive urban design principles (refer Section 5.2). Nominal potable water will be utilised for operation.	Complies
	• The objectives of water management are to be consistent with BASIX and incorporate at least 40% reduction targets in potable water usage through reduction methods and/or rainwater utilisation. This may be achieved by the installation of a suitable sized rainwater tank.	Potable water will be predominantly used for construction and will be supplemented by stormwater reuse and licenced groundwater take (if required). Nominal water use is anticipated for site amenities as the BESS will be largely operated remotely. Operational water use will be serviced by a combination of potable water and/or rainwater and licenced groundwater take.	Complies in principle
	• All developments are required to demonstrate that they will not have an adverse impact on the stormwater flows/flooding of any adjoining land.	Impacts to stormwater flows/flooding are expected to be localised and contained within the project site (refer Section 6.2.3).	Complies

Table 3.1 Compliance with relevant Wellington DCP provisions

Development provision	Relevant controls	Assessment	Compliance
	• The development should incorporate fixtures, rated to at least AAA under the National Water Conservation Rating and Labelling Scheme, for taps, showerheads and toilet suites.	Potable water will be predominantly used for construction. Nominal water use is anticipated for routine maintenance (eg cleaning) and site amenities as the BESS will be largely operated remotely. Operational water use will be serviced by a combination of potable water and/or rainwater and licenced groundwater take.	Complies in principle
	• Where stormwater discharge to the street frontage and on site stormwater detention is not practical, the DA must include the written agreement from all downstream property owners stating that they have no objection to the discharge of stormwater through their properties to reach Council's drainage system/Council approved receival point. In addition, if required, downstream property owners do not have an objection to the creation of necessary easements over the pipeline.	The project site's point of discharge will be directly to Watercourse A. No stormwater runoff will be discharged through downstream properties (refer Section 5.2).	Complies
B7 – Protection of the Karst Environment			
Section B7.3 – Land to which this applies	This clause applies to all rural land identified on the *Wellington LEP 2012 Natural Resources - Karst Map*.	The development is located just outside the Mapped Karst.	N/A
C2 – Flood Hazard			
Section C2.5 – Development requirements for building in an unmapped watercourse	Controls also apply where development is located in the base of any watercourse or where land is known to be subject to flood and/or inundation.	The development is located outside of the watercourse extents of Watercourse A (refer Section 7.2.2). A culvert or bed-level crossing across Watercourse A will be incorporated as part of the project detailed design phase. Any flood impacts related to the crossing are anticipated to be localised and will not extend to neighbouring properties.	Complies

3.3 Relevant guidelines

The following guidelines have been considered when preparing this WA.

3.3.1 Floodplain Development Manual

The *NSW Floodplain Development Manual* (DIPNR) is a document published in 2005 by the NSW Government. The document details guidelines consistent with the State government's flood prone land policy which has the primary objective of reducing the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods. At the same time, the policy recognises the benefits from occupation and development of flood prone land.

3.3.2 Guidelines for controlled activities on waterfront land

The Natural Resource Access Regulator (NRAR), part of the NSW Department of Industry (DoI), provides a number of guidelines in relation to works on waterfront land, as defined by the WM Act. These include *Guidelines for controlled activities on waterfront land – riparian corridors* (DoI 2018) and *Guidelines for watercourse crossings on waterfront land* (DoPI 2012). Whilst a Controlled Activity Approval (CAA) is not required for the project due to its SSD designation, relevant guidelines have been considered in the development of the project description and assessment presented in this WA.

3.3.3 Erosion and Sediment Control Guidelines

Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom 2004) provides guidance on best practice erosion and sediment control methods.

3.3.4 Bunding and Spill Management Guidelines

The following NSW Government guidelines detail best practice storage, handling and spill management procedures for liquid chemicals:

- *Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation* (DECC 2005); and
- *Storing and Handling Liquids: Environmental Protection: Participant's Manual* (DECC 2007).

3.3.5 Australian Rainfall and Runoff

Australian Rainfall and Runoff, 2019 edition (Ball et al 2019) (ARR 2019) is a national guideline document, data and software suite that can be used for the estimation of design flood characteristics in Australia.

3.3.6 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) provides guidance on monitoring, assessing and managing ambient water quality in a wide range of water resource types and according to specified environmental values, such as aquatic ecosystems, primary industries, recreation and drinking water. The guidelines provide a framework for:

- establishing water quality objectives;
- assessing and managing water quality for environmental values; and
- establishing protection levels, water quality indicators and trigger values.

Environmental values associated with the waterways and water sources surrounding the site include primary industry, aquatic ecosystems, recreational users, irrigation and stock watering.

Watercourse A is considered to be a “slightly to moderately disturbed” system, due to the impact of disturbance in the catchment associated with past and ongoing agriculture. The watercourse is also classified as an “upland river” as the elevation of the site is greater than 150 m.

3.4 Water quality and river flow objectives

The *NSW Water Quality and River Flow Objectives* (DECCW 2006) provides Water Quality Objectives (WQOs) that are consistent with ANZG (2018) water quality guidelines for the protection of the aquatic environment. The WQOs are “primarily aimed at maintaining and improving water quality, for the purposes of supporting aquatic ecosystems, recreation and where applicable water supply and the production of aquatic foods suitable for consumption and aquaculture activities” (DECCW 2006).

WQOs are provided for catchments throughout NSW (DECCW 2006). The primary watercourse that can potentially be impacted by the project is Watercourse A, which lies within the Macquarie-Bogan River Catchment.

Table 3.2 summarises the WQOs and river flow objectives (RFOs) for uncontrolled streams within the Macquarie-Bogan River Catchment and applicability to the site.

Table 3.2 Application of water quality and river flow objectives

Environmental value	Objective	Application to Watercourse A and Macquarie River
WQOs		
Aquatic ecosystems	Maintaining or improving the ecological condition of water bodies and their riparian zones over the long term.	Watercourse A is an ephemeral stream and unlikely to support aquatic ecosystems; however, there are aquatic ecosystems further downstream of the project within the Macquarie River. The protection of aquatic ecosystems is the primary water quality objective to be met.
Visual amenity	Aesthetic qualities of waters.	There are no public views or access to the site, watercourse adjacent to the project area or immediate downstream areas.
Secondary contact recreation	Maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed.	There is no public access to the watercourse adjacent to the project area or immediate downstream areas.
Primary contact recreation	Maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed.	There is no public access to the watercourse adjacent to the project area or immediate downstream areas.
Livestock water supply	Protecting the water quality to maximise the production of health livestock.	Some downstream users may use water from Watercourse A for stock.
Irrigation water supply	Protecting the quality of waters applied to crops and pasture.	It is unlikely that downstream users extract water from Watercourse A for agricultural purposes. However, downstream agricultural users are likely to extract from the Macquarie River downstream of Watercourse A.
Homestead water supply	Protecting water quality for domestic use in homesteads, including drinking, cooking and bathing.	It is unlikely that any downstream users extract water from Watercourse A or the Macquarie River downstream of the site for homestead water supply.

Table 3.2 Application of water quality and river flow objectives

Environmental value	Objective	Application to Watercourse A and Macquarie River
Drinking water at point of supply – Disinfection only Drinking water at point of supply – Clarification and disinfection Drinking water at point of supply – Groundwater	These objectives apply to all current and future licensed offtake points for town water supply and to specific sections of rivers that contribute to drinking water storages or immediately upstream of town water supply offtake points. The objective also applies to sub-catchments or groundwaters used for town water supplies.	Town water supply to Wellington is sourced from the Macquarie River upstream of its confluence with Watercourse A. No water is extracted from Watercourse A downstream of the project area for town water supply.
Aquatic foods (cooked)	Refers to protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities.	Recreational fishers may use downstream waterways. However, the trigger values for aquatic foods apply to aquaculture not recreational fishing. The required level of protection will be provided by meeting the trigger values for aquatic ecosystems.
RFOs		
Protect pools in dry times	Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows.	The flow regimes in Watercourse A have been modified by land clearing and agriculture within the catchment. Stormwater discharges from the project will enter Watercourse A adjacent to the project area. Hence, the project has potential to impact existing flow regimes in Watercourse A.
Protect natural low flows	Share low flows between the environment and water users and fully protect very low flows.	
Protect important rises in water levels	Protect or restore a proportion of moderate flows and high flows.	
Maintain wetland and floodplain inundation	Maintain or restore the natural inundation patterns and distribution of floodwater supporting natural wetland and floodplain ecosystems.	
Maintain natural flow variability	Maintain or mimic natural flow variability in all streams.	
Manage groundwater for ecosystems	Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems.	Construction of the project is not anticipated to intercept the groundwater table. Some groundwater may be sourced for use in construction; however, this will be nominal and extracted within licenced limits. Groundwater levels are not expected to be impacted by the development.
Minimise the effects of weirs and other structures	Minimise the impact of instream structures.	The proposed crossing of Watercourse A is an instream structure. Hence, this river flow objective is relevant and is assessed in this report.

3.5 Previous studies

The *Wellington Floodplain Risk Management Study* and *Plan* (Wellington Council, 2013) provides flood mapping for the Macquarie River adjacent the township of Wellington completed originally by Evans and Peck in 1996 and updated in 2013. The 1%, 0.5% and 0.2% Annual Exceedance Probability (AEP) events were simulated for the study, along with an 'extreme flood' case, approximating a Probable Maximum Flood (PMF), given the flood mitigation effect of Burrendong Dam.

The *Proposed Solar Farm, Wellington New South Wales – Hydrological and Hydraulic Analysis* (Footprint, 2017) was prepared to support the Wellington Solar Farm Environmental Impact Statement. Flood modelling of Wuuluman Creek was undertaken for this assessment, with simulations of the 20%, 10%, 5%, 2% and 1% AEP events provided as flood mapping.

4 Existing environment

4.1 Overview

This chapter describes the existing water environment and related aspects of the site and regional context as relevant to this WA.

4.2 Land use

The locality surrounding the project contains a variety of landscapes within an agricultural setting. Most of the local and sub-regional setting has been cleared for grazing and/or cultivation. The project is directly south of the Wellington Solar Farm and adjacent and east of the Wellington Substation. The land use zoning of the site under the Wellington Local Environmental Plan 2012 (Wellington LEP) is RU1 Primary Production.

Land uses zoning surrounding the site include:

- RU1 Primary Production associated with rural residences and cropping and grazing activities;
- SP2 Electricity Generating Works associated with the Wellington Substation site;
- SP2 Correctional Centre associated with the Macquarie Correctional Centre and Wellington Correctional Centre north of the site; and
- R5 Large Lot Residential associated with those residences along Goolma Road, Twelve Mile Road, Cadonia Drive, and Cadia Place.

4.3 Topography and vegetation

Land surrounding the project is relatively flat, apart from a hill approximately 600 m east of the project, which rises about 100 m above the majority of the site. The topography around the site is characterised by rolling hills, with elevations ranging from 330–360 mAHD. Slopes at the project site gently grade to the west and towards Watercourse A at approximately 5%. Vegetation near the site consists largely of grassed exotic species with native vegetation often occurring in isolated patches.

4.4 Soils

The predominant soil landscape for the project site is Nanima (na) based on soil mapping from the eSPADE database (OEH 2016). The Bodangora (bz) landscape is present in the north of the project area near Goolma Road and the proposed laydown area. Soils in these landscapes are characterised by sandy clay loams with moderate to high infiltration rates and moderate erosion hazards, however, the bz landscape experiences high erosion hazard under cultivation and low cover levels. The runoff potential from these landscapes is expected to be low.

4.5 Climate

Patched point climate data was obtained from the Scientific Information for Land Owners (SILO) database hosted by the Science Division of the Queensland Government's Department of Environment and Science. SILO patched point data consist of interpolated estimates based on historically observed data from Bureau of Meteorology weather stations. For this assessment, SILO data was obtained for the grid point located at -32.55N, 148.95E.

Table 4.1 presents key information and statistical data calculated from the SILO patched point data between 1970 and 2021. Figure 4.1 presents the average annual rainfall and evaporation rates on a monthly basis calculated from the SILO data.

Table 4.1 Key climate statistics

Key annual statistic	Units	Rainfall	Evaporation
Average	mm/year	631	1,725
Minimum	mm/year	290	1,345
5th percentile	mm/year	347	1,468
10th percentile	mm/year	400	1,545
Median	mm/year	617	1,740
90th percentile	mm/year	875	1,932
95th percentile	mm/year	953	1,983
Maximum	mm/year	1,117	2,076

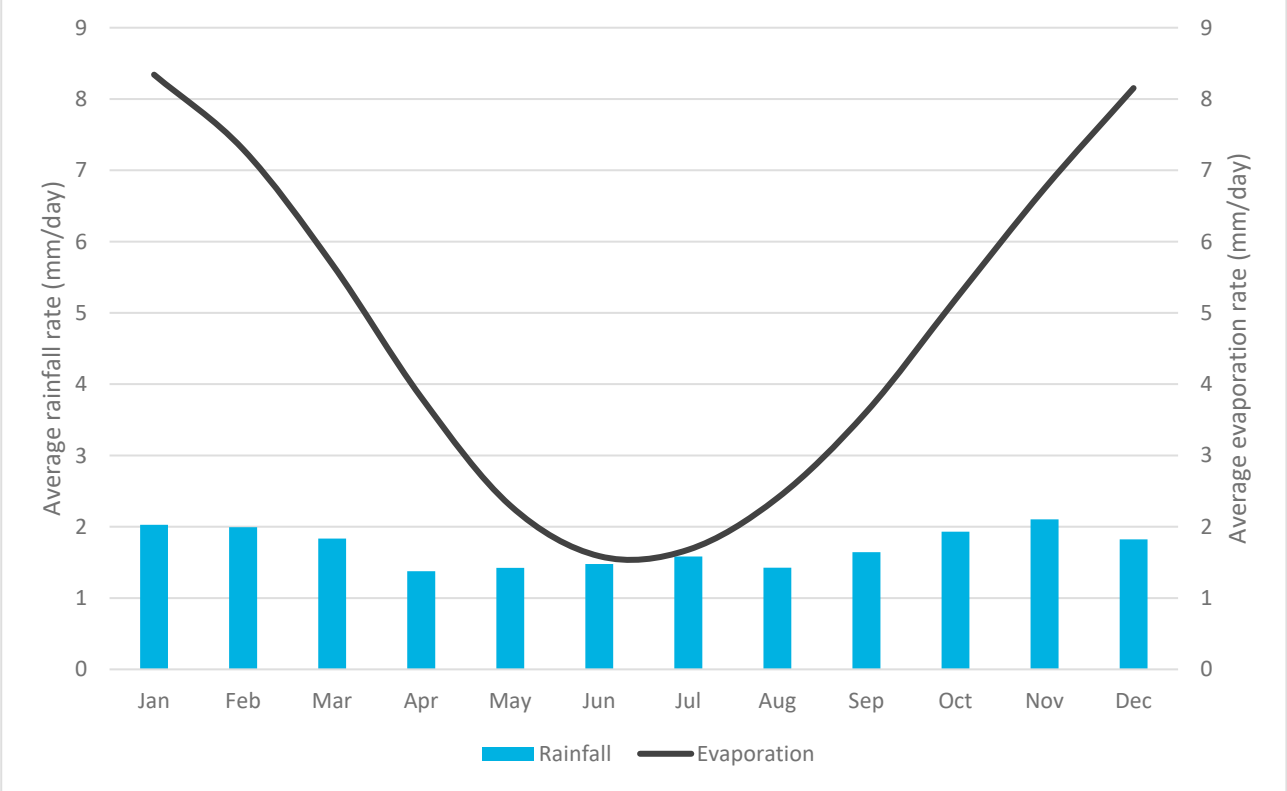


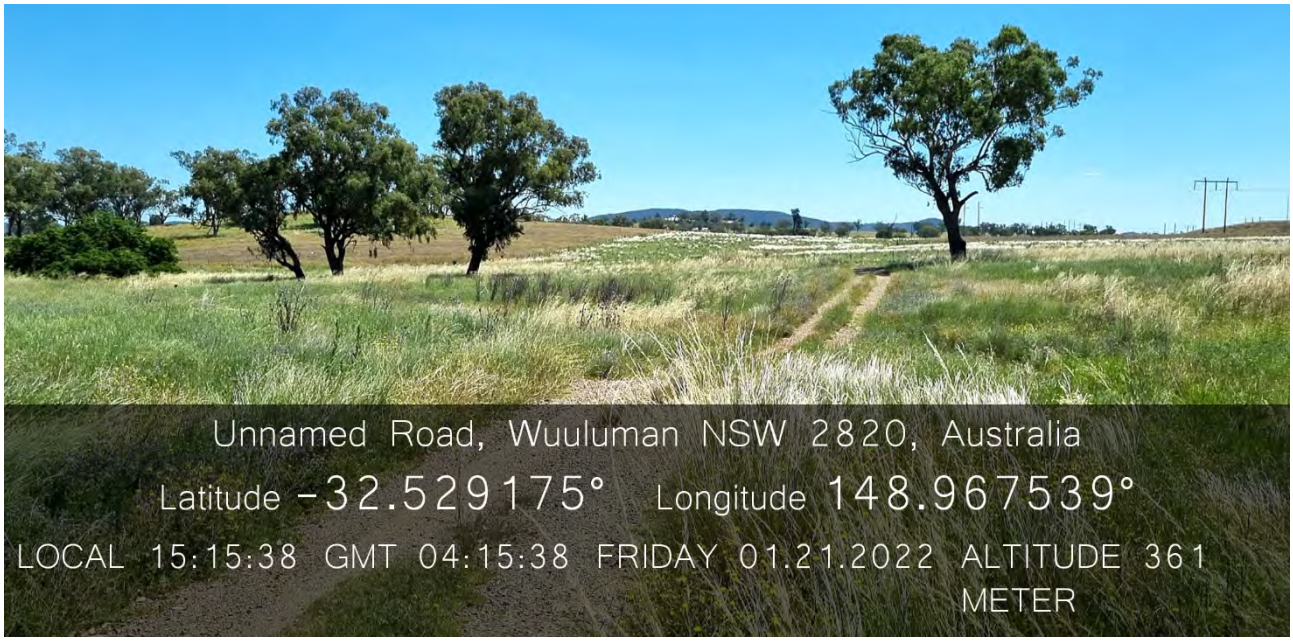
Figure 4.1 Average daily rainfall and evaporation rates

4.6 Hydrology

4.6.1 Local context and site drainage

The hydrologic context for the project and the existing site drainage is presented in Figure 4.2 and Figure 4.3, respectively. The project site is located predominantly within existing agricultural land in the upper reaches of Watercourse A, an ephemeral second order watercourse and tributary of the Macquarie River.

Watercourse A drains an existing catchment area of approximately 84 ha as measured at the downstream end of the project site. To the north of the proposed substation area, two first order drainage channels converge immediately upstream of an existing access track, where Watercourse A crosses the track via an existing bed level crossing (refer Photograph 4.1). Watercourse A then continues as a second order watercourse to the west of the proposed substation, where it crosses a second existing access track via a reinforced concrete pipe culvert (refer Photograph 4.2).



Photograph 4.1 Existing bed level crossing at Watercourse A

Photograph 4.2 Existing culvert crossing at Watercourse A

Minor portions of the project also sit within the Wuuluman Creek and Watercourse B catchments, however, proposed works within these catchments are limited to the construction of very short lengths of access road and a vehicle washdown bay, to be situated at the site entrance off Goolma Road (refer Figure 4.2).

Wuuluman Creek is an ephemeral third order watercourse located to the north of the project area, across Goolma Road adjacent the Wellington Solar Farm. Watercourse B comprises ephemeral first and second order tributaries which subsequently join Watercourse A, approximately 900 m downstream of the project site and 1 km upstream of the Macquarie River confluence.

4.6.2 Regional hydrologic context

Watercourse A, Watercourse B and Watercourse C are all tributaries of the Macquarie River, located immediately upstream of the township of Wellington (refer Figure 4.2). Within the vicinity of the project site, the Macquarie River flows generally to the west, forming part of the Macquarie-Bogan River catchment. Burrendong Dam is located on the Macquarie River upstream of Wellington approximately 30 km to the southeast. The dam is a major gated structure which provides irrigation and municipal water supply, hydroelectric power generation and is also used for flood mitigation, controlling downstream flood levels in the Macquarie River.

4.6.3 Water quality

No known water quality monitoring data is available for surface water runoff generated within the site.

The water quality of the Macquarie River downstream of Burrendong Dam been rated by DPIE (2020) as fair. Water quality degradation occurring within the catchment is likely to result from a number of factors including historical grazing practices, bank and riparian condition, the presence of carp in watercourses and changes to the natural flow regime, particularly from the presence of Burrendong Dam.

4.6.4 Flooding

In the event of extreme flooding, of a magnitude similar to the PMF, the Macquarie River is predicted to reach approximately 310 mAHD at the downstream reaches of Watercourse A (Wellington Council, 2013). The project site is situated above 335 mAHD, meaning that the project lies above the upper limit of river flooding.

The flood extent of Wuuluman Creek up to the 1% AEP event is predicted to remain on the northern side of Goolma Road/Twelve Mile Road, situated away from the project area (Footprint, 2017). There is no current flood information available for Watercourse A, B and C, however, these watercourses have relatively small catchments limited to the local topography.

4.7 Hydrogeology

The project site falls within the Lachlan Fold Belt geological structure. Bedrock within the structure consists of felsic volcanics, shales and sandstone fractured rocks which are overlain by colluvial deposits and shallow alluvium.

Two groundwater systems are present near the project site:

- a shallow system residing in the shallow colluvium and unconsolidated sediments; and
- a deeper system associated with the underlying fractured rock.

Based on a review of bore logs from MinView (DPE 2018), groundwater levels within the fractured rock aquifer range from approximately 10–30 metres Below Ground Level (mBGL) near the project site. Levels within the colluvium/alluvium are likely to vary depending on the depth to bedrock (OEH 2016). Flow direction of both systems is expected to be southerly toward the Macquarie River.

Salinity risk is generally very localised and present at minor seasonal sites behind structures on mid-slopes where groundwater discharges at the surface, with larger salinity sites present on big colluvium flats. Salinity of groundwater ranges from 4,000–12,000 microsiemens per centimetre (µS/cm) (OEH 2016).

With reference to the Bureau of Meteorology's (BOM) *Australian Groundwater Explorer* (BOM 2020a), six registered landholder bores are recorded within a one km radius of the site, outlined in Table 4.2.

Table 4.2 Registered groundwater bores within 1 km

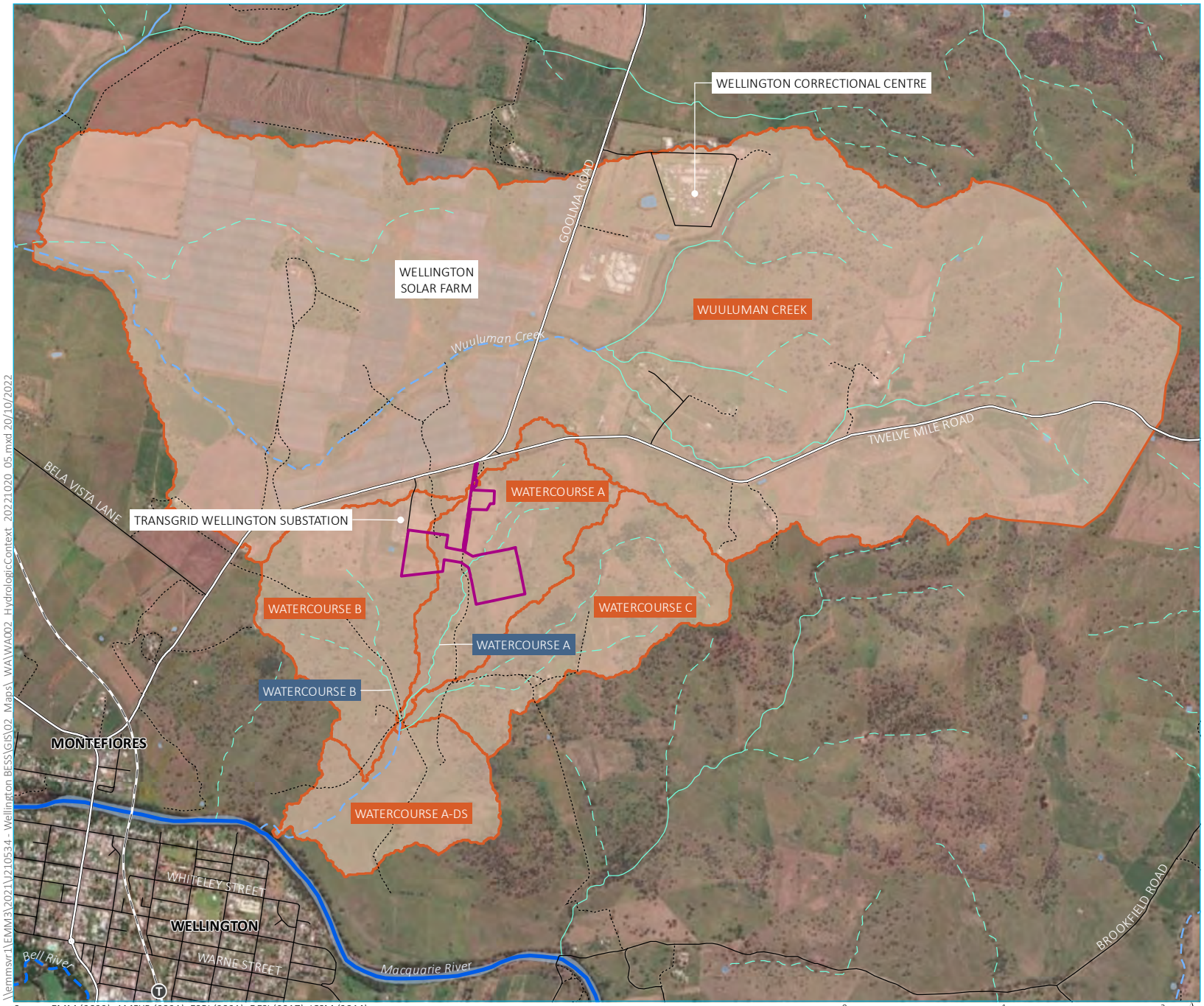
State Bore ID	Licence	Bore depth (m)	SWL (mBGL)	Drilled date	Purpose	Assumed screened lithology
GW803289	Unknown	50.0	22.0	27-10-2006	Stock and Domestic	Fractured rock
GW016606	80WA709209	12.2	Unknown	Unknown	Water Supply	Fractured rock
GW016601	80WA709208	9.1	Unknown	Unknown	Stock and Domestic	Fractured rock
GW016604	80WA709206	15.2	Unknown	Unknown	Stock and Domestic	Fractured rock
GW016605	80WA709207	19.8	Unknown	Unknown	Stock and Domestic	Fractured rock
GW016647	80WA709081	10.4	Unknown	Unknown	Stock and Domestic	Fractured rock

The Wellington Caves System, a high priority listed groundwater dependent ecosystem (GDE), is located approximately 7.5 km south of the project and is highly unlikely to be impacted through construction or operation of the project.

There are several low potential terrestrial GDE's surrounding the site, as characterised in the BOM's *Groundwater Dependant Ecosystems Atlas* (BOM 2020b), including:

- *Eucalyptus albens/Acacia decora, Acacia implexa, Acacia deanei subsp. paucijuga/Themeda austra*; and
- *Maireana microphylla, Pimelea neo-anglica, Pimelea neo-anglica, Sclerolaena birchii/Dichanthium*.

All terrestrial GDEs are mapped at the southern extent of the project site near the substation and BESS compound. Low potential terrestrial GDEs are likely to be opportunistically dependant on groundwater and are therefore unlikely to be impacted by the project. No aquatic GDEs are present at the project site.



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Source: EMM (2022); AMPYR (2021); ESRI (2021); DFSI (2017); ICSM (2014)

Hydrologic context

Wellington Battery Energy Storage System
Water assessment
Figure 4.2

EMM
creating opportunities

Source: EMM (2021); AMPYR (2021); ESRI (2021); DFSI (2017); ICSM (2014)

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KEY

- Development boundary
- Project components
- Indicative asset protection zone (10 m)
- Indicative transmission connection corridor
- Indicative TransGrid substation upgrade core infrastructure area
- Indicative TransGrid substation upgrade disturbance area
- Battery Energy Storage System (BESS) (battery rows offset at 6 m spacing and setback from substation)
- Substation
- Washdown bay
- Construction laydown
- Indicative landscaping (post construction)
- Access road
- Causeway
- Reinforced concrete pipe culvert
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Existing site drainage

Wellington Battery Energy Storage System
Water assessment
Figure 4.3

EMM creating opportunities

5 Proposed water management

5.1 Overview

This chapter describes the proposed water management approach for the project.

5.2 Proposed water management approach

5.2.1 Construction phase

The project is well located with access to a number of potentially secure water supplies within close proximity to the site. Potential water sources have been outlined below in order of preferred option:

1. Groundwater bore – access to the local groundwater source (the Lachlan Fold Belt MBD Groundwater Source) either via arrangements with the landholder with an existing water bore or construction of a new water supply bore within the proposed project boundary. Pump testing would be required to ensure the existing water bore has the required capability, capacity and quality of water required, if the existing water bore is to be used. A Water Access Licence (WAL) would need to be established and entitlement could be secured, either temporally or permanently via the water trading market. There are significant volumes of water entitlement within this water source and the trading market is well established. Alternatively, entitlement could be bid for in future Controlled Allocation Orders that are likely to include this water source.

2. Local water utility – arrangement could be entered into with the local utility (Dubbo City Council) to connect to the Wellington town water supply network. This would be considered to be a commercial agreement between AMPYR and Dubbo City Council and would not require any licenses or approvals under the *Water Management Act 2000*.

3. Independent pump site – due to the proximity of the regulated Macquarie River, an independent pump site and works could be established to pump water to the project. Legal access to a suitable pump site and pipeline would need to be established and a WAL would need to be established and entitlement could be secured, either temporally or permanently via the water trading market. There are significant volumes of water entitlement within this water source (the Macquarie and Cudgegong Regulated Rivers Water Source) and the trading market is well established.

As a State Significant Development, requirements for work approvals under the Water Management Act for works associated with options 1 and 3 would be exempt (see clause 4.41(1)(g) of the *Environmental Planning and Assessment Act*, 1979). A Miscellaneous Work would need to be granted to link the works to any resulting WAL. Ongoing operational water requirements are minimal and could be satisfied by capture of rainfall from roof runoff, supplemented by any of the options provided above.

Prior to construction, an erosion and sediment control plan (ESCP) will be developed as part of the overall construction environmental management plan (CEMP) to address temporary and site-specific risks to water quality and drainage during the construction phase. A range of proposed measures for adoption in the CEMP are provided in the Land, Soils and Erosion Assessment (LSEA) (EMM 2022). Measures provided in the LSEA include details for:

- minimising the extent and duration of land disturbance;
- controlling water movement through the site;
- minimising soil erosion;
- promptly stabilising disturbed areas;
- maximising sediment retention on site;
- maintaining drainage, erosion and sediment control measures;
- monitoring and adjustment protocols for drainage, erosion and sediment control practices to achieve the desired performance standard; and
- drainage, erosion and sediment control personnel competence.

In addition to the above, the CEMP will include measures to:

- implement procedures for hazardous material storage and spill management as defined in NSW EPA guidelines (refer Section 3.3.4);
- consider weather preparedness and response planning; and
- identify requirements for monitoring and maintenance of water management and drainage systems.

5.2.2 Operational phase

A conceptual approach to water management for the project has been developed to inform this WA. This will be subject to further design development as part of future detailed design.

The proposed water management approach has been developed with consideration of several key objectives, described in Table 5.1, consistent with best practice approaches and methods for stormwater management as defined by the Wellington DCP. The proposed approaches are widely adopted for site water management and can therefore be effectively integrated with proposed site infrastructure and designs.

Table 5.1 Water management objectives and approach

Water management objectives		Approach
WM_1	Site stormwater will discharge from the site at a defined receival point.	• Stormwater will discharge from the site into Watercourse A to the west of the substation. No stormwater will be discharged through adjacent properties.
WM_2	Avoid uncontrolled discharge from site of stormwater generated on developed areas.	• Adopt a site grading that falls generally to the west towards Watercourse A (refer WM_1). • Any concentration of flow is to be directed to the proposed water management basin for treatment ahead of discharge.
WM_3	Minimise the extent of hardstand/impervious areas to reduce the additional volume of stormwater generated on site.	• Maximise retention of existing grassed areas. • Maximise use of gravel and/or other more permeable surfaces in lieu of hardstand/impervious treatments (eg for access road and areas surrounding battery infrastructure).
WM_4	Provide stormwater collection and conveyance systems to control stormwater generated on developed areas.	• All drainage systems to direct runoff to the proposed water management basin, which subsequently flows to Watercourse A (refer WM_1). • Vegetated swale drains to be used to the extent practicable. • Piped drainage systems and/or concrete lined open drains to be used only where necessary.
WM_5	Promote on-site infiltration of stormwater where feasible and practical, to minimise the need for flow and water quality management measures.	• Design of the site water management basin to consider infiltration where practical.
WM_6	Provide water quantity controls to ensure peak flow rates discharging from site are not increased for all events up to and including 1% AEP event.	• The following measures will be implemented to minimise changes to peak flow rates: – maximise retention of grassed areas and minimise increase in imperviousness (WM_3); – vegetated swale drainage systems to the extent practicable to promote physical screening of mobilised sediments and infiltration of stormwater into soils (WM_4); – infiltration of stormwater, where feasible (WM_5); and – stormwater detention via a proposed water management basin for events up to the 1% AEP event. The size and configuration of the water management basin will be determined at detailed design.
WM_7	Provide water quality controls that collectively meet industry standard pollutant load reductions as follows: • 70% reduction in gross pollutants; • 80% reduction in total suspended solids; • 45% reduction in total phosphorous; and • 45% reduction in total nitrogen.	• The following measures will be implemented to meet the proposed pollutant load reduction targets: – maximise retention of grassed areas and minimise increase in imperviousness (WM_3); – vegetated swale drains to be used to the extent practicable (WM_4); and – infiltration of stormwater (WM_5), where feasible. • If necessary, the water management basin could be configured as a dual purpose basin (ie have a combined water quality and water quality function) if required to meet the proposed load reduction targets. The need for the water quality function and associated sizing supported by MUSIC modelling, would be confirmed during detailed design.

Table 5.1 Water management objectives and approach

Water management objectives		Approach
WM_8	Specific stormwater management measures will be provided for the substation area.	• Measures will include the following (consistent with EPA bunding and spill management guidelines): – diversion of clean runoff away from potentially oil-contaminated areas; – bunding of potentially oil contaminated areas; and – provision of appropriate stormwater treatment devices to remove oil/grease, hydrocarbons and sediment from runoff prior to discharge, if required.
WM_9	Minimise site water requirements. Maximise reuse of stormwater and other water sensitive strategies to lower demand from external sources.	• Water demand for operational purposes is negligible. Potable connection to mains supply is assumed for minor/incidental use and will be supplemented by reuse from a rainwater tank.
WM_9	Minimise the interaction of undisturbed and disturbed site runoff.	• Provide clean water diversions around the site, discharging into Watercourse A.
WM_10	Provide flood protection to project assets and avoid offsite flood impacts.	• Incorporate Watercourse A flooding estimates within the detailed design.
WM_11	Maintain condition and functionality of water management infrastructure.	• Monitoring and maintenance plan to be developed as part of future detailed design.

Key aspects of the proposed water management approach are presented conceptually in Figure 5.1, in particular:

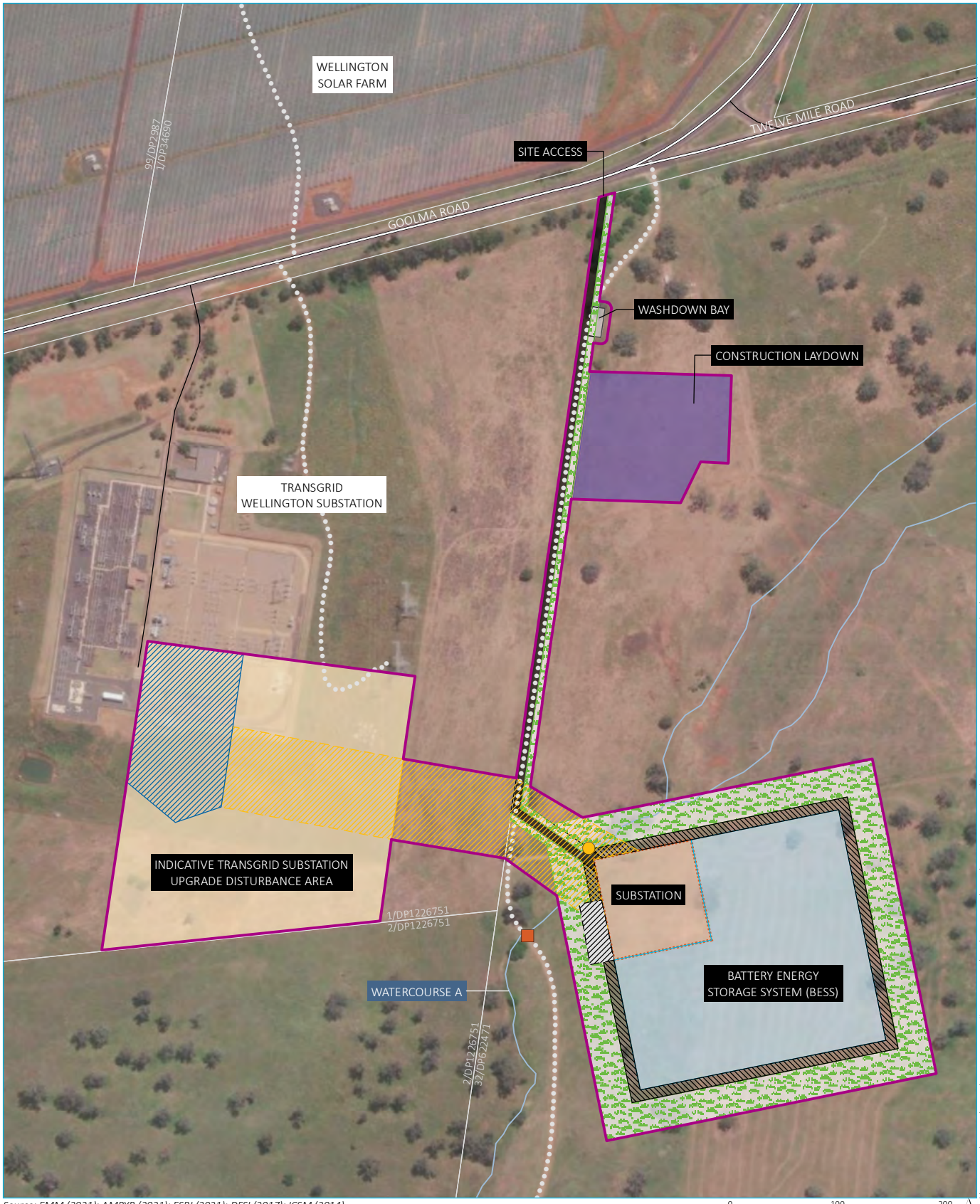
- the assumed point of discharge from the site to Watercourse A (refer WM_1 in Table 5.1);
- proposed catchment areas draining to points of discharge from the site; and
- an indicative location for a water management basin to the west of the substation that could provide attenuation and treatment of stormwater to achieve both flow management and water quality control objectives (refer WM_6 and WM_7, respectively, in Table 5.1).

Water management will be further refined and finalised during detailed design consistent with the above objectives.

5.3 Flood management

During detailed design of the project, a new crossing of Watercourse A will be required to provide access to the substation and BESS compound. The detailed design will incorporate either a bed level crossing or culvert crossing to cater for an appropriate level of service for the project site and consider the flood potential of Watercourse A. The crossing is to be designed and constructed in accordance with DoPI (2012) to minimise the erosion and scour potential of the watercourse.

Detailed design for the project, particularly the design of finished levels for the substation, will also consider the flood potential of Watercourse A to minimised impacts to the project assets and surrounding land.



Source: EMM (2021); AMPYR (2021); ESRI (2021); DFSI (2017); ICSM (2014)

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KEY

- Development boundary

Project components

- Indicative asset protection zone (10 m)
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- Indicative water management basin
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- Cadastral boundary

Proposed water management concept

Wellington Battery Energy Storage System
Water assessment
Figure 5.1

EMM creating opportunities

6 Impact assessment

6.1 Overview

Chapter 5 describes the proposed conceptual water management approach for the project. This chapter considers predicted residual impacts, after the implementation of the proposed water management approach. Predicted impacts to water resources are assessed with respect to surface water and groundwater for construction and operation. Water licencing and impacts to waterfront land are discussed in Chapter 7.

6.2 Surface water impacts

6.2.1 Water quality

Stormwater runoff from the site during both construction and operation has the potential to impact receiving water quality.

i Construction

The primary risk to water quality during construction will occur as a result of ground disturbance during earthworks and other site activities, including material handling, installation of battery infrastructure and surrounding areas, new buildings, new substation, trenching for services and grading for new access roads. There is potential that these works will lead to exposure of soils and increase potential risk of erosion and mobilisation of sediment into receiving watercourses.

Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality.

Potential residual risks and impacts are considered minor and manageable with implementation of temporary water and soil management measures that would form part of the ESCP and CEMP (refer Section 5.2.1).

ii Operation

Section 6.2.2 describes the potential for increases in site runoff to Watercourse A during the operational phase of the project. Similarly, there is potential for an increase in stormwater pollutant loads to this receiving environment as a result of an increase in pollutant generation rates associated with the proposed site land use.

Pollutants of concern for the site infrastructure would include typical stormwater pollutants such as gross pollutants (litter and small vegetation/debris), sediment (in the form of increased TSS loads/concentrations) and nutrients (in the form of increased TN and TP loads/concentrations). For the substation area, pollutants and contaminants of concern would also likely include hydrocarbons and oil/grease.

A range of measures to mitigate potential increases in pollutant loads are described in Section 5.2.2. These have the objective of ensuring that relevant pollutant load reduction targets are met, and that specific water quality risks associated with the substation area are addressed. These targets are described under WM_7 and WM_8 in Table 5.1.

On this basis, potential adverse residual impacts to water quality discharging from the site are not anticipated.

6.2.2 Water quantity

Stormwater runoff from the site during both construction and operation has the potential to impact receiving water quantity.

i Construction

During construction there is the potential for a temporary increase in site runoff as a result of clearing, earthworks, compaction of soils and installation of impervious surfaces, leading to additional runoff leaving the project site and impacting downstream properties and receptors.

However, potential construction phase impacts to site runoff volumes and rates are considered minor and manageable with implementation of temporary water and soil management measures that would form part of the ESCP and CEMP (refer Section 5.2.1).

ii Operation

Site runoff potential for the catchment contributing to Watercourse A is likely to increase permanently during the operational phase as the project will involve the replacement of a proportion of the currently pervious grassed areas with:

- hardstand areas that are effectively impervious (eg BESS compound, and substation area); and
- other areas with higher imperviousness than existing grass cover (eg gravel access roads and areas surrounding battery infrastructure).

The increase in runoff potential will be mitigated by the range of measures described in Section 5.2.2. These have the objective of ensuring that peak flow rates are not increased for events up to and including the 1% AEP event. On this basis, potential operational phase impacts to peak flow rates discharging from the site are not anticipated.

6.2.3 Flood impacts

The only potential flood impact mechanism for the project site is from local flooding within Watercourse A (refer Section 4.6.4). Impacts associated with Watercourse A flooding have not been assessed but are expected to be localised to the site and immediate surrounds and are not expected to extend to offsite properties. The flood potential of Watercourse A will be considered during detailed design to inform construction planning and also the final design of permanent infrastructure to ensure adequate protection of sensitive infrastructure (refer WM_10).

6.3 Groundwater impacts

Design of the project is likely to require minor earthworks to provide finished levels for the substation and BESS compound. Excavation during construction is expected to be less than 10 m and therefore unlikely to intercept the fractured rock lithology where neighbouring bores are screened (refer Section 4.7).

Infiltration of stormwater runoff to the underlying soils and groundwater system is likely to occur via the water management system, however, the residual water quality of stormwater will be limited to conventional treated stormwater (refer Section 5.2). Water sourced during construction may be supplemented by minor (<10 ML) groundwater take. However, any take from the groundwater source will be undertaken via a licenced water supply approval (refer Section 7.1) and would be arranged prior to the commencement of construction.

As such, the project is not expected to have any adverse impacts on groundwater levels or quality.

6.4 Assessment against WQOs and RFOs

Table 6.1 assesses the performance of the proposed water management system against the WQOs and RFOs.

Table 6.1 Assessment of water quality and river flow objectives

Environmental value	Objective	Potential impacts
WQOs		
Aquatic ecosystems	Maintaining or improving the ecological condition of water bodies and their riparian zones over the long term.	No impacts to aquatic ecosystems are expected as the water quality of stormflows is expected to be similar to the water quality of the receiving environment during discharge.
Visual amenity	Aesthetic qualities of waters.	There are no public views or access to the site watercourse adjacent to the project area or immediate downstream areas. Storm flows are also not expected to have elevated concentrations of oils, suspended solids, petrochemicals and floating debris and nuisance organisms such as algae.
Secondary contact recreation	Maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed.	There is no public access to the watercourse adjacent to the project area or immediate downstream areas and no impacts to secondary or primary contact recreation activities are expected as the water quality of site runoff is expected to be similar to the water quality of the receiving environment during discharge.
Primary contact recreation	Maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed.	
Irrigation water supply	Protecting the quality of waters applied to crops and pasture.	No impacts to downstream irrigators are expected as the water quality of site runoff is expected to be similar to the water quality of the receiving environment during discharge.
Homestead water supply	Protecting water quality for domestic use in homesteads, including drinking, cooking and bathing.	It is unlikely that any downstream users extract water from Watercourse A or the Macquarie River downstream of the site for homestead water supply. Hence, impacts to homestead water supply are not assessed and assumed negligible.
Drinking water at point of supply - Disinfection only Drinking water at point of supply - Clarification and disinfection Drinking water at point of supply - Groundwater	These objectives apply to all current and future licensed offtake points for town water supply and to specific sections of rivers that contribute to drinking water storages or immediately upstream of town water supply offtake points. The objective also applies to sub-catchments or groundwaters used for town water supplies.	Town water supply to Wellington is sourced from the Macquarie River upstream of its confluence with Watercourse A. No water is extracted from Watercourse A downstream of the project area for town water supply. Hence, impacts to drinking water supply are not assessed and assumed negligible.
Aquatic foods (cooked)	Refers to protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities.	It is likely that recreational fishers use the Macquarie River. However, the trigger values for aquatic foods apply to aquaculture not recreational fishing. The required level of protection will be provided by meeting the trigger values for aquatic ecosystems.

Table 6.1 Assessment of water quality and river flow objectives

Environmental value	Objective	Potential impacts
RFOs		
Protect pools in dry times	Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows.	No impacts to river flow objectives are expected as: • no extraction from any watercourse is proposed; and • whilst an increase in runoff volume leaving the site is expected due to the proposed land use, peak flows will be attenuated by the proposed water management basin. The site also represents a very minor percentage of the overall Macquarie River catchment, indicating that the potential for a material change to flow the major receiving water environment is low.
Protect natural low flows	Share low flows between the environment and water users and fully protect very low flows.	
Protect important rises in water levels	Protect or restore a proportion of moderate flows and high flows.	
Maintain wetland and floodplain inundation	Maintain or restore the natural inundation patterns and distribution of floodwater supporting natural wetland and floodplain ecosystems.	
Maintain natural flow variability	Maintain or mimic natural flow variability in all streams.	
Manage groundwater for ecosystems	Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems.	Groundwater take may be required to supplement construction water use. However, this will be relatively minor and undertaken through a licenced water supply approval.
Minimise the effects of weirs and other structures	Minimise the impact of instream structures.	The proposed crossing of Watercourse A has the potential to impact flows, but would be designed in accordance with best practice and relevant guidelines.

7 Water licencing and approvals

7.1 Water licensing

Stormwater reuse is likely to be undertaken during construction, in line with best practice water management. Water extraction (or water take) from disturbed areas is excluded works under the *Water Management (General) Regulation 2018.* No other surface water take or capture is proposed. Accordingly, the project is not expected to have any requirements for surface water licensing.

Groundwater may be sourced from an existing landholder bore, subject to approvals, for construction uses and to supplement rainwater, where required, for irrigation of the visual screening during operation. To use water from the existing bore (or a new bore), a WAL will need to be obtained either by entering the water trading market or via a Controlled Allocation Order (CAO). The number of shares available for the Lachlan Fold Belt MDB Groundwater source in the 2021 CAO was 5,125, demonstrating sufficient depth in the market.

7.2 Water approvals

7.2.1 Work approval

Providing the existing landholder's bore is sufficient to supply water potentially required to supplement construction and operation, a water supply work approval (WA) will be required to change the approved usage of the bore from stock and domestic use to water supply use.

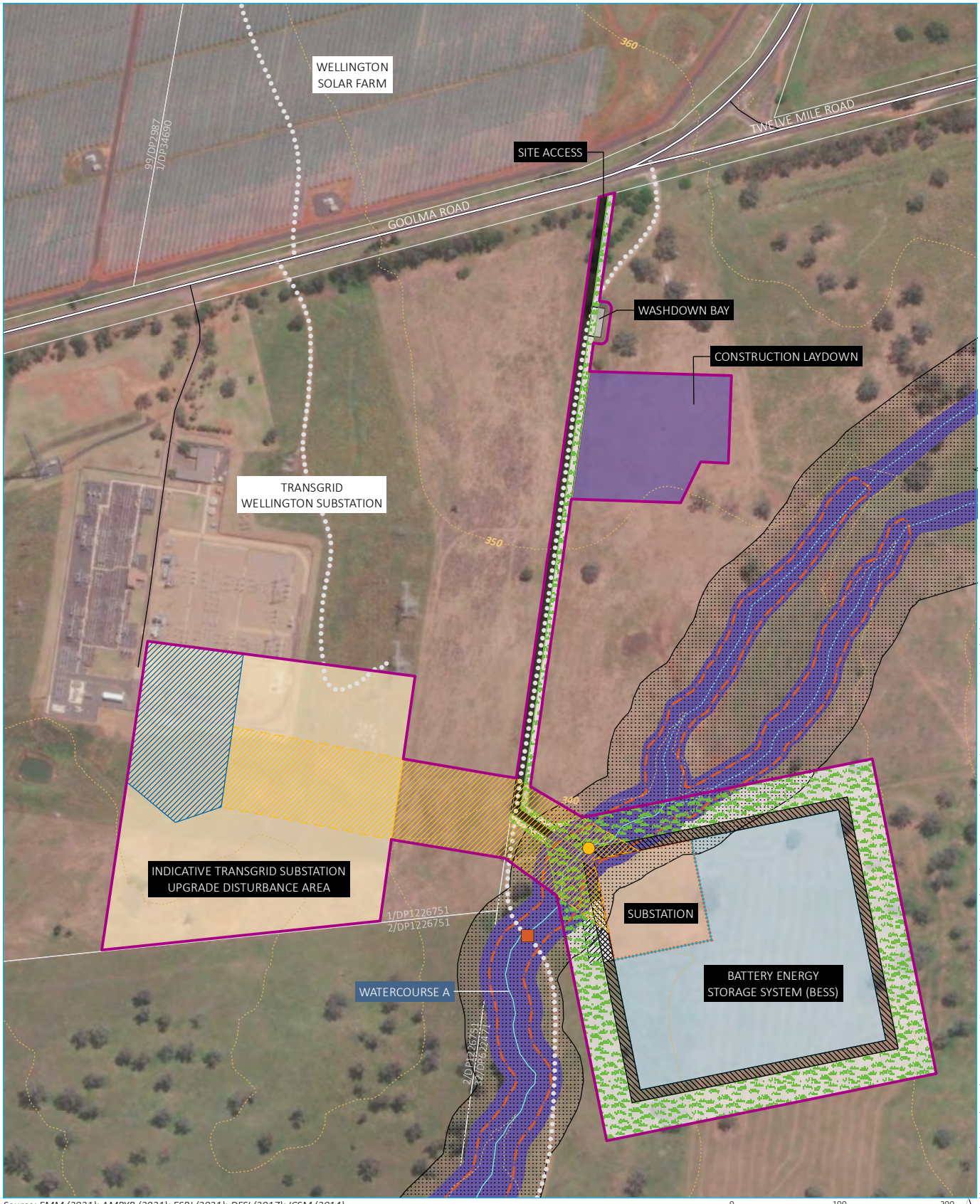
7.2.2 Impacts to waterfront land

The WM Act defines waterfront land as the bed and bank of any river, lake or estuary and all land within 40 m of the highest bank of the river, lake or estuary, as mapped by the Water Management (General) Regulation 2018 hydroline dataset. The extent of waterfront land in the vicinity of the project has been determined and is presented in Figure 7.1. This shows that works will be required on waterfront land associated with Watercourse A. Whilst a CAA is not required for the project due to its SSD designation, relevant guidelines have been considered in the development of the project description and assessment with a view to minimising potential impacts to the riparian corridor.

The primary objective when considering the merits of works on waterfront land is to maintain or enhance riparian corridor health and function. Riparian corridors perform a range of important environmental functions (DoI 2018). These are listed in Table 7.1 along with an assessment of potential impacts the development could have on the Watercourse A riparian corridor. It is noted that for the current conceptual site layout, the substation location shows a minor encroachment on the Inner 50% of the Vegetated Riparian Zone (VRZ). The final siting of the substation infrastructure will be determined during detailed design, where it will be sited to avoid the Inner 50% of the VRZ, where possible.

Table 7.1 Assessment of riparian corridor impacts to Watercourse A

Environmental function	Potential impacts
Providing bed and bank stability and reducing bank and channel erosion.	Erosion potential of the channel bed will be limited by the mitigation measures described in Section 5.2. Scour protection will also be provided for the spillway of the water management basin.
Protecting water quality by trapping sediment, nutrients and other contaminants.	The development is predominantly located outside of the VRZ, with opportunity to offset VRZ encroachments upstream and downstream of the development boundary.
Providing diversity of habitat for terrestrial, riparian and aquatic plants (flora) and animals (fauna).	Habitat is to be maintained within the VRZ and available offset areas surrounding the development.
Providing connectivity between wildlife habitats.	Connectivity of wildlife habitat can be maintained along the VRZ and available offset areas surrounding the development.
Conveying flood flows and controlling the direction of flood flows.	The conveyance of flood flows is unlikely to be impacted by the development in this location. The direction of flood flows during frequent events will be maintained with the development provision of the Watercourse A crossing. Any potential impacts of less frequent events will be temporary and localised.
Providing an interface or buffer between developments and waterways.	An interface buffer is achievable with the VRZ and available offset area surrounding the development.
Providing passive recreational uses.	The area in question is unlikely to serve in any recreational capacity.



Source: EMM (2021); AMPYR (2021); ESRI (2021); DFSI (2017); ICSM (2014)

0 100 200 m

GDA 1994 MGA Zone 55

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KEY

- Development boundary
- Project components
- Indicative asset protection zone (10 m)
- Indicative transmission connection corridor
- Indicative TransGrid substation upgrade core infrastructure area
- Indicative TransGrid substation upgrade disturbance area
- Battery Energy Storage System (BESS) (battery rows offset at 6 m spacing and setback from substation)
- Substation
- Washdown bay
- Construction laydown
- Indicative landscaping (post construction)
- Access road
- Causeway
- Reinforced concrete pipe culvert
- Indicative water management basin
- Major road
- Minor road
- Vehicular track
- Topographic contour (10 m)
- Cadastral boundary
- Vegetated riparian zone (VRZ)
- Inner 50% of VRZ
- Waterfront land
- Strahler stream order
- 1st order
- 2nd order

Impacts to waterfront land

Wellington Battery Energy Storage System
Water assessment
Figure 7.1

EMM creating opportunities

8 Summary of mitigation measures

A summary of the proposed surface water mitigation and management measures is provided in Table 8.1.

Table 8.1 Summary of proposed mitigation and management measures

Ref.	Aspect	Proposed mitigation measures
General		
G1	Watercourses and riparian corridors	Final project layout to be adjusted, where possible, during detailed design to avoid encroachment into the inner 50% of the vegetated riparian zone along Watercourse A. This should apply to permanent works as well as any temporary works required during construction.
G2	Watercourses and riparian corridors	Detailed design to develop a bed level or culvert waterway crossing design for Watercourse A that is consistent with guidance in DoPI (2012).
Construction		
C1	Water quality	Implementation of erosion and sediment control measures and site rehabilitation and revegetation in accordance with best practice. The LSEA (EMM 2020) describes a range of proposed measures for adoption. Proposed measures will be considered further and formalised as part of detailed design and documented in the CEMP. Access tracks to incorporate appropriate water quality treatment measures such as vegetated swales to minimise the opportunity of dirty water leaving the site and entering waterways. Implementation of procedures for hazardous material storage and spill management to be prepared and documented within the CEMP.
C2	Flooding	Construction site planning at detailed design stage to: • consider flood risk and locate temporary site works, compounds, storage areas and plant/equipment away from flood prone areas where practicable; • ensure connectivity of temporary drainage to Watercourse A and retention of overland flow paths from the site; and • maintain riparian corridor setbacks along watercourses.
C3	Water licencing	A WA is to be obtained to convert the existing landholder bore to a water supply bore and a WAL is to be obtained for the required construction water take, should onsite groundwater sources be utilised to supplement other water sources.
Operation		
O1	Watercourses and riparian corridors	Monitoring of watercourse and riparian corridor condition for Watercourse A immediately adjacent to the project will be undertaken at an appropriate frequency, with maintenance undertaken as required to minimise scouring and erosion in particular in the vicinity of the new watercourse crossing.
O2	Water quality	Continuation of erosion and sediment control and site rehabilitation and revegetation measures as appropriate, and monitoring and maintenance of ground cover vegetation and other stabilised surfaces throughout operation to limit erosion and transport of sediment to watercourses. The LSEA (EMM 2020) describes a range of proposed measures for adoption. Proposed measures will be considered further and formalised as part of detailed design and documented in the OEMP. Implementation of procedures for hazardous material storage and spill management to be prepared and documented within the OEMP.

Table 8.1 Summary of proposed mitigation and management measures

Ref.	Aspect	Proposed mitigation measures
O3	Flooding	Detailed design of project to minimise potential for offsite flooding impacts up to and including 1% AEP event by: • ensuring finished ground levels are constructed at-grade and not materially higher than existing levels, in particular along potential hydraulic controls that could be formed by the proposed internal access roads; • maintaining connectivity of internal stormwater drainage to Watercourse A and retention of overland flow paths from the site; • incorporation of a detention function for the site water management basin, to maintain pre-developed storm flows to existing conditions up to the 1% AEP event; and • maintaining riparian corridor setbacks along watercourses. Flood emergency management protocols and procedures to be developed and documented in a FERP (or equivalent).
C3	Water licencing	The WAL obtained for the required construction water take, will also be required to cover nominal water use for potential irrigation of the visual screening during operation.

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Abbreviations

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AMPYR	AMPYR Australia Pty Ltd
ANZG	*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
BESS	battery energy storage system
BOM	Bureau of Meteorology
CAA	controlled activity approval
CEMP	construction environment management plan
DCP	development control plan
DECC	Department of Environment and Climate Change
DoI	Department of Industry
DPIE	Department of Planning Industry and Environment
DRC	Dubbo Regional Council
EIS	environmental impact statement
EPA	Environment Protection Authority
EP&A Act	NSW *Environmental Planning and Assessment Act*
EPL	environment protection licence
ESCP	erosion and sediment control plan
LEP	local environment plan
LGA	Local Government Area
NEM	National Electricity Market
ML	megalitre
MW	megawatts
MWh	megawatt hours
NRAR	Natural Resource Access Regulator
PMF	probable maximum flood
POEO Act	*Protection of the Environment Operations Act 1997*
RFOs	river flow objectives
SEARs	Secretary's Environmental Assessment Requirements
SILO	Scientific Information for Land Owners

SRD SEPP	State and Regional Development State Environmental Planning Policy
SSD	State significant development
WA	water assessment
WAL	water access licence
WMA	*Water Management Act 2000*
WSP	water sharing plan
WQOs	water quality objectives
VRZ	vegetated riparian zone

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