Appendix P
Surface Water and Groundwater Report

PROJECT BOOST

Penrith HV BESS – Surface Water and Groundwater Report

AUSCONNEX

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Executive summary

Ausconnex are proposing the development of a grid scale high voltage (HV) battery energy storage system (BESS) with a capacity to supply up to 100MW of power and the ability to store up to 200MWh of energy adjacent to the existing Penrith Substation.

This report forms part of the Environmental Impact Statement (EIS) prepared to accompany the HV BESS project classified as a State Significant Development (SSD) under the provisions of Part 4 Division 4.7 of the *Environmental Planning and Assessment Act 1979* to the New South Wales (NSW) Department of Planning, Housing and Infrastructure (DPHI) for determination.

The HV BESS project is proposed in the Penrith local government area in NSW, sited wholly within the existing Penrith substation property boundary. The project is approximately 500m upstream from Boundary Creek, which is a tributary to the Nepean River. The Boundary Creek catchment has an area of 2.45km^2 and is highly urbanised, with a mixture of industrial, residential and pockets of public open space.

The historical land use of the site included impervious surfaces that were removed, or covered with grass around 2018. The site has remained revegetated since. Under Council's stormwater management policy, the proposed change from vegetated land cover to the paved BESS reference design area would normally trigger the need for flood controls to prevent an increase in peak flows leaving the site for a range of storm events. However, given the historical land use, Council may consider that the new development is consistent with the pre-2018 land use and therefore does not present a risk of impact on the adjacent and downstream stormwater network. Notwithstanding this, any increases in peak stormwater discharge from the developed site can be controlled with on-site stormwater detention basin that can be co-located within the fire water storage without increasing the storage footprint.

Hydrologic and water quality modelling of the reference design has been assessed to ensure adequate space is available to accommodate stormwater management measures that will mitigate the impact of the HV BESS project on the surrounding groundwater and surface water including:

- Erosion and sediment controls to capture sediment laden runoff during bulk earthworks and construction.
- Filtration cartridges to manage operational stormwater runoff and contribute to the improvement of water quality in the Hawkesbury Nepean catchment in accordance with Stage water quality objectives.
- On site stormwater detention to manage the increase in peak stormwater runoff generated from the proposed development that would otherwise impact on the capacity of the downstream stormwater network.
- Firewater storage to capture potential contaminants during firefighting operations and store this water for disposal at a licenced off-site facility.

The key potential impacts of the project on surface water and groundwater during construction and operation are as follows:

- Surface water:
  - Minor to moderate water quality impacts due to sediment laden runoff being released to waterways during construction activities such as earthworks, stockpiling, dewatering, and transportation of materials if proper controls/measures are not incorporated.
  - Minor water quality impacts during construction related to mishandling, incorrect storage and or accidental spills of construction materials, hydrocarbons and chemicals.
  - In the event of a fire, minor water quality impacts during operation due to contaminants being mobilised during firefighting.
  - Negligible to minor impacts to geomorphology and hydrology as Project is located outside waterfront lands and increase in impervious areas relatively minor to overall Boundary Creek catchment.

- Groundwater:
  - Unlikely impacts to groundwater flow and levels as excavations are unlikely to intercept groundwater table.
  - Minor to moderate water quality impacts related to mishandling, incorrect storage, accidental spills or firefighting, hydrocarbons and/or chemicals during construction and operation.
- Water Supply and consultation:
  - The project is proposed to be entirely contained within the existing transmission substation site, which is serviced by Sydney Water, provided for by Endeavour Energy. It is assumed that water supply for the project would be supplied by Endeavour Energy as the site would not be subdivided from the overall substation asset. As such, no direct consultation with water suppliers has been undertaken for this EIS. Refer to Appendix C for evidence of water consultation.
  - During construction, water cart services will be brought to the project site and refilled by hire companies as required. Broader construction water requirements will be confirmed during the detailed design phase; however, the site has access to the town water/Sydney Water supply for use as required. Ausconnex has obtained an email agreement from P&M Galea Plant Hire for water cart services (by liquid tanker) for water during construction. Refer to Appendix C for evidence of water consultation.
  - During operations, the project will utilise the existing water infrastructure at the substation; consultation in relation to standard operational water requirements is therefore not considered necessary. During operation, the water service will be limited to amenities block with a single toilet and hand-wash basin, requiring minimal water for operations (estimated ~0.1 kL/yr). Stormwater from the project is proposed to be directed into the existing piped stormwater network for the substation. The project would include hydrants for fire-fighting purposes, which shall use existing mains water supply.

The potential impacts identified above are to be managed and/or mitigated through the following:

- Preparation of a Soil and Water Management Plan (SWMP) and other aspects of the Construction Environmental Management Plan (CEMP) to manage water quality impacts during construction of the Project, including implementation erosion and sedimentation measures and dewatering operations by the construction contractor.
- Proposed on-site stormwater detention will prevent increased stormwater peak flows impacting on the local drainage network and avoid downstream localised flooding.
- Proposed stormwater filtration will achieve Council's adopted pollution reduction targets for waterway health. Modelling shows that discharge to Boundary Creek and Nepean River does not directly worsen water quality during ambient conditions.
- The water retention can capture and temporarily retain firewater for proper management and disposal offsite. A one-way valve will be shut off to prevent contaminated water from entering the stormwater network and waterways. The dam will also provide attenuation of stormwater flows during large storm events.
- Preparation of an Operational Water Management Plan (OWMP) to identify and mitigate operational activities that may pose a risk to water quality, dictate the management and maintenance of the operational basins and define fire water management practices.

There are no unacceptable identified impacts to surface water and groundwater as a result of the project.

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Glossary

Term	Definition
µm/s	Micrometre per second
µS/cm	Micro siemens per centimetre
AEP	Annual Exceedance Probability
ANZG	Australian and New Zealand's Guidelines for fresh and marine water quality
ANZECC	Australia and New Zealand Environment and Conservation Council
ASRIS	Atlas of Australian Soils
BESS	Battery Energy Storage System
BoM	Bureau of Meteorology
CEC	Cation Exchange Capacity
CEMP	Construction Environmental Management Plan
DCP	Development Control Plan
DGV	Default Guideline Value
DPHI (previously DPE)	Department of Planning, Housing and Infrastructure (prior to 1st January 2024 this was the NSW Department of Planning and Environment)
dS/m	DeciSiemens per metre
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
ESP	Exchangeable Sodium Percentage
FID	Final Investment Decision
GDE	Groundwater Dependent Ecosystem
GP	Gross Pollutants
HGL	Hydrogeological Landscape
KFH	Key Fish Habitat
kg/year	Kilograms per year
km	Kilometre
kV	Kilovolt
L	Litres
LEP	Local Environmental Plan
LGA	Local Government Area
m^2/d	Metres squared per day
m AHD	Metres Australian Height Datum
m bgl	Metres below ground level
m/d	Metres per day
meq/100g	Milliequivalent per 100 grams
ML	Megalitres
ML/d	Megalitres/day

Term	Definition
mg/kg	Milligram per kilogram
mg/L	Milligrams per Litre
ML/d	Megalitres per day
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
MW	Megawatts
MWh	Megawatt hours
n.d	No date
NARCliM	NSW and ACT Regional Climate Modelling
NEM	National Electricity Market
NGIS	National Groundwater Information
NorBE	Neutral or Beneficial Effect
NSW	New South Wales
NTU	Nephelometric Turbidity Units
NWQMS	National Water Quality Management Strategy
OSD	On-site stormwater detention basin
OWMP	Operational Water Management Plan
PCC	Penrith City Council
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SWMP	Soil and Water Management Plan
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WM Act	*Water Management Act 2000*
WQO	Water Quality Objectives

1 Introduction

1.1 Secretary's environmental assessment requirements

Aurecon has prepared this surface water and groundwater assessment report for the Project The report has been prepared in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs) SSD 78368474 for the project as well as relevant government assessment requirements, guidelines and policies. The requirements specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1-1.

Table 1-1: Secretary's Environmental Assessment Requirements

Key issues	SEARs to be addressed by the study	Where addressed in this report
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;	An assessment of surface water and groundwater is discussed in Section 6 (construction impacts) and Section 7 (operational impacts). Management and mitigation measures for impacts are provided in Section 8. Please note that a detailed assessment of regional flood impacts is provided in a separate report.
	A site water balance for the development	A site water balance assessment is provided in Section.7.3.
	Details of water requirements and supply arrangements for construction and operation (including consultation with suppliers)	Water requirements for construction and operation activities are provided in Sections 6.1 and 7.1 respectively. As the proposed project is entirely contained within the existing transmission substation site, which is already serviced by Sydney Water, no direct consultation has been undertaken as part of the EIS. It is assumed Endeavour Energy would provide for water under a lease agreement for the site. Ausconnex has obtained an email agreement from P&M Galea Plant Hire for water cart services (by liquid tanker) for water supply during construction. Evidence of water consultation is provided in Appendix C.
	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)	Management and mitigation measures for impacts to groundwater and surface waters are provided in Section 8.
	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;	An assessment of impacts on downstream peak flows that may impact on local drainage function and flood risk are discussed in Section 7.5. Please note that a detailed assessment of regional flood impacts is provided in a separate report.

Key issues	SEARs to be addressed by the study	Where addressed in this report
	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 (2022) 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 closest water body is a constructed pond located 150m west. Therefore, guidelines for waterfront lands not relevant to the Project. Discussion of impacts to key fish habitats and mitigation measures to be according to those guidelines are discussed in Sections 7.4 and 8 respectively.

2 Project description

2.1 Existing land use

Detailed Site Investigation and aerial photography shows that the site was used for substation infrastructure up to 2018. After this time, the infrastructure was decommissioned and the site was converted to grass and tree cover.

Surface water management is provided by a Council drainage network that passes along the western site boundary that discharges to Boundary Creek in the north.

More detail is provided in Sections 5.3.1 and 5.3.2.

2.2 Proposed land use

The Penrith HV Battery Energy Storage System (BESS) project involves the development, construction, and operation of a grid-scale HV BESS with a capacity to supply up to 100MW of power and the ability to store up to 200MWh of energy adjacent to the existing Penrith Substation to meet the growing demands of the local Penrith community.

The Penrith HV BESS project includes the following key components:

- Electrical infrastructure including:
  - a 100MW/200MWh BESS comprised of 48 battery containers installed in enclosures (thermal cabinet) and associated ancillary infrastructure. Lithium-ion phosphate is the preferred Lithium-ion battery chemistry for reasons of safety and widespread availability from BESS Original Equipment Manufacturers (OEM). The battery container includes an integrated AC power inverter;
  - step up transformers, auxiliary transformer and ring main units (RMUs)
  - 33kV switch room and control room;
  - installation of one (1) x 33kV underground cable and entry point for HV BESS cabling to connect the Project to the Penrith Substation via new and existing conduits; and
  - two harmonic filters.
- Other permanent ancillary infrastructure including:
  - earth grading and levelling works to allow for installation of concrete pads for the BESS containers and associated infrastructure;
  - Operation and Maintenance (O&M) building;
  - car parking;
  - security fencing, lighting, signage and lightning protection;
  - fire detection and suppression equipment;
  - internal access road (about 6m wide) and driveway access off Thornton Drive;
  - formalised underground stormwater network,
  - Stormwater management infrastructure including stormwater filters and on-site stormwater detention (OSD) basin
  - vegetation clearance of non-native vegetation; and
  - noise attenuation wall (7m high).

- Temporary construction facilities including:
  - site office;
  - construction compounds and laydown areas; and
  - stormwater and sediment controls for the project site.

The overall project footprint is approximately 0.9ha. This includes the temporary construction facilities as well as the 33kV grid connection.

Typically, BESS containers are 2.8m in height, with a total associated footprint of 50m^2 in area per container. There are 48 battery containers proposed. The BESS containers typically contain internal heating, ventilation and cooling (HVAC) controls.

Figure 2-1 shows the concept design for the Penrith HV BESS project. The final Penrith HV BESS project configuration would be confirmed pending detailed design.

Figure 2-1: Proposed site layout

2.3 Construction of the project

2.3.1 Construction program

The construction of the BESS project is expected to last 15 months. The key construction activities and staging required for the project are detailed in Table 2-1. Prior to undertaking these activities, minor pre-construction work, e.g. geotechnical may need to be carried out to finalise the design and construction methodology.

Table 2-1: Key construction activities and staging

Activity	Time frame	Details
Installation and maintenance of environmental controls	2 weeks – ongoing maintenance throughout program	Daily expectancy of 30 light and 5 heavy vehicles.
Establishment of temporary construction facilities	2 weeks	Daily expectancy of 30 light and 10 heavy vehicles required for: ■ upgrading and/or construction of the: ■ access and internal access roads, ■ laydown area(s), ■ fencing, and ■ construction facilities including site office and amenities;
Site enabling works	1 month	Daily expectancy of 30 light and 15 heavy vehicles required for relocation and removal of existing services;
Infrastructure construction	3 months	Daily expectancy of 30 light and 15 heavy vehicles required for: ■ clearing of vegetation such as tree removal, ■ ground clearing, ■ shallow excavation, and ■ other ground disturbance activities including concrete slab construction and gravel laying to support battery containers, control room, switch houses and a substation;
Equipment installation	3 months	Daily expectancy of 30 light and 15 heavy vehicle for installation of: ■ battery units and ancillary infrastructure;
Testing and commissioning activities	2 months	Daily expectancy of 40 light and 5 heavy vehicles
Removal of temporary facilities and demobilisation	1 month	Daily expectancy of 30 light and 10 heavy vehicles.

2.3.2 Workers and working hours

The construction of the project would take place during standard working hours as per the *Interim Construction Noise Guideline* (DECC, 2009). This includes:

- Monday to Friday: 7.00am-6.00pm
- Saturday: 8.00am-1.00pm
- Sunday and public holidays: no work.

It is estimated a peak workforce of 35 to 40 workers would be required on average during the construction phase.

2.4 Operation of the project

The Project does not require regular attendance by personnel and would be remotely monitored with maintenance visits only, as required.

Maintenance activities that may be required throughout the Project's operational life could include the replacement of BESS components, safety and environmental audits and testing of the equipment. Light vehicles are typically used to undertake such maintenance, while heavy vehicles are likely only required to replace larger components due to unforeseen circumstances. It is noted that maintenance vehicles would not outnumber the construction vehicles and, consequently, would not affect the traffic network. It is anticipated that such works would be undertaken in accordance with an Operational Environmental Management Plan (OEMP).

Information from comparable projects also indicates that very low number of staff members may typically visit site at any given time to carry out maintenance or operational services. Therefore, it can be anticipated that the proposed BESS facility would generate very minimal movements accessing the site and would have negligible impact on general traffic.

2.4.1 Workers and working hours

The project would operate over a 24-hour period 365 days per year and would generally be operated and monitored remotely except for site maintenance.

2.5 Decommissioning of the project

Upon reaching the end of its economic lifespan, the decommissioning of the BESS will entail the safe removal and, where feasible, the repurposing of above-ground components. Efforts will be made to reuse or recycle materials whenever possible. Additionally, land rehabilitation will be carried out as necessary to ensure that acceptable conditions are met in line with relevant approval requirements.

There may also be potential opportunities to replace the BESS or its ancillary infrastructure to prolong its use, which could be examined later during the operational phases.

The expected number of workers, equipment requirements, and programme during the decommissioning phase are Projected to be comparable to those during the construction phase, with similar impacts anticipated.

The standard construction hours established for the Penrith MV BESS project will also apply to the decommissioning process.

3 Legislative and policy context

3.1 Legislation

Table 3-1: Legislation

Document	Relevance to this assessment
Water Act 1912, Water Management Act 2000, and Water Management (General) Regulation 2018	The *Water Management Act 2000* (WM Act) establishes a framework for managing water in NSW. Section 91 of the WM Act discusses activity approvals and notes that there are two types of approvals, namely controlled activity approvals and aquifer interference approvals. The WM Act specifies certain activities as controlled activities when carried out on waterfront land. This is defined as within 40 m of the banks of a river, lake or estuary. Licences, permits and approvals such as a water management work approval under section 90, or an activity approval under section 91 of the *Water Management Act 2000* do not apply to a state significant development project in accordance with sections 1.7 and 4.41 of the EP&A Act. Despite the provision for not needing a controlled activity approval under the EP&A Act, an aquifer interference approval (NSW Aquifer interference Policy (DPI, 2013) discussed below) is still required if the works have potential to impact a groundwater aquifer. Shallow excavations are expected for the project however not anticipated to encounter the groundwater aquifer. Therefore, an aquifer interference approval is not required for the project.
Protection of the Environment Operations Act 1997 (POEO Act)	The *Protection of the Environment Operations Act 1997* (POEO Act) establishes the procedures for issuing licences for environmental protection. An Environment Protection Licence (EPL) is required under Chapter 3 of POEO Act to undertake a scheduled activity or scheduled development work. Under Part 5.3 of the POEO Act, it is an offence to pollute waters unless an EPL is held and the conditions of any discharge in the EPL are met. Schedule 1 of the POEO Act provides a list of activities that require an EPL. None of these activities apply to the project and as such an EPL is not required for the Project specifically.
Fisheries Management Act 1994 (FM Act)	Key Fish Habitat (KFH) are defined under the FM Act (NSW). The presence of KFHs is an indication of ecological value of the watercourse. There are KFH associated with the Boundary Creek, approximately 800m downstream, and Nepean River, approximately 1.5km downstream from the project and the ultimate surface water receptor of the project. Therefore, the FM Act is relevant and applies to the project.
Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2023 Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023	These water sharing plans (WSPs) are defined under the *WM Act 2000*, to protect water source and its dependent ecosystems and basic landholder rights. They are also required to promote sustainable use of water resources, and reserve water for the overall health of the groundwater source and to protect specific ecosystems that depend on groundwater, such as wetlands The project lies within the Greater Metropolitan Region for both unregulated River water and groundwater sources. These WSPs are relevant to this location for water usage by the Project during construction, operation and decommissioning.

3.2 Policies and guidelines

Table 3-2: Policies and guidelines

Document	Relevance to this assessment
National Water Quality Management Strategy (WQA, 2018)	The National Water Quality Management Strategy (NWQMS) is a nationally agreed upon strategy and framework to enable effective water quality management for the delivery of fit-for-purpose water that supports community values. The project should integrate water quality management strategies such that the environmental values of the sensitive receiving watercourses are not adversely impacted.The NWQMS provides guidelines, such as the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, used to select water quality trigger values to protect natural waterways and ecosystems.
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ (2000)	These water quality guidelines were prepared as part of Australia's NWQMS which aims to achieve the sustainable use of Australia's and New Zealand's water resources by protecting and enhancing their quality. This has been superseded by Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). However, certain guideline values are still relevant where ANZG 2018 have not been updated for certain analytes. The ANZECC guidelines have been used to define the WQOs for the project, further discussed in Section 3.3.
Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (ANZG, 2018)	ANZG (2018) provides an update to the ANZECC (2000) default guideline values (DGVs), which are the adopted WQOs selected for the project.
Guidelines for groundwater quality protection in Australia (Australian Government, 2013)	These guidelines are designed to support the overall objective of the National Water Quality Management Strategy 2018, focusing on protecting and enhancing groundwater quality to support the nominated environmental values and preventing groundwater contamination. The guidelines for groundwater quality protection in Australia have been used for interpretation of groundwater quality results discussed in Section 5.5.2.
Penrith Development Control Plan (PDCP) (Penrith City Council (PCC), 2014) Stormwater Drainage Specification for Building Developments (PCC, 2014)	The project is wholly within the Penrith Local Government Area (LGA). Although the project is classified as State Significant Development (SSD) under the provisions of Part 4 Division 4.7 of the *Environmental Planning and Assessment Act 1979*, the project must also consider relevant stormwater development controls outlined in the Penrith City Council's Development Control Plan (PDCP 2014) and Stormwater Drainage Specification for Building Developments (Penrith City Council, 2020). The guidelines have been used to inform the design of the stormwater treatment train, further discussed in Section 3.4.

3.3 Hawkesbury-Nepean catchment water quality objectives

The NSW Water Quality Objectives (WQOs) are the community's agreed values and uses (environmental values) of waterways for all NSW catchments. These underpin environmental impact assessment, catchment management and waterway protection activities.

The project is located within the Boundary Creek catchment, which forms part of the Hawkesbury-Nepean catchment. The Hawksbury-Nepean catchment has no defined current WQOs, however interim WQOs for the Hawkesbury-Nepean catchment were defined by the Healthy Rivers Commission (HRC) under Inquiry into the Hawkesbury-Nepean system (HRC, 1998) for nutrients and chlorophyll-a and approved by the NSW government in September 1999.

The inquiry recommended that non nutrient criteria be adopted from Australia and New Zealand Environment and Conservation Council (ANZECC) (now Australian and New Zealand's Guidelines (ANZG) 2018). Environmental values and WQOs relevant to the project are listed in Table 3-3.

Table 3-3 Water quality objectives for Hawkesbury-Nepean catchment

Environmental Value	Indicator	Numerical guideline value
Aquatic ecosystems – maintaining or improving the ecological condition of waterbodies and riparian zones over the long term. *ANZECC Guideline Trigger Values for lowland rivers in south-east Australia with slightly disturbed ecosystems indicated.*	Total Phosphorus (TP)	30 µg/L
	Total Nitrogen (TN)	500 µg/L
	Chlorophyll-a	10-15 µg/L
	Turbidity	6 - 50 Nephelometric Turbidity Unit (NTU)
	Salinity (electrical conductivity)	125 – 2,200 µS/cm
	Dissolved Oxygen (DO)	85 - 110% saturation
	pH	6.5 – 8.0
	Toxicants	As per ANZG 2018 toxicant guidelines for slightly to moderately disturbed ecosystems.
Visual amenity – aesthetic qualities of waters	Visual clarity and colour	Natural visual clarity should not be reduced by more than 20%. Natural hue of water should not be changed by more than 10 points on the Munsell Scale. The natural reflectance of the water should not be changed by more than 50%.
	Surface films and debris	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour. Waters should be free from floating debris and matter.
	Nuisance organisms	Macrophytes, phytoplankton scums, filamentous algal mats, blue-green algae, sewage fungus and leeches should not be present in unsightly amounts. No quantitative value specified.
Secondary contact recreation – maintaining or improving water quality of activities such as boating and wading, where there is a low probability of water being swallowed	Faecal coliforms, enterococci, algae and blue-green algae	As per the Guidelines for managing risks in recreational water (NHMRC, 2008)
	Nuisance organisms	As per the visual amenity guidelines. Large numbers of midges and aquatic works are undesirable.
	Chemical contaminants	Waters containing chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable of recreation. Toxic substances should not exceed values provided in the Guidelines for managing risks in recreational water (NHMRC, 2008).
	Visual clarity and colour	As per the visual amenity guidelines.
	Surface films	As per the visual amenity guidelines.
Primary contact recreation – maintaining or improving water quality for activities such as swimming where there is a high probability of water being swallowed	Faecal coliforms, enterococci, algae and blue-green algae	As per the Guidelines for managing risks in recreational water (NHMRC, 2008).
	Protozoans	Pathogenic free-living protozoans should be absent from bodies of fresh water.
	Chemical contaminants	Waters containing chemicals that are either toxic or irritating to the skin or mucus membranes are unsuitable for recreation. Toxic substances should not exceed values provided in the Guidelines for managing risks in recreational water (NHMRC, 2008).
	Visual clarity and colour	As per the visual amenity guidelines.
	Temperature	16° - 34°C for prolonged exposure.

3.4 Penrith City Council guidelines

The project is located within the Penrith Local Government Area (LGA). Although the project is classified as State Significant Development (SSD) under the provisions of Part 4 Division 4.7 of the *Environmental Planning and Assessment Act 1979*, the project must also consider relevant stormwater development controls outlined in the Penrith City Council's Development Control Plan (PDCP 2014) and Stormwater Drainage Specification for Building Developments (Penrith City Council, 2020).

3.4.1 Penrith Development Control Plan 2014

The PDCP 2014 sets out Penrith City Council's (PCC) objectives and development controls on what built form and environmental outcomes are acceptable for different land uses and development types. Specific to the project, C3 Water Management from the PDCP 2014 provides guidance on the design of the water quality treatment train.

The requirements for stormwater quality include:

- 90% reduction in the post development mean annual load total gross pollutant (greater than 5mm);
- 85% reduction in the post development mean annual load of Total Suspended Solids (TSS);
- 60% reduction in the post development mean annual load of Total Phosphorus (TP); and
- 45% reduction in the post development mean annual load of Total Nitrogen (TN).

As later discussed in Section 7.2, with the proposed treatment train, the development is expected to achieve the stormwater quality reduction targets.

3.4.2 Stormwater Drainage Specification for Building Developments

Penrith City Council's 'Stormwater Drainage Policy and 'Stormwater Specification for Building Developments' provides guidance to ensure that stormwater drainage for building developments is designed to provide a robust, safe and low maintenance system to manage stormwater impacts on the drainage network and surrounding properties in a holistic manner that is incorporated aesthetically with the overall development. The Stormwater Drainage Policy outlines that on-site detention (OSD) is generally required for all developments, particularly as there is a change of use and increase of impervious area in the project site.

The 'Stormwater Drainage Specification for Building Developments' policy notes it should be read in conjunction with Australian Rainfall and Runoff (ARR), which is also considered best practice. The Project has subsequently adopted climate values, outlined in Section 5.1, and climate change parameters in line with ARR Book 1 Chapter 6 (v4.2), with the values outlined in Table 3-4.

Table 3-4: Climate change parameters adopted values (PCC, 2020)

Parameter	Adopted value	Comment
Planning horizon	Medium term	Taken as 20 years to match the battery economic life
Socio-economic pathway	SSP2-4.5	Middle of the road scenario
Rainfall rate of change	15% per degree	As per ARR Table 1.6.1 central (median) estimate for storm events <1 hour
Global temperature change	1.7 degrees	As per ARR Table 1.6.2
Climate change factor adopted	26.8% increase in rainfall intensity	As per ARR equation 1.6.1

4 Methodology

4.1 Study area

Surface water and groundwater have their own respective study areas for this assessment.

The groundwater study area is an industry standard 1,600 metre (m) radius around the centroid of the project footprint.

The surface water study area includes areas directly affected by the project and any additional areas likely to be indirectly affected by the project. This includes the property boundary, local stormwater drainage network, and downstream waterways. The waterways include Boundary Creek, 500m north of the Project, and to the Nepean River, extending to the road crossing approximately 1.2km downstream.

The surface water and groundwater study areas are presented in Figure 4-1.

4.2 Assessment approach

The surface water and groundwater assessment involved the following tasks:

- Desktop review of documents and data including:
  - review of project description and design information;
  - legislation, policy and guidelines; and
  - review of publicly available data.
- Description of the climate, topography, land use, soils, geology and existing surface water and groundwater environments and dependent ecosystems based on the desktop review Surface water features were classified based on Section 4.4.
- Water demand and supply assessment including an estimate of water demands during construction and operation, identification and preliminary assessment of the availability and reliability of potential groundwater and surface water sources of supply, in addition to functional and legislative constraints for use.
- Qualitative assessment of impacts to surface water quality, surface water quantity and geomorphology within the receiving surface water features during construction and operation. The residual risk of each impact was assessed based on the criteria listed in Section 6.6 with consideration of the proposed management or mitigation measures.
- Qualitative assessment of impacts to groundwater recharge, groundwater flow directions and availability, groundwater quality and groundwater dependent ecosystems during construction and operation. The residual risk of each impact was assessed based on the criteria listed in Section 6.6 with consideration to the proposed management or mitigation measures.
- Description of management or mitigation measures to eliminate or reduce the identified potential impacts.

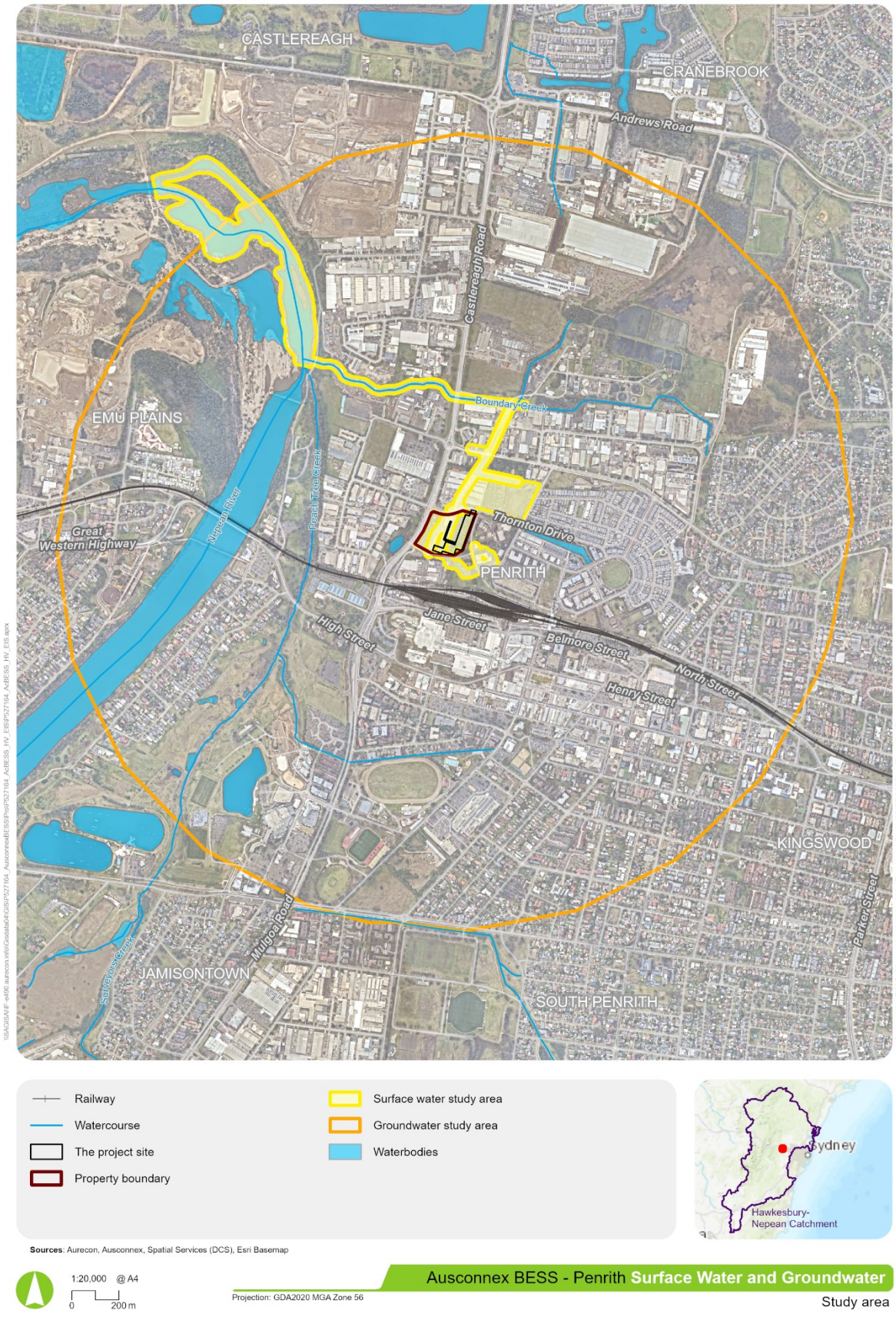

Figure 4-1: Study area

4.3 Data sources

Table 4-1 lists and describes the data sources used for analysis in this report.

Table 4-1: Data sources

Data	Source
Aerial Imagery	Nearmap, captured 23rd February 2025
Topography and land use	Land Systems of Western New South Wales dataset (NSW Department of Climate Change, Energy, the Environment and Water) via SEED
Climate data (daily rainfall)	BoM Climate Station 067113 data online. Available at: http://www.bom.gov.au/climate/data/
Design	Penrith Hv Bess 92.496MW / 184.992MWh Overall Site Locality Plan (Aurecon, 2024) Penrith HV BESS Civil Bench Earthworks Layout (Aurecon, 2024)
Geology	Seamless geology of NSW: MinView Geological Survey of NSW (NSW Government) Available at: https://data.gov.au/dataset/ds-nsw-0e598ae6-f566-4036-aa61-3f1a1f73ade9/details?q=
Groundwater Dependant Ecosystems (GDEs)	**Spatial Layer of High Ecological Value Aquatic Ecosystems (HEVAE) Vegetation Groundwater Dependent Ecosystems Value in NSW.** Available at: Spatial Layer of HEVAE Vegetation Groundwater Dependent Ecosystems Value in NSW | Dataset | SEED **High Ecological Value Aquatic Ecosystem (HEVAE) Instream Value of freshwater rivers in NSW.** Available at: High Ecological Value Aquatic Ecosystem (HEVAE) Instream Value of freshwater rivers in NSW | Dataset | SEED
Soils	Hydrologic Soil Groups (HSG) of NSW (NSW Department of Climate Change, Energy, the Environment and Water) https://datasets.seed.nsw.gov.au/dataset/hydrologic-groups-of-soils-in-nSW5f9e8
	JBS& G 2024, Penrith Zone Substation 2235-2249 Castlereagh Road, Penrith, NSW - Detailed Site Investigation
Water levels for surface water and groundwater	WaterNSW 2025. Available at: https://realtimedata.waternsw.com.au/ Gauging data for surface water gauging sites and groundwater monitoring locations
Water Sharing Plans	Water Sharing Plans: Available at:https://water.dpie.nsw.gov.au/our-work/plans-and-strategies/water-sharing-plans#map-of-water-sharing-plan-regions
Watercourses and water bodies	NSW Hydrography (State Government of NSW and Spatial Services (DCS) 2024). The NSW Hydrography web service provides access to a topographic map of New South Wales showing hydrography-related features and drainage. The hydrography features provided includes features such as waterfalls and springs, bores, hydroline (watercourses) and hydro area (water bodies), inundated land, dam walls, stock dams, reefs and mangroves, swamps, dams, lakes and oceans and bays.
Wetlands	NSW Wetlands (Biodiversity Wetlands) (NSW Department of Climate Change, Energy, the Environment and Water, 2010). https://data.nsw.gov.au/data/dataset/nsw-wetlands047c7 This dataset is based on wetlands that were identified using a combination of classification of spectral classes of Landsat Multispectral Scanner (MSS) and Thematic Mapper (TM) imagery and ancillary wetland information to create information classes of broad wetland groups (floodplain wetlands, freshwater lakes, saline lakes, reservoirs, estuarine wetlands and coastal lagoons and lakes).
	Ramsar Wetlands of NSW (NSW Department of Climate Change, Energy, the Environment and Water, 2012) Shows Ramsar Wetland polygons covering New South Wales. The Ramsar Convention is an inter-governmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance. Environment and Heritage Group is responsible for managing the majority of Ramsar wetlands in NSW.
Floodplain	Cranebrook Overland Flow Flood Study (Penrith City Council, 2023) The Overland Flow Flood Study defines flood behaviour under existing catchment conditions in terms of flows, water levels and velocities for floods ranging between 0.5 Exceedances per Year (EY) and 0.2 per cent Annual Exceedance Probability (AEP), as well as for the Probable Maximum Flood (PMF). The flood study includes the Nepean River catchment, specifically Boundary Creek sub-catchment, where the Project is situated within.

Data	Source
River Styles	River styles framework per the NSW River styles database (NSW Department of Planning & Environment, 2025) The database is the largest and most comprehensive dataset of geomorphic river character and condition available in Australia. It serves as a decision support tool for integrated river management.

4.4 Desktop characterisation of surface water environments

Surface water features have been characterised based on their stream order (watercourses only), whether they have permanent or temporary waters and their flow regime, geomorphological characteristics and their condition and water quality. A summary of what was used to inform the characterisation is provided below.

4.4.1 Stream order

Stream order is used to describe the hierarchy of streams from the top to the bottom of a catchment. There are different methods for describing stream order. The Water Management (General) Regulation 2018 uses the Strahler system as shown in Figure 4-2. The stream order is important for determining controlled activity approval requirements.

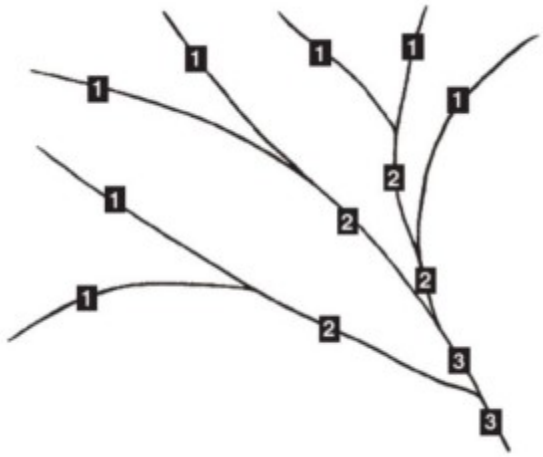

Figure 4-2: Schematic diagram of Strahler System (extract from DPE, 2022)

4.4.2 Permanence

Where possible, the surface water features (watercourses and water bodies) have also been described based on their likely permanence and predictability of filling/flowing, as per Table 4-2 which is based on descriptions provided in Boulton et al (2014).

Table 4-2: Waterway permanence classification

Duration	Classification	Description of predictability and duration of flow/filling
Temporary	Ephemeral	Flows or filled after unpredictable rainfall and runoff. Surface water dries within days to weeks of filling and can support only short lived aquatic life
	Episodic	Usually dry but flows or is filled after rare and large, unpredictable rainfall events. Surface water persists for months to years and often supports longer-lived aquatic life.
	Intermittent	Alternatively wet and dry but less frequently or regularly than seasonal waters. Surface water persists for months to years, and often supports longer-lived aquatic life.

Duration	Classification	Description of predictability and duration of flow/filling
	Seasonal	Alternatively wet and dry every year, according to season. Usually fills and dries predictably and annually. Surface water persists for months, long enough for some plants and animals to complete the aquatic stages of their life-cycles
Permanent or near permanent	Perennial	Predictably filled / flowing, although water levels may vary. During extreme droughts, these waters may dry. Usually supports diverse aquatic life, much of which cannot tolerate desiccation (dried out periods).

4.5 Criteria adopted

A qualitative risk assessment was undertaken of potential impacts identified for construction and the operational phases as per the following scale:

- **Low**: Potential adverse impact could result in a minimal/not noticeable decline in the resource/quality of a surface water or groundwater resource in the study area.
- **Medium**: Potential adverse impact could result in a decline in the resource/quality of a surface water or groundwater resource in the study area. Impact can often be managed through standard safeguards.
- **High**: Potential adverse impact could result in a decline in resource/quality of a surface water or groundwater resource to lower than-baseline/worse-than-baseline. Impacts would require specific management as impact could have major community/environmental issues.
- **Very high**: Potential adverse impact could result in significant decline in the resource/quality of a surface water or groundwater resource to significantly lower-than-baseline/worse-than-baseline condition. Impacts would require specific management as impact would have significant community/environmental consequences.

This scale is displayed in a risk assessment matrix in Table 4-3.

Table 4-3: Qualitative risk assessment

Risk assessment		Most credible consequence level				
		Negligible	Minor	Moderate	Major	Severe
Likelihood	Almost Certain	Low	Medium	High	Very high	Very high
	Likely	Low	Medium	High	High	Very high
	Possible	Low	Low	Medium	High	High
	Unlikely	Low	Low	Low	Medium	High
	Rare	Low	Low	Low	Medium	Medium

4.6 Key assumptions, limitations and uncertainty

Key surface and groundwater limitations are as follows:

- No numerical modelling for groundwater or regional flood behaviour.
- Assumed the existing mains water supply will be provided during construction and operation of the project.
- No field investigations were conducted as part of this assessment.
- Limited background information was available for the majority of the surface water and groundwater quality and levels within the study area, therefore conservative assessment principles were adopted.

5 Existing environment

5.1 Climate

The nearest Bureau of Meteorology (BoM) station selected with sufficient coverage of rainfall data is located at Penrith Lakes AWS (BoM station ID: 067113). The weather station is approximately 3 km north-west of the Project footprint.

The climate zone is characterised as mild to warm summers and cold winters (BoM, 2025).

Rainfall values, from the Penrith Lakes AWS BoM station, were calculated from long term records from 1995 to 2025. Key monthly statistics are captured in Table 5-1 and Figure 5-1. Comparing monthly medians show evidence of wetter summers (October to March) and drier winters (April to September).

Table 5-1: Monthly rainfall statistics from BoM (station ID: 067113)

Statistic	Jan (mm)	Feb (mm)	Mar (mm)	Apr (mm)	May (mm)	Jun (mm)	Jul (mm)	Aug (mm)	Sep (mm)	Oct (mm)	Nov (mm)	Dec (mm)	Annual (mm)
Mean	94.2	117.2	104.7	57.6	36.1	46	37	29.7	30.6	53.8	81.7	64.1	734.4
Lowest	19.2	1.8	3.8	1.8	3.2	2	1.4	0	0.2	4.6	13	0	450
10th %ile	22.9	21.2	21.3	9.5	4.7	11.8	5.3	4	6.5	7.4	16.3	27.8	533.5
Median	89.7	87.4	67.4	38.6	27.2	32.3	19.2	20.2	25.4	45.2	65.7	59.3	704.6
90th %ile	152.7	247.8	194.8	95.6	84.5	83.8	73.8	64.6	69.8	85.2	155.5	114.3	992.8
Highest	307.8	356.8	592.8	264	150.2	226	259.2	161.2	93.6	256.2	233.4	164.2	1180.8

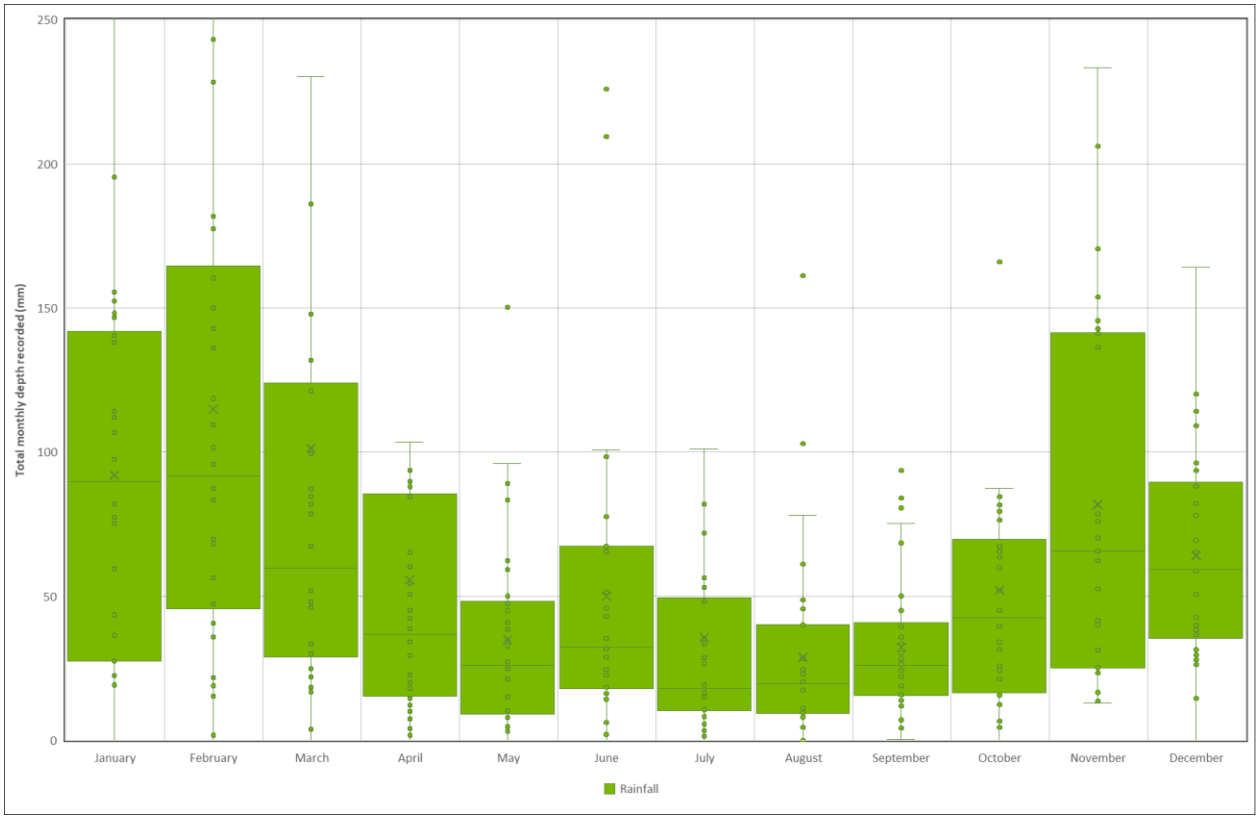

Figure 5-1: Monthly rainfall statistics from BoM (station ID: 067113)

5.2 Topography

The topography of the project footprint is relatively flat with a gentle slope westward towards the drainage easement that bisects the property boundary, which sits at the low point. The topography of the project is presented in Figure 5-2.

The project site has an approximate gradient of 1%, ranging elevations from approximately 25 to 27m AHD.

Figure 5-2: Topography

5.3 Surface waters

5.3.1 Catchment overview and land use

The existing grassed areas of the project site were previously an extension of the existing Penrith substation and were overlaid with concrete. The project site was used for as an outdoor switchgear, and constructed between 2002 and 2014 as per the Detailed Site Investigation (DSI) (JBS&G, 2024). However, based on aerial imagery those hardstand areas were returned to a grassed, managed landscape since 2018.

The project is located within the Boundary Creek catchment, which is a tributary to the Nepean River. The Boundary Creek catchment has an area of 2.45 km2 (PCC, 2020). The catchment is highly urbanised, with a mixture of industrial, residential and pockets of public open space as well as a wastewater treatment plant known as the Penrith Water Resource Recovery Facility (WRRF), located approximately 700m northeast from the northern project boundary.

The Boundary Creek catchment sits within the wider Hawkesbury-Nepean catchment. The main tributaries of Hawkesbury–Nepean River, downstream of the project, originate from highly vegetated lands, such as rural areas and national parks (BoM, 2016).

5.3.2 Local surface water features

A review of the NSW Government hydroline dataset in accordance with Water Management (General) Regulation 2018 (NSW Government, 2023) identified no natural watercourses through the project site. The closest waterbody is a constructed pond, approximately 150m west of the site.

Two natural watercourses downstream from the project were identified, namely Boundary Creek and Nepean River. Boundary Creek. Boundary Creek, approximately 500m downstream from the project site, is a 1st order stream flowing in a westerly direction and ultimately discharges into the Nepean River. The Nepean River is approximately 1.5km downstream from the project site and a 9th order waterway.

The Cranebrook Overland Flow Flood Study (PCC, 2022) indicates an existing piped stormwater network that bisects the property boundary south to north. The main stormwater trunk receives local catchment from the Museum of Fire, approximately 50m east and upstream from the project.

A headwall off Museum Drive discharges in a grassed open drainage channel within the southern boundary of the property which the project is located. The open drainage channel travels north towards Thornton Drive and transitions into a concrete lined channel once within the existing substation site southern boundary, where it connects to the main stormwater trunk. The main stormwater pipe becomes an open channel approximately 200m before Coreen Avenue and enters a culvert under Coreen Avenue and entering to a piped network, which eventually discharges into Boundary Creek.

The drainage network is presented in Figure 5-3.

A constructed wetland downstream from the site was identified via aerial imagery, as presented in Figure 5-3. The wetland connects to the main stormwater network, just south of Coreen Avenue, downstream from the project which eventually outlets into Boundary Creek. The constructed wetland is assumed to treat runoff from the local residential catchment.

The local surface water features are presented in Figure 5-3.

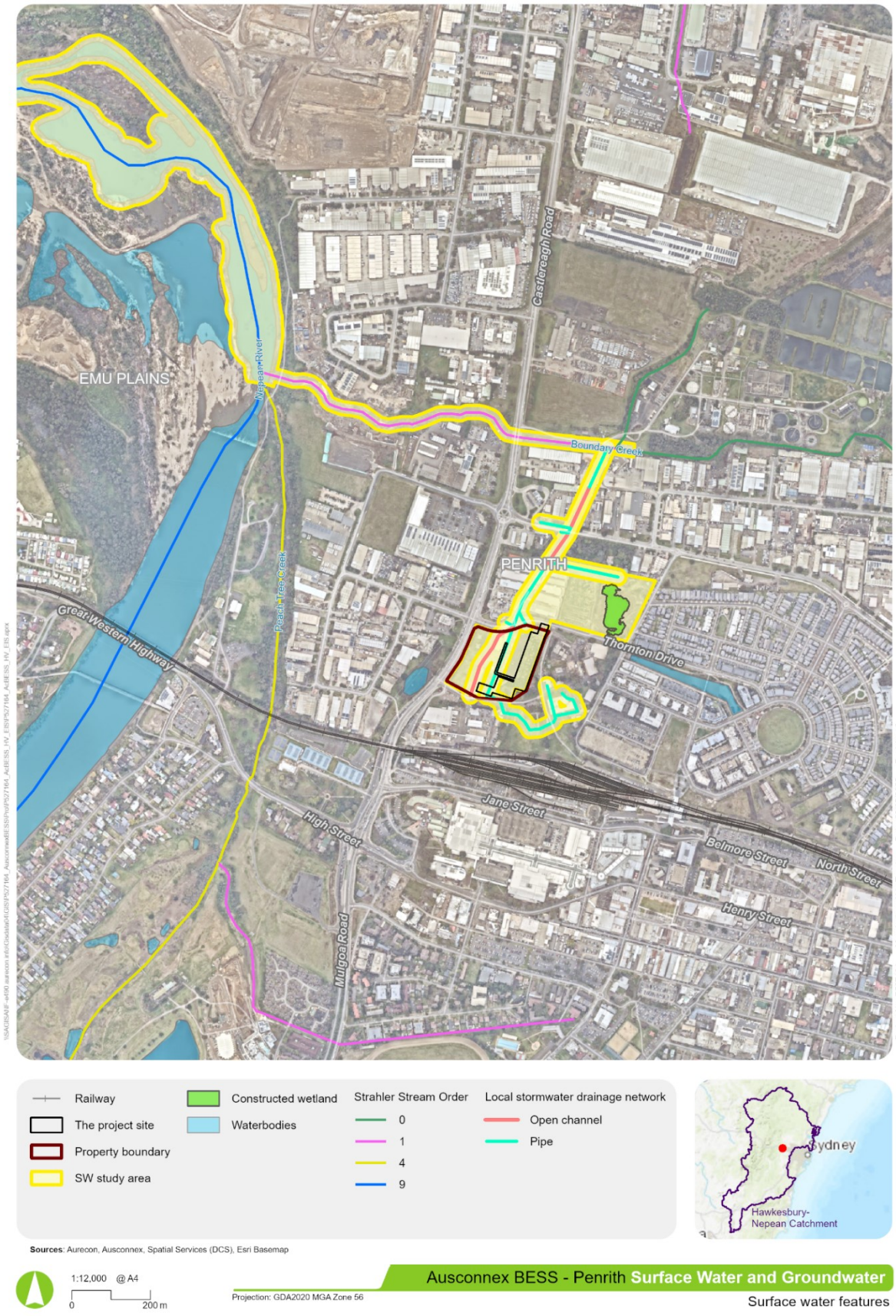

Figure 5-3: Local surface water features

5.3.3 Surface water quality

Desktop water quality data has been used to derive an understanding of the condition of surrounding waterways. Water quality results from the Sydney Water Aquatic Monitoring Program 2023 -2024 Boundary Creek and Nepean River are presented in Appendix B.

Generally, both Boundary Creek and Nepean River are affected by agricultural and urban runoff, resulting in elevated levels of nutrients above ANZG 2018 guideline values and NSW WQOs. Discharge from the Penrith Water Resource Recovery Facility (WRRF) and St Mary's Advanced Water Treatment Plant (AWTP) provide some dilution, reducing concentrations of nutrients to within WQOs values.

Boundary Creek receives urban run-off and effluent discharges from Penrith Water Resource Recovery WRRF and St Marys AWTP. The Sydney Water Aquatic Monitoring Program (Sydney Water, 2024) provides water quality monitoring of waterways downstream from their wastewater treatment plants.

The portion of Boundary Creek that is upstream of the WRRF and the project experiences water quality issues due to sewer overflow and land use. During two sewer overflows incidents in October and December 2023, the upstream sampling site (N542) experienced nutrient levels well above ANZG limits. However, the elevated nutrient levels were not reflected in the downstream sampling sites within Boundary Creek (N541) and Nepean River (N57). These sampling sites are located downstream of the project and where the project drains into the portion of Boundary Creek. This suggests most likely water quality concerns experience upstream are reduced due to dilution from low nutrient discharges from Penrith WRRF and St Marys AWTP.

Boundary Creek and Nepean River water quality at sites downstream from the project site were compared to the Hawkesbury-Nepean catchment WQOS and ANZG guidance. Total nitrogen (TN) at both sites regularly exceeded WQO value of 0.5mg/L and ANZG guideline value of 0.35 mg/L, indicating that both waterways are susceptible to elevated nutrient levels. However, electrical conductivity, turbidity, pH, chlorophyll-a were within WQOs guidelines values at both sites.

Annual Water Quality Monitoring Report 2023 – 2024 (WaterNSW, 2024) undertook monthly water quality sampling including a site 800m upstream of the site on the Nepean. The sampling results revealed pH, turbidity and total phosphorous (TP) remained within ANZG guidelines values. However, total nitrogen (TN) and chlorophyll-a generally exceeded the ANZG 2018 trigger values. Dissolved oxygen (DO) was exceeded for one sample.

Table 5-2: Percentage of samples exceeding ANZG 2018 guideline values

Site	Station code	Number of samples	pH	Turbidity	Dissolved Oxygen	Nitrogen Total	Phosphorus Total	Chlorophyll-a
Nepean River @ Penrith	N57	12	0%	0%	8%	83%	0%	58%

5.3.4 Geomorphology

A review of aerial imagery of Boundary Creek reveals the banks have experienced a major erosion event, particularly the northern banks near the confluence with the Nepean River. Rectification works have been completed to stabilise the banks to prevent further erosion.

The River Styles Framework (DCCEEW, 2023) is a system for understanding and managing rivers in all their diverse geomorphic characteristics and behaviours. Developed at Macquarie University, the framework is a method for classifying river character, behaviour, condition, and recovery potential. The recovery potential refers to the likelihood that a river reach will improve its geomorphic condition over management timeframes, from the construction and operational impacts from new developments.

The river style of Boundary Creek downstream from the project site shows the creek is in poor geomorphic stream condition, low recovery potential and low to moderate fragility. The portion of Nepean River, where Boundary Creek outlets, has poor stream condition, moderate recovery potential and moderate high fragility.

5.4 Soils

5.4.1 Salinity

A review of the online eSPADE mapping portal indicates that the project footprint has a moderate salinity potential. The soil EC (measure of salts in soil) is modelled as 0.05 to 0.10 deciSiemens per metre (dS/m) (DPE, 2018a). The preferred EC levels, as stated by the NSW Department of Primary Industries (DPI) is <0.15dS/m.

5.4.2 Acid sulfate soils

A review of the CSIRO Atlas of Australian Acid Sulfate Soils Data identified the area of the property as a “low probability of occurrence, 6-70 % chance of occurrence”. Review of the Department of Land and Water Conservation (1997) ‘Acid Sulfate Soil Risk Map 2nd Edition’ for Springwood/Riverstone indicates that the site is within an area classified as “no known occurrence of acid sulfate soil (ASS) materials”. This classification relates to sites where land management activities are not likely to be affected by ASS materials (JBS&G, 2024).

5.4.3 Hydrologic soil groups

Soils are classified into four hydrologic soil groups, depending on the soil’s runoff potential. These four groups are A, B, C and D, with Group A generally having the smallest runoff potential and Group D the largest.

A review of NSW hydrologic soil groups available on the Sharing and Enabling of Environmental Data (SEED) portal revealed that the entire Project footprint is classified as D. D classified soils have very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

However, hydrologic soil groups are indications of pre-development soil conditions, and assumptions made based on natural properties may not be entirely accurate considering the site history.

The DSI (JBS&G, 2024) indicated fill materials were observed at depths that varied from the surface (or directly below the grass) to a maximum depth of 1.4m bgs and comprised clayey sand, gravelly/sandy/silty clay, silty clay, sandy gravel, sand and black ash. Preliminary waste classification results indicate that should topsoil require off-site disposal it would be classified as GSW (non-putrescible) and could be recyclable, except where asbestos is present.

5.5 Hydrogeology

5.5.1 Geology

A review of the seamless geology (NSW Government, 2024) indicates the surface geology of the whole site is dominated by Quaternary alluvial terrace deposits (Q_at). The formation comprises of silt, clay, fine- to medium-grained quartz-lithic sand, polymictic gravel.

A review of the online tool, ESPADE 2.2, (NSW Office of Environment and Heritage, 2024), indicates the site is located within the Richmond Soil Landscape group. Richmond soils are found on quaternary terraces of the Nepean and Georges Rivers. Mainly flat (slopes < 1%) with splays and levees providing local relief up to 3m. The landscape is characterised by tree cover, which is almost completely cleared now, and was formerly a low open woodland. The soil profile consists of poorly structured orange to red clay loams, clays, and sands, with texture generally increasing with depth. Ironstone nodules may be present, and Plastic Clays are commonly found in drainage lines. On terrace surfaces, deep acid non-Calcic Brown Soils, Red Earths and Red Podzolic Soils are prevalent, while Earthy Sands are typically observed along terrace edges. Localised flood hazards, localised seasonal waterlogging, and localised water erosion hazards on terrace edges are associated limitations of the landscape (JBS&G, 2024).

5.5.2 Aquifer characteristics

Groundwater resources within the project footprint are governed by the *Greater Metropolitan Region Groundwater Sources 2023* Water Sharing Plan. The project is located within the Hawkesbury Alluvium Groundwater Source, which comprises the alluvial deposits of the Hawkesbury River, extending downstream of the Warragamba Dam to the township of Spencer, and covers an area of 122.68 square kilometres (NSW DCCEEW, 2011). The Hawkesbury Alluvium Groundwater Source overlies two groundwater sources, namely the Sydney Basin Central Groundwater Source and Lachlan Fold Belt Greater Metropolitan Groundwater Source.

The alluvial aquifer is predominantly unconfined or semi-confined and has a high hydraulic conductivity of great then 20m^3/day. There is significant surface water to groundwater interaction, allowing for the groundwater recharge through rainfall and river flow. Also, this results in groundwater within the aquifer to have high impact on instream values and a relatively short travel time (days to months) to unregulated rivers (NSW DCCEEW, 2011).

5.5.3 Registered bores

A search using the Water NSW real-time data returned no registered bores within the project footprint or the broader Penrith Transmission substation site. However, 88 registered bores with a total of 90 wells were identified within the groundwater study area. Currently of the 90 pipes, 35 are in still in use while the statuses of 55 pipes are unknown.

The uses of the registered bores are as follows:

- 8 groundwater bores used for exploring;
- 3 groundwater bores used for irrigation;
- 68 groundwater bores used for monitoring;
- 4 groundwater bores for water supply; and
- 5 groundwater bores for unknown uses.

The registered bore locations of the registered bores within the groundwater study are presented in Figure 5-4 and a summary of these bores are captured in Appendix A.

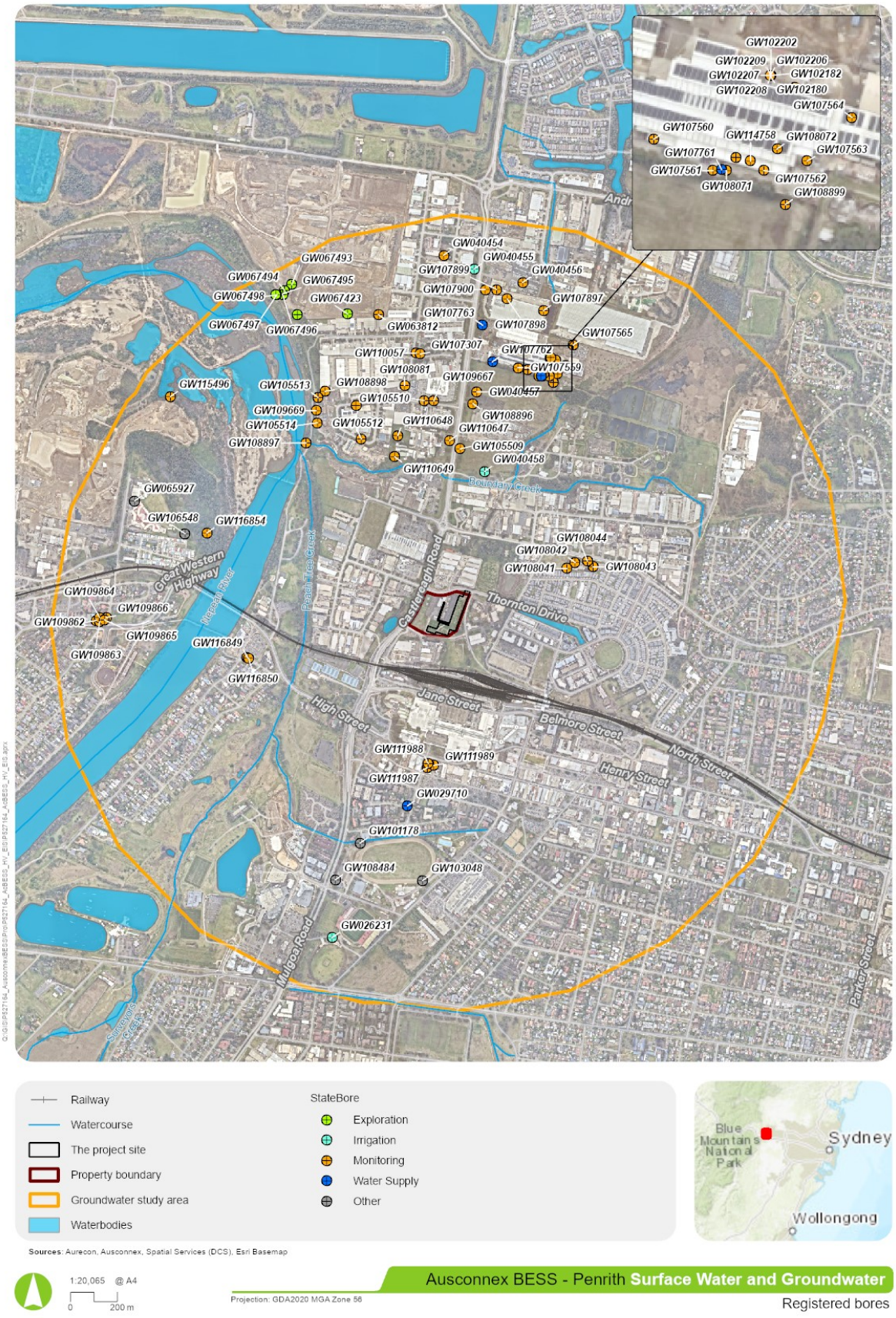

Figure 5-4: Registered bores

5.5.4 Groundwater quality

Limited groundwater quality data was available for the site. The few available salinity readings from the registered bores indicated salinity levels from 180 to 550mg/L, suggesting freshwater. However, groundwater conditions may have changed as the readings from these bores ranged from 1998 to 2006.

Generally, the Ashfield and Bringelly shales (Late Triassic Wianamatta Group), groundwater is saline, typically in the range of 5,000 to 50,000mg/L (McNally, 2009).

5.5.5 Groundwater levels and flow regime

Publicly available groundwater level readings were limited for the project footprint. However, groundwater data was available for registered bores within the groundwater study area, particularly in the northern portion of the study area. Standing water levels (SWL) closest to the project site, approximately 500m northwest ranged from 6m below ground level (m BGL) to 6.8m BGL.

An existing geotechnical investigation undertaken in 2007 for the development of the substation building and new transformers on the property, where the project sits on, included the drilling of nine boreholes, to depths ranging from 3.5 to 5.7mbgl. The boreholes were observed for groundwater during and shortly after borehole drilling. All boreholes were found to be dry during and upon completion of the site investigation. Groundwater conditions may, however, vary seasonally or as consequence of construction activities (GeoEnviro Consultancy, 2007).

Based on topography and geology, groundwater is anticipated to migrate northwest towards the nearest waterways such as Peach Tree Creek and Boundary Creek, and further to the Nepean River and the Penrith Lakes (JBS&G, 2024).

5.6 Sensitive receiving environments

5.6.1 Surface water

Protected wetlands

An assessment of RAMSAR wetlands was undertaken through the SEED portal. While the Nepean River, approximately 900 metres downstream from the project is identified as a floodplain wetland, based on the NSW Wetland geospatial dataset (DCCEEW, 2010), no Ramsar or Nationally Important Wetlands were identified downstream or surface water study area.

Key fish habitat

A review of the Fisheries NSW Spatial Data Portal was undertaken to identify any potential Key Fish Habitat (KFH) impacted by the project. No KFH are intercepted by the project. However, Boundary Creek and Nepean River have been designated as KFHs. The KFH within the Nepean River relates to a freshwater fish community which is identified as having a fair condition status. The sensitive receiving surface water environments are presented in Figure 5-5.

Figure 5-5: Sensitive surface water receiving environments

5.6.2 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems that rely solely or partially on groundwater to survive. The Australian Government's Atlas of Groundwater Dependent Ecosystems (GDE Atlas NSW, 2023) is a spatial tool used to identify three types of GDEs within the study area. These GDEs include:

- Aquatic ecosystems – GDEs that require surface expression of groundwater such as wetlands and springs.
- Terrestrial ecosystems – GDEs that rely on the presence of groundwater, including all vegetation ecosystems.
- Subterranean ecosystems – Subterranean factors that rely on the presence of groundwater, such as stygofauna or cave systems.

The GDE High Ecological Values Aquatic Ecosystems (HEVAE) spatial data set (NSW DCCEEW, 2024) was used to identify any high value aquatic ecosystems. The value of the aquatic ecosystems is based on four criteria: diversity, distinctiveness, naturalness and vital habitat (NSW DCCEEW, 2024). The low to medium HEVAE GDEs identified within the groundwater study area were concentrated around the natural waterways, particularly Boundary Creek (to the north), Peach Tree Creek and Nepean River. Additionally, the GDE instream value for Boundary Creek, Boundary Creek and Nepean River within the groundwater study area were considered medium. The GDEs and their instream values are presented in Table 5-3 and Figure 5-6.

However, the data indicated no GDEs were present within the vicinity of the project footprint.

Table 5-3: Summary of GDEs within the groundwater study area

GDE	Location	HEVAE Category
Central Coast Gallery Rainforest	Along Nepean River and Peach Tree Creek	Low to Medium
Central Eastern Ranges River Oak Forest	Large areas along west bank of Nepean River, and minor areas at Nepean River confluence with Boundary Creek and Peach Tree Creek respectively and within Boundary Creek	Low to Medium
Cumberland Red Gum Riverflat Forest	Along entirety of Boundary Creek	Medium

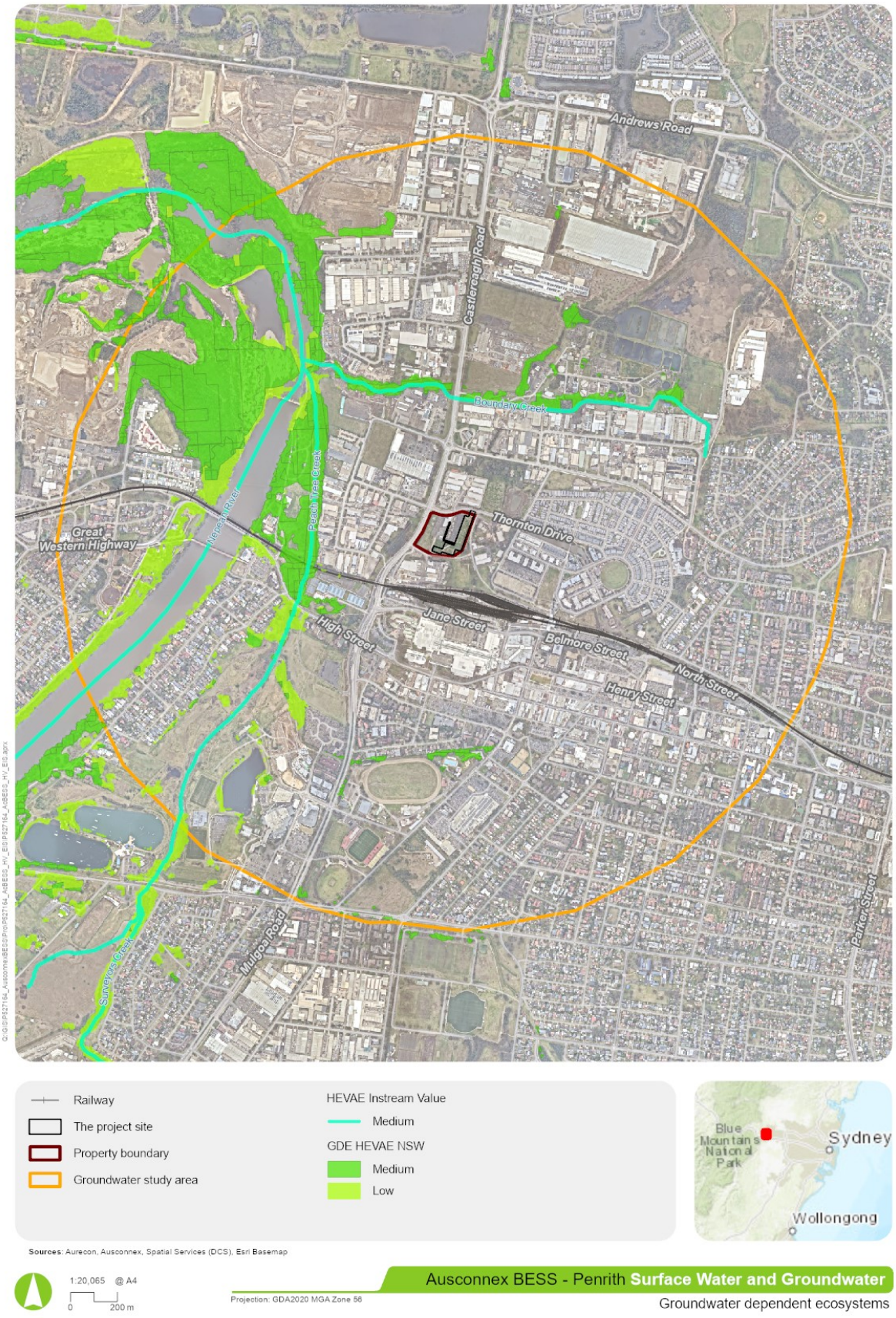

Figure 5-6: Groundwater dependent ecosystems

6 Construction impacts

Construction activities outlined in Section 2.3 have the potential to impact surface water and groundwater resources as follows:

- Water quality impacts from earth works and site establishment works mobilising sediments, leading to increased nutrient loads and suspended solids
- Stockpiling of materials which may affect overland flow paths and cause localised flooding

Potential groundwater impacts include:

- Dewatering requirements due to excavations intercepting groundwater
- Reduced infiltration due to the construction of concrete hardstand and compaction of ground for access roads
- Water quality impacts from spills and sediment fencing / erosion control.

To mitigate the construction impacts, a Construction Environmental Management Plan (CEMP) shall be prepared by the Contractor and prior to the issue of the Construction Certificate for the project. The CEMP will include a Soil and Water Management Plan (SWMP) inclusive of an Erosion and Sediment Control Plan (ESCP) prepared in accordance with Best Practice Erosion and Sediment Control (IECA, 2008) and Managing Urban Stormwater – Soils and Construction Volume 2C Unsealed Roads (DECC, 2008), commonly referred to as 'Blue Book'. The erosion and sediment controls detailed in the ESCP shall be installed prior to the commencement of any works and remain in place and maintained until all disturbed areas have been stabilised.

6.1 Construction water supply and demand

Construction of the battery systems themselves will not use any water; however, the construction activities that are expected to require non-potable water supply include the following:

- bulk earthworks;
- environmental management (e.g. dust suppression during construction);
- maintaining access roads; and
- firefighting purposes.

Dust suppression water is predicted to be the most significant water demand. Dust suppression would likely need to be applied to exposed soils during windy conditions and on trafficked areas more frequently. The need for dust suppression would be monitored by visual observation and when signs of dust occur. The construction methods, staging, quantities and measurements for the project may vary following future design refinements or following award of the construction contract.

The project is expected to require 6,393 to 6,426kL of water throughout the 15-month construction program. Construction water requirements for the project are to be finalised during detailed design. However, it is understood that water cart services with their own water tanks will be brought to site and refilled by the hire companies as required. Broader construction water requirements will be confirmed during the detailed design phase and managed by the appointed construction contractor in accordance with relevant guidelines and approvals. The water demand calculations are detailed in Table 6-1.

As water from creeks or groundwater is not proposed to be extracted for water supply, the groundwater and surface water resource capacity is not anticipated to be impacted by the project.

Table 6-1: Construction water demand

Item	Quantity	Water demand (kL)
Workforce potable water demands1	35 – 40 people	231 – 264
Dust suppression[2]	9870m^2	5,922
Concrete[3]	1202m^3	240
Total		6,393 – 6,426

Note:
1 Assuming 30L/person/day, 5.5 day working week, 4 weeks leave/year and construction program of 11 months
2 Assuming 600mm/m^2/year over total project footprint
2 Volume given by concept designers, assuming 0.2kL/m^3

6.2 Surface water quality

Site establishment works would include clearing of existing turf within the project footprint and earthworks across an area of approximately 7,000m^2 for the battery storage footprint and access road to achieve the levels and grades required. Total earthwork volumes, including water retention dam, are anticipated to be approximately 250m^3 and 1925 m^3 in cut and fill respectively. The earthworks will involve stripping a nominal 200mm depth of topsoil, resulting in exposing and mobilising underlying soils and materials during construction.

According to 'Blue Book' (Landcom, 2004) guidance, a sediment basin will be required to manage runoff during construction. The CEMP will include an ESCP that will outline sediment and erosion control measures to manage soils and sediment mobilised during rainfall. It is anticipated that this plan will also use the on-site stormwater detention basin and fire water storage as a sediment basin during construction. These measures shall be installed prior to the commencement of any works and remain in place and maintained until all disturbed areas have been stabilised.

Stockpiled construction and excavated material will either need silt controls or will need to be stored in sediment basin catchments to prevent mobilised sediment entering drainage lines which could cause water quality impacts including increased concentrations of metals and other chemicals, sedimentation and increased turbidity within Boundary Creek.

Accidental spills or inappropriate storage or handling of chemicals, may release potentially harmful chemicals (e.g. hydrocarbons, oil and grease, heavy metals). Leakage from construction worker facilities or wastewater collection points could directly flow into drainage lines or result in contamination of exposed soils which may be mobilised into drainage lines during rainfall events, resulting in water quality impacts to Boundary Creek and Nepean River. Material handling procedures and spill control measures outlined in the CEMP would be implemented to manage the potential impacts.

Standard environmental controls such as prevention of spills, sediment fencing / erosion control, waste tracking and surplus water discharge would also serve to limit any impacts construction works could have on groundwater quality and should be managed through a CEMP.

Given the footprint of the Project within the context of the wider catchment and with the implementation of proposed management measures, the Project is likely to have a negligible influence on whether the WQOs within the receiving surfaces are achieved or not during construction.

6.3 Hydrology and geomorphology

No construction work and vegetation clearing will occur within waterfront land, as the closest natural waterway, Peach Tree Creek, is located approximately 150m east of project footprint.

The project site is approximately 0.9ha or 0.04%, which represents a minor portion of the overall Boundary Creek catchment (245ha), as discussed in Section 5.3.1. Therefore, it is anticipated that the increase in runoff from compacted ground will be very minor. Additionally, Boundary Creek have commenced bank stabilisation works therefore geomorphological impacts such as erosion and changes in catchment hydrology are also unlikely to occur. Hence, there will be negligible direct geomorphic changes to the watercourse (alterations of banks).

6.4 Regional and local flooding

Stockpiling of materials within overland flow paths and any temporary drainage works may result in localised flooding within the project footprint. The CEMP shall ensure appropriate measures are in place for managing stockpiles. Stockpiles would be sited outside of overland flow paths and a suitable distance away from drainage channels.

6.5 Groundwater

During construction of the project, trenching may be required for the 33kV underground cables or stormwater drainage network and treatment devices.

Although no groundwater levels are available for the site, the closest groundwater SWLs readings approximately 500m upstream from the site ranges from 6 m BGL to 6.8 m BGL. Given the anticipated westerly groundwater flow and gentle sloping topography towards the Nepean River and, groundwater levels on the site are expected to be deeper.

Therefore, it is unlikely excavations will encounter shallow groundwater, or minor dewatering activities may be required. However, if any dewatering is required, the dewatering management plan will be prepared by the construction contractor and managed through a CEMP.

The construction of concrete hardstand for the BESS containers and accompanying transformers, and compaction of ground for the internal access roads is proposed on land that is currently grassed. The construction will increase impervious areas, therefore may reduce infiltration and increase surface runoff rates. This can alter the groundwater flow regime. As the impacted area is relatively small, indirect impacts to groundwater flow as a result of reduce infiltration will likely be negligible.

Similar to surface water, mitigation controls outlined in the CEMP such as prevention of spills, sediment fencing / erosion control, waste tracking and surplus water discharge would also serve to limit any impacts construction works could have on groundwater quality.

Given the project footprint accounts for approximately 0.04% of Boundary Creek catchment, the likelihood of impacts on groundwater resources and GDEs as a result of the project are low and unlikely, therefore, no aquifer interference activities are anticipated. During the construction phase, the project is unlikely to impact the registered groundwater bores within proximity to the project footprint, as all bores are outside of the project footprint.

6.6 Summary of assessment of construction impacts

Table 6-2 summarises the project's construction impact on surface and groundwater resources.

Table 6-2: Summary of construction impact assessment

Activity / event	Description of potential impact	Receptor/s	Potential impact	Management and mitigation	Assessed residual risk
Site establishment works including earthworks and vegetation clearing	Erosion and mobilisation of sediment into downstream watercourses potentially degrading downstream water quality.	Surface water (Boundary Creek and Nepean River).	Likely, moderate impact	The SWMP and ESCP will include erosion and sediment control measures to prevent sediment laden water entering any surface water features in most rain events.	Low
	Excavations may directly intercept groundwater, or local aquifers at depth. As such, minor dewatering may be required. Dewatering may alter the groundwater levels in the immediate area.	Groundwater	Rare, moderate impact	Preparation of a Dewatering management plan will be included as part of the CEMP if dewatering is anticipated. This would be developed in accordance with the *Water Management Act 2000* and may require further approvals depending on the scale of dewatering required. Additionally, the SWMP will include measures to manage water quality during dewatering activities, such as wastewater management.	Low
Road works and concrete pad construction	Cement laden runoff from concreting activities may be accidentally released into the environment due to poor handling, storage or disposal. This deteriorates surface water quality by increasing levels of pH, TSS, TDS and aluminium, iron and magnesium oxides.	Surface water (Boundary Creek and Nepean River).	Unlikely, moderate impact	The SWMP will include erosion and sediment control measures to prevent cement laden runoff entering any surface water features.	Low
	Increase in impervious areas from concrete hardstand and compaction of ground for access road construction may reduce groundwater recharge.	Groundwater	Likely, minor impact	No mitigation measures are required.	
Construction material and spoil stockpiles	Loose materials may be mobilised into downstream surface water features potentially degrading water quality.	Surface water (Boundary Creek and Nepean River).	Possible, minor impact	The CEMP shall ensure appropriate measures are in place for managing stockpiles. Construction stockpiles should be placed within the approved project area only and away from waterways.	Low
	Blockage of existing overland flow may cause localised flooding within the project footprint. Not considered to cause flood impacts to surrounding areas outside the project footprint.	Surface water (flooding within the project footprint)	Unlikely, minor impact		Low
Storage, handling and use of hydrocarbons and other chemicals (including spills, leaks and accidental discharges)	Release of pollutants into the surface water environment leading to water quality impacts.	Surface water (Boundary Creek and Nepean River)	Unlikely, moderate impact	The CEMP will include the proper storage, containment, and usage of all fuels and chemicals. Measures to minimise the potential impacts associated with accidental leaks during construction will be incorporated in the CEMP as well.	Low

7 Operational impacts

Operational activities have the potential to impact surface water as follows:

- Water quality impacts from chemicals leaked from maintenance vehicles and transformers or wastewater from firefighting stored within the water retention dam, and not treating before entering existing stormwater drainage system.
- Increased impervious areas leading to increased flow volumes and pollutant loads to watercourses, degrading water quality.
- Earthworks associated with site forming works impacting on regional, overland flow paths, as the project will generally be in fill (approximately 1,925m^3), as compared to cut (approximately 250m^3).

Stormwater management infrastructure associated with the proposed BESS includes:

- Stormwater pits and pipeline to collect and transfer stormwater runoff to the downstream basin.
- Stormwater filtration to remove generic pollutants (sediment, metals, phosphorous and nitrogen) during frequent storm events.
- An on-site stormwater detention basin to control discharge during large storms.
- Fire water capture volume of 313.16kL, within the on-site stormwater detention basin to retain contaminated water. The discharge valve will have to be shut off manually by on-site personnel or fire services when responding to a fire. Any firefighting water collected must not be discharged into the stormwater network and should be pumped and transported to a licensed facility for disposal.
- Connection to the local stormwater pipe network that drains to Boundary Creek.

The BESS will not use any groundwater or harvest stormwater.

The reference design includes stormwater filtration devices that have been specified in accordance with the Penrith DCP 2014 and Stormwater Drainage Specification for Building Developments, which is Council's adopted strategy for managing waterway health.

The reference design also includes stormwater detention that has been specified to ensure there is no increase in peak discharge from the Site in storm events, that could impact on the performance of the downstream stormwater network.

7.1 Operation water supply and demand

Water extraction from surface water or groundwater sources within the indicative development footprint is not proposed during operation. Operational water demands will be satisfied by existing mains water supply. While the Project footprint will be fenced off from existing substation operations and daily activities, the BESS site would not be subdivided from the overall substation asset (leased by Endeavour Energy) and therefore would be provided with town water supply provided for by Endeavour Energy.

Water service will be limited to an O&M building housing an amenities block containing a single toilet and hand-wash basin. The annual water demands for the project are expected to be 0.1kL/yr as summarised in Table 7-1. The operation water demands are typically low enough to be satisfied through town water supply and not requiring specialised infrastructure or supply.

The project would include hydrants for fire-fighting purposes, which shall use existing mains water supply. This water would only be used for firefighting and not for potable water supply nor general non-potable site water use. Hydrant locations and related design specifications will be finalised as part of the detailed design phase.

Table 7-1: Operation water demand

Item	Annual demand (kL/yr)
Amenities	0.1

Note:
Assuming 2L/person/day, and 2-person visit once a week

7.2 Surface water quality

The battery and transformer units would be fully enclosed without the generation of wastewaters. The potential surface water quality impacts include:

- potential risks associated with handling of fuels and hydrocarbons;
- leakage from site infrastructure such as oil from transformers;
- exposure of materials and mobilisation of contaminants during a battery fire; and
- increased generic pollutant loads to downstream watercourses due to increases in impervious surfaces in operational areas.

The handling of fuels and hydrocarbons and leakage of oils from transformers may mobilise contaminants to downstream watercourses via the onsite drainage network during rainfall events. Impacts to the receiving environment of Boundary Creek are likely to be temporary, short term, negligible (small spills) to minor (large spills) considering the size of Boundary Creek upstream catchment and quantity of hydrocarbons that could potentially be released through these activities. The potential impacts would be managed through spill response measures and chemical handling procedures in the OWMP and a stormwater treatment system design.

In the highly unlikely event of a fire, contaminants may be mobilised in firefighting water. Tesla's Emergency Response Guide recommends applying water in a fog pattern to surrounding exposures if deemed appropriate by fire services. This may potentially result in temporary, short to medium term, moderate water quality impacts to occur within Boundary Creek. A water retention dam, with a capacity of 313.16kL, to store firewater is proposed as part of the stormwater treatment system to prevent contaminants being mobilised into downstream watercourses. A one-way valve (flap valve or similar) at the connection from the dam outlet to the local stormwater drainage network shall be turned off. Wastewater stored within dam shall be treated and disposed off-site. Additionally, the 7m high noise wall, along the eastern boundary of the project, shall further contain and prevent any wastewater being released to the surrounding environment. Therefore, there is a very low risk of impacts occurring with these measures in place.

The proposed stormwater treatment design achieves the required pollution reduction targets outlined in the Penrith DCP 2014. The MUSIC modelling results of the treatment train is captured in Table 7-2.

Table 7-2: MUSIC modelling post-development pollutant loads results

Pollutant	Pre-development	Post development			Pollution reduction target (%) (PCC, 2014)	Council's Waterway Health Targets Met
	Source loads (kg/yr)	Source loads (kg/yr)	Residual loads (kg/yr)	Load reduction (%)		
Total Suspended Solids (TSS)	99	837	96.1	88.5	85	Y
Total Phosphorus (TP)	0.175	1.36	0.512	62.4	60	Y
Total Nitrogen (TN)	1.36	8.78	4.82	45.1	45	Y
Gross Pollutants	0	114	0	100	90	Y

While there is an increase in annual pollutant loads for TP and TN compared from pre-development and post development, Council's adopted water quality management targets are achieved for all pollutants, as captured in Table 7-2. The proposed treatment train marginally achieves Council's reduction targets, with the pollutant load reduction ranging from between 0.1% to 3.5% above the targets for TSS, TP and TN. Gross pollutants loads are greatly reduced, achieving an 100% load reduction.

Figure 7-1 to Figure 7-3 shows the operational TN, TP and TSS concentrations respectively from the proposed stormwater management elements (filtration devices) under the operation phase and the expected concentrations from the pre-developed Site.

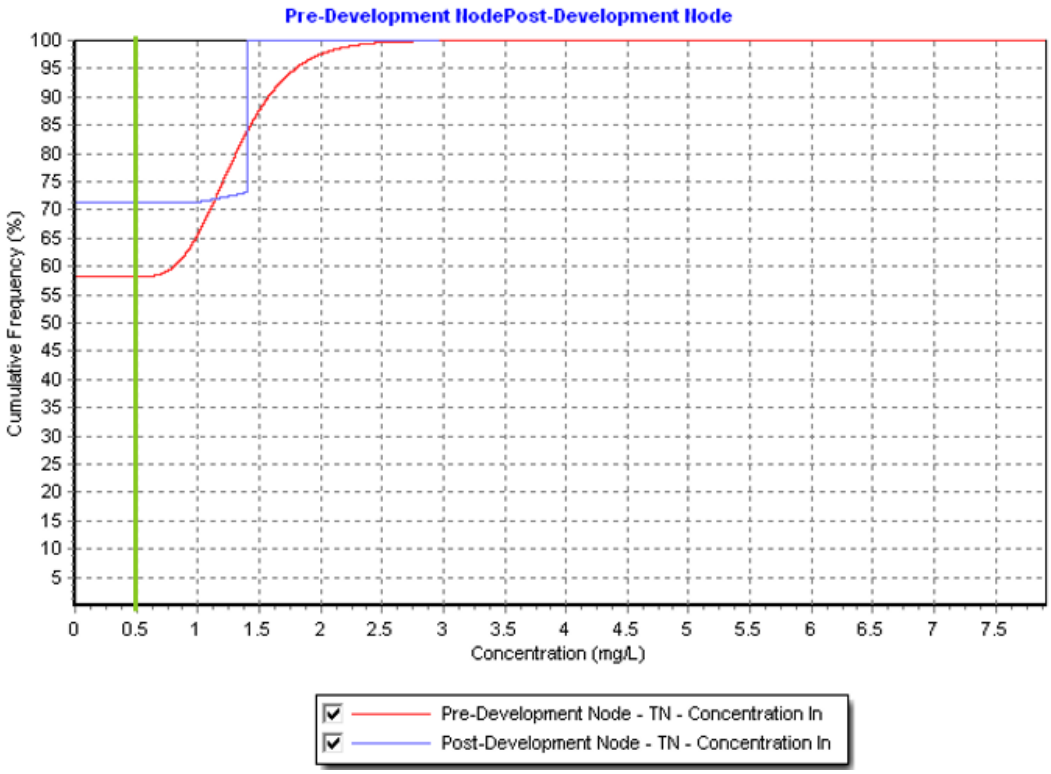

Figure 7-1: Modelled TN concentrations for pre and post development

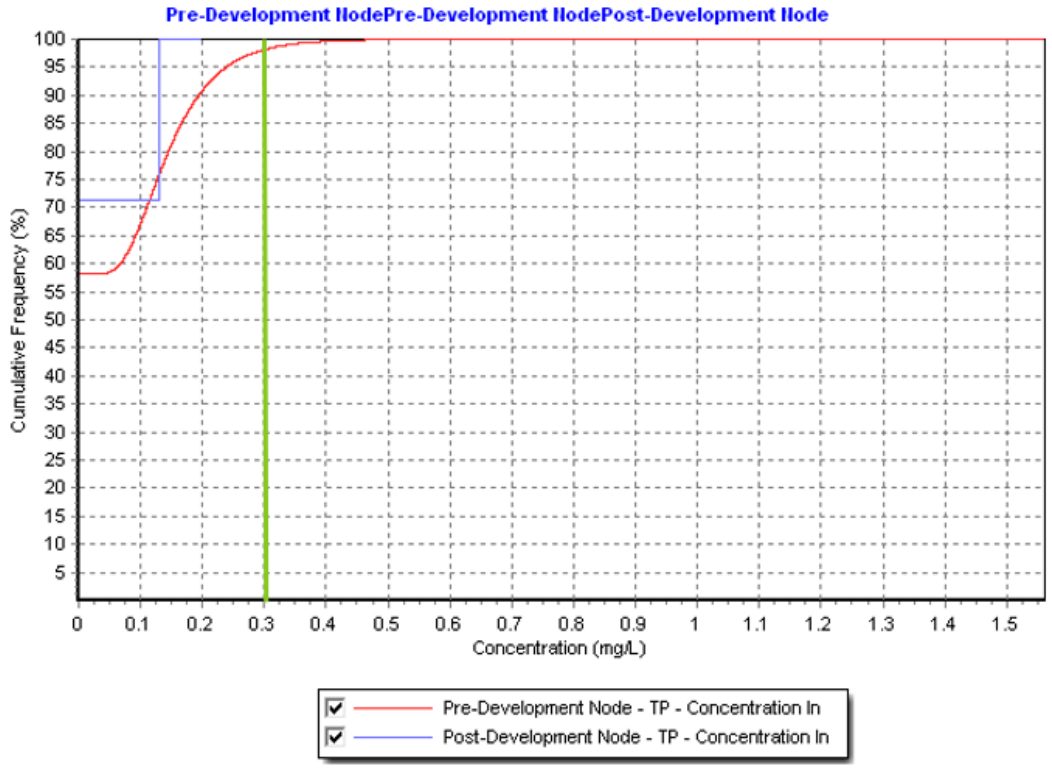

Figure 7-2: Modelled TP concentrations for pre and post development

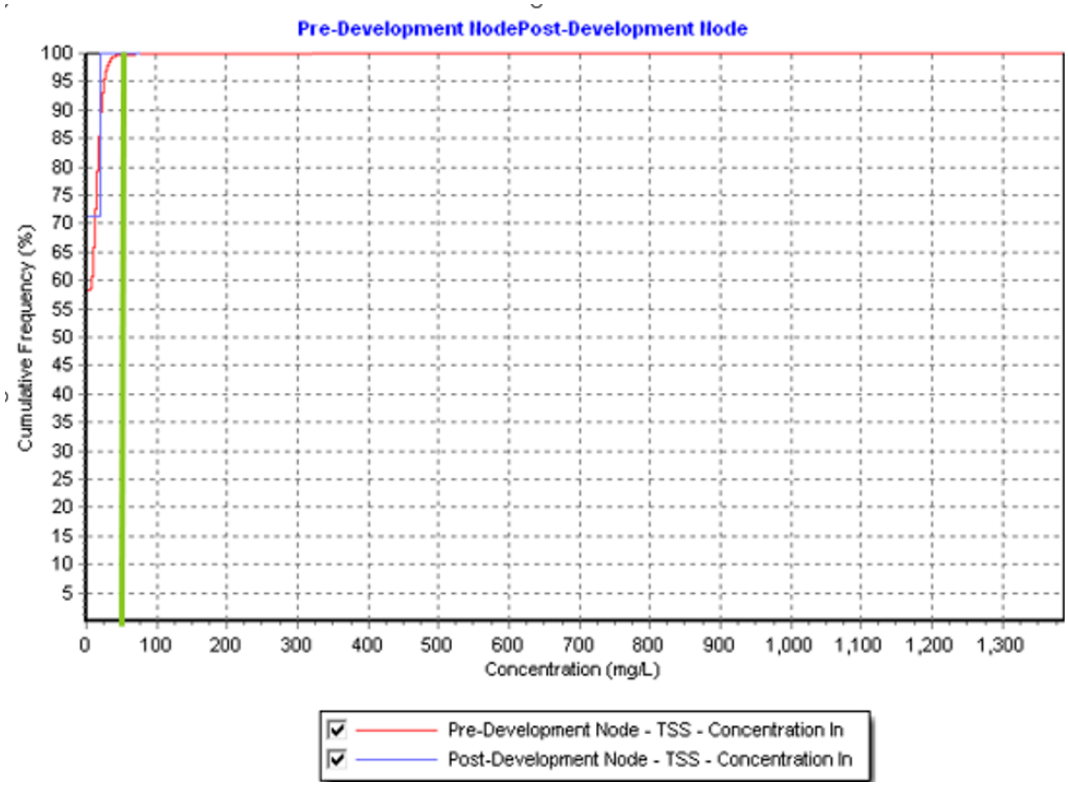

Figure 7-3: Modelled TSS concentrations for pre and post development

7.3 Surface water quantity and flow regime

Surface water features may experience an altered hydrological regime during the operational stage of the project. Compared to existing conditions, more of the Site would be hardstand during the operational stage, resulting to more runoff entering various surface water bodies including swamps and freshwater lakes, causing higher flow rates through these water bodies. This may exacerbate other impacts, such as erosion, scour, geomorphological change, and water feature degradation due to increased flow volume and velocity in these areas.

Water balance analysis was undertaken using Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to assess the change in mean annual runoff volume (MARV) throughout the project area. As the laydown areas within the indicative development footprint are to remain grassed, only the areas that would be altered, totalling to approximately 0.715ha, were included in the MUSIC modelling. Source nodes were created based on different assumed imperviousness. The MUSIC model was created using the Penrith City Council MUSIC link and following assumptions from NSW MUSIC guidelines (BMT, 2015):

- Revegetated areas, assuming 5% impervious
- Hardstand areas, assuming 90% imperviousness
- Sealed road pavement areas, assuming 100% imperviousness
- Soil parameters for sandy clay loam

The permanent project infrastructures were broken down based on imperviousness assumption, and MARV calculated from their areas are presented in Table 7-3.

Table 7-3: Summary of MARV from project - pre and post development

Stage	Component	Area (ha)	MUSIC Source node	MARV (ML/yr)
Pre-development	Turf	0.715	Revegetated land	0.775
Post-development	Access road	0.116	Sealed road	0.686
	Batteries (north of access road)	0.487	Hardstand	2.64
	Batteries (south of access road)	0.112	Hardstand	0.607
	Total	0.715		3.933

Comparing the total pre and post development MARV as captured in Table 7-3, the project is anticipated to increase MARV by approximately 3.158 ML/year or 307% within the project site, presenting a significant impact on flow regime in local receiving waterways.

DRAINS modelling was also used to size the OSD basin. Hydrology parameters assumptions were as follows:

- ILSAX hydrology
- Class D soil selected based on NSW SEED database
- Antecedent moisture condition value adopted as ‘3’

As per Endeavour Energy Substation Design Instruction SDI532 – Plumbing and Drainage, the drainage design is to be in accordance with local Council requirements. As Penrith City Council have adopted the 2019 Australian Rainfall and Runoff Book 1 Chapter 6 (V4.2), climate change is now required to be considered in all designs. For this project the climate change factors have been adopted as per Table 7-4

Table 7-4 Climate change parameters adopted values from ARR 2019

Parameter	Adopted value	Comment
Planning horizon	Medium term	Taken as 20 years to match the battery economic life
Socio-economic pathway	SSP2-4.5	Middle of the road scenario
Rainfall rate of change	15% per degree	As per ARR Table 1.6.1 central (median) estimate for storm events <1 hour
Global temperature change	1.7 degrees	As per ARR Table 1.6.2
Climate change factor adopted	26.8% increase in rainfall intensity	As per ARR equation 1.6.1

Table 7-5 captures DRAINS modelling results for peak flows from the project during various rainfall events.

As expected, the post development scenario without the detention increases pre-development flows due to increase in impervious areas. However, with the OSD basin, the post development scenario improves on the pre-development peak flows across all the rainfall events, representing approximately a drop ranging from 27% to 37% between the 5% Annual Exceedance Probability (AEP) and 1% AEP storm event.

Table 7-5 Modelled peak flows from project over various storm events

Rainfall event	Predevelopment (L/s)	Post development (L/s)	Post development + detention (L/s)
1EY	122	152	81
5% AEP	324	363	235
1% AEP	444	497	280

Therefore, greater volumes of runoff are anticipated from the project footprint due to increased impervious areas. However, the risk of scouring and erosion to receiving waterways are mitigated through installation of OSD, as peak flows will be reduced compared to pre-development peak flows.

7.4 Hydrology and geomorphology

Currently, the project would be underlain with gravel, replacing the grassed areas, which may result in increased runoff volumes and frequency. However, the changes in impervious areas are expected to be relatively minor compared to the Boundary Creek catchment, therefore changes to runoff volume and frequency to Boundary Creek are likely to be negligible. Boundary Creek have commenced bank stabilisation works therefore geomorphological impacts such as erosion and changes in catchment hydrology are also unlikely to occur.

All discharge points from developed areas of the indicative development footprint would be into existing stormwater drains within the indicative development footprint.

7.5 Regional and local flooding

The historical land use of the site included impervious surfaces that were removed, or covered with grass in around 2018. The site has remained in this vegetated state since. Under Council's stormwater management policy, the change in grassed area to paved area would normally trigger the need for flood controls to prevent an increase in peak flows leaving the site for a range of storm events. However, given the historical land use, Council may consider that the new development is consistent with the pre-2018 land use and does not present a risk of impact on the adjacent and downstream stormwater network.

Notwithstanding this, any increases in peak stormwater discharge from the developed site can be controlled with on-site stormwater detention as demonstrated in the sections below.

Modelling of the reference design shows that the stormwater detention basin will reduce the peak discharge rates to below pre-development (vegetated) rates. Modelling of the reference design also shows that the onsite stormwater detention basin can be co-located within the fire water storage without increasing the storage footprint.

Tailwater levels were extracted from the 2023 Cranebrook Flood Study for the on-site detention / firewater storage dam connection to the existing 1200W x 0.45H reinforced concrete box culvert (RCBC). The flood levels for this study are noted to be approximate due to a regional approach and therefore a secondary analysis was taken, adopting tailwater levels at the downstream RCBC connection to the Council network at Peach Tree Road of:

- 25.25m AHD (surface level) for the 1% AEP
- 23.881m AHD (RCBC obvert level) for the 5% AEP

The secondary approach, in line with Penrith City Council and Austroads guidance, yielded a more conservative tailwater level and was therefore adopted for the hydraulic analysis at this stage.

Due to the effects of the downstream adopted tailwater level, minor backflow from the RCBC into the proposed OSD basin occurs during storm events more severe than the 5% AEP. Whilst this is included within the OSD basin design, there is a potential risk of backflow reducing the capacity of the fire water storage during a large storm event occurring coincidingly with a fire.

To minimise this risk, a one-way valve (flap valve or similar) is required at the connection from the basin outlet to the Council line. This valve will not affect either the normal operation of the basin or the upstream fire valve operation during a fire event.

7.6 Groundwater

It is unlikely that operational impacts would be experienced in relation to groundwater. The underground service trenches will need to be designed to be above the groundwater elevation or designed to prevent groundwater ingress.

During the operational phase the project is unlikely to impact the registered groundwater bores as registered bores are outside the project footprint.

Therefore, it is considered unlikely that operational impacts would be experienced in relation to groundwater.

7.7 Summary of operational impacts

Table 7-6 summarises the project's operation impact on surface and groundwater resources.

Table 7-6: Summary of operational impact assessments

Activity / event	Description of impact	Receptor/s	Potential impact classification	Management and mitigation	Assessed residual risk
Leakage from site infrastructure, or vehicles such as oil from transformers or vehicles from maintenance team	Fuels used by transformers may result in mobilising hydrocarbons and other chemicals into drainage network, degrading water quality.	Surface water (Boundary Creek and Nepean River) Groundwater	Rare, minor impact	The OWMP will include spill management measures to prevent fuels, hydrocarbons and other chemicals enter any surface water features.	Low
Exposure of materials and mobilisation of contaminants during a battery fire	Contaminants in firefighting water may be mobilised in the event of a fire, ending up in onsite drainage networks and degrading the water quality released to the environment.	Surface water (Boundary Creek and Nepean River) Groundwater	Rare, minor impact	The OWMP will include firefighting water management measures to prevent contaminated waters entering any surface water and groundwater resources.	Low
Increased development footprint / impervious surface	Increased pollutant loading to Boundary Creek and Nepean River. This may lead to surface water quality impacts.	Surface water (Boundary Creek and Nepean River)	Possible, minor impact	The proposed treatment train design will be designed achieve stormwater pollution reduction targets, outlined in the Penrith DCP 2014 50%ile concentrations of stormwater discharged from site do not exceed WQOs or ANZG guidelines	Low
	Impacts on existing stormwater drainage system downstream of the substation and surrounds.	Surface water (drainage system within project footprint and surrounding network)	Unlikely, minor impact	OSD basin ensures no impact on local discharge and function of the surrounding stormwater drainage network. No change in drainage or flooding patterns in the downstream trunk drainage network.	Low

8 Management of impacts

8.1 Overview of approach

This section describes the environmental management approach for surface water, groundwater and water use throughout the construction and operational phases of the project as well as the decommissioning phase (construction measures are also applicable to decommissioning phase).

Mitigation measures would be implemented to minimise the impacts to receiving environments. An overview of the management measures is provided in Sections 8.1.1 and 8.1.2 and specific measures are listed in Section 8.2.

8.1.1 Construction

A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the Construction Environmental Management Plan (CEMP) prior to the issue of the Construction Certificate. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution during construction and describe how these risks would be managed. The SWMP would contain appropriate measures (as a minimum) to:

- minimise the extent of ground disturbance;
- divert surface water runoff around construction locations;
- install erosion controls within construction locations;
- collect and filter sediment from surface water runoff within construction locations;
- store/stockpile materials away from receiving waters and overland flow paths;
- manage stockpiles to minimise erosion and sediment transport;
- minimise the potential of soil and water quality impacts during storage of wastes and potentially polluting substances ;
- minimise the duration of soil exposure and progressively rehabilitate and stabilised disturbed areas;
- manage unexpected finds of contaminated materials;
- record groundwater inflow and disposal volumes should excavations intercept groundwater;
- management of dewatering processes, expected groundwater take/ impact and licencing requirements against the minimal impact criteria listed within the NSW Aquifer Interference Policy and relevant WSPs;
- procedures for the appropriate handling, storage, transport, and disposal of groundwater; and
- manage spills to reduce and address soil and water contamination.

The SWMP would include Erosion and Sediment Control Plans (ESCPs) to detail erosion and sediment controls to be implemented at specific sites and for specific construction activities and would include rehabilitation requirements. The SWMP and ESCPs would be prepared in accordance with Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and other relevant volumes and other relevant guidelines. Confirmation of whether sedimentation basins are to be utilised as a mitigation measure during construction would be confirmed during development of the ESCP. If required, these would likely be located at the proposed operational basin locations.

Where sediment basins are proposed, the water quality will be observed and tested prior to release of surface waters to the downstream drainage system. Water quality testing procedure and criteria would be confirmed as part of the SWMP but include turbidity, pH and a visual inspection of oil and grease as a minimum.

Mitigation measures to minimise impacts associated with handling hazardous materials would include:

- Scheduling works to avoid forecasted rainfall during handling of hazardous materials;
- Bunding of potentially hazardous areas to capture any spills;
- Safely storing all fuels and other hazardous liquids and materials (e.g. collected transformer oil) on ground level away from existing stormwater drainage systems and watercourses. These would be stored in a sealed bunded area within the indicative development footprint;
- Limiting plant and battery refuelling and minor maintenance activities to designated areas with established spill capture and management controls;
- Regular visual inspections of the works area and watercourses to identify any potential water quality issues, as per the implementation of the CEMP and SWMP; and
- An Emergency Spill Procedure would be developed to manage spill events during construction as part of the CEMP. The procedure would include spill emergency response measures.

It is not expected that excavation works will encounter groundwater given the site is high in the catchment, however there is a potential for some local water to pond in trenches.

8.1.2 Operation

An Operational Water Management Plan (OWMP) will be required prior to the issue of a construction certificate. The OWMP will include details about on-site water management including fire water handling and disposal.

In order to control potential water quality impacts associated with a fire event, it is proposed to provide combined firewater storage and on-site stormwater detention basin a capacity of 313.16kL. During a fire, a one-way valve would be manually operated by on-site personnel or fire services, and used to prevent discharges from the operational dam by closing the connection to the stormwater drainage network.

Any captured water produced from firefighting would be tested and then disposed of off-site at a licensed facility.

As well as firewater storage, if required, to protect the conveyance capacity of existing drainage onsite, the operational basins could also be used as detention basins to attenuate flows. Potential impacts on the existing stormwater network would be assessed by drainage modelling during detailed design.

An OWMP would be prepared after the construction but prior to the operation of the project. The OWMP is to be complied with during the entirety of the operational phase and shall address:

- Operational activities that may pose a risk to water quality.
- Management and maintenance of the operational basins.
- Identification of emergency response actions that would be undertaken to manage water quality at the site during a battery fire and any associated water quality testing and disposal requirements.
- Identification of any ongoing monitoring of water quality at the Site.
- Maintenance of stormwater system to ensure serviceability.
- Emergency response actions undertaken to manage water quality at the site, eg battery fires and any associated water quality impacts.
- Accountability and responsibilities of key staff.

Drainage provisions for the works associated with the project would be confirmed during detailed design to minimise blockage of upstream stormwater flows.

8.2 Summary of mitigation measures

A summary of mitigation measures to reduce the potential impacts on each activity for detailed design, construction and operation phase is presented in Table 8-1.

Table 8-1: Summary of mitigation measures

Impact/s	Environmental safeguard	Responsibility	Timing	Relevant location
Water quality, erosion and sedimentation	A SWMP shall be prepared and implemented as part of the CEMP The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution during construction and describe how these risks will be managed. This includes consideration of stockpile locations and management.	Contractor	Pre-construction and construction	All locations
	ESCPs would be developed and implemented in consultation with a Suitable Qualified Professional in Erosion and Sediment Control during construction for the activities and areas that are considered higher risk. The plan will detail the processes, responsibilities, and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: ■ *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Volume 2A* (DECC, 2008a) and *Volume 2C* (DECC, 2008b) commonly referred to as the 'Blue Book' ■ *Best Practice Erosion and Sediment Control* (IECA, 2008)	Contractor	Pre-construction and construction	All locations
	Design, implementation, and maintenance of sedimentation basin (as required) in accordance with the SWMP and ESCP. Biofiltration systems would only be completed (in terms of placement of filter media and planting) once earthworks are fully complete.	Detailed Design Team and Contractor	Pre-construction and construction	All locations
Water quality	For the design and construction of works, consider, and adhere to Watercourse Policy and Guidelines for *Fish Habitat Conservation and Management* (Update 2013) (DPI, 2013)	Contractor	Pre-construction and construction	Water courses
	Prior to construction, an Emergency Spill Procedure would be created to dictate actions if a spill is to occur during construction. A separate decommissioning plan would be developed which would include emergency spill procedures for the decommissioning phase.	Contractor	Pre-construction and construction	All locations
	Currently, the reference design includes proposed stormwater filtration devices to achieve water quality targets adopted by Penrith City Council for waterway health	Detailed Design Team	Pre-construction	All locations
	The OWMP (to be developed under the OEMP) would outline and define, operation, monitoring and maintenance of stormwater treatment assets throughout the operation of the BESS.	Ausconnex	Construction and operation	All locations
	Firewater storage to be provided upstream of all discharge points to contain the maximum expected firewater usage.	Detailed Design Team	Pre-construction	All Locations
Flooding	Design of stormwater infrastructure, such as drainage channels and detention basins should be designed to the sufficient rainfall event and in consideration of existing infrastructure to avoid unnecessary impacts to the existing network.	Detailed Design Team	Pre-construction	All locations
	All stockpiles shall be located outside of overland flow paths and a suitable distance away from drainage channels.	Contractor	Pre-construction and construction	All stockpiles

Impact/s	Environmental safeguard	Responsibility	Timing	Relevant location
Groundwater flow paths, levels, and users	Alternative construction methodologies will be investigated and implemented as required to minimise impacts to GDEs if identified to be directly impacted during detailed design.	Contractor	Pre-construction and construction	All locations
	If excavation during construction is required to intercept groundwater, a Dewatering Management Plan shall be prepared by the Proponent in accordance with the *Water Management Act 2000.* Should dewatering be required, groundwater monitoring would be undertaken for the duration of the dewatering.	Contractor	Pre-construction and construction	All Locations

9 Conclusion

The key potential impacts of the project on surface water and groundwater during construction and operation are as follows:

- Surface Water:
  - Minor to moderate water quality impacts due to sediment laden runoff being released to waterways during construction activities such as earthworks, stockpiling, dewatering, and transportation of materials if proper controls/measures are not incorporated.
  - Minor water quality impacts during construction related to mishandling, incorrect storage and or accidental spills of construction materials, hydrocarbons and chemicals.
  - Negligible increase of runoff volume, frequency, flow rate and pollutant load being discharged to receiving waterways in Boundary Creek and Nepean River catchments as a result of an increased impervious footprint.
- Groundwater:
  - Unlikely impacts to groundwater flow and levels as excavations are unlikely to intercept groundwater table.
  - Water quality impacts related to mishandling, incorrect storage and or accidental spills of construction materials, hydrocarbons and/chemicals.

The potential impacts identified above are to be managed and/or mitigated through the following:

- Prior to the issue of the Construction Certificate, a Soil and Water Management Plan (SWMP) and other aspects of the Construction Environmental Management Plan (CEMP) shall be prepared to manage water quality impacts during construction of the Project. This will include implementing erosion and sedimentation measures and dewatering operations by the construction contractor.
- Proposed on-site stormwater detention will prevent increased stormwater peak flows impacting on the local drainage network and avoid downstream localised flooding
- During non-fire events, the proposed stormwater filtration will achieve Council's adopted pollution reduction targets for waterway health. Modelling shows that discharge to Boundary Creek and Nepean River does not directly worsen water quality during ambient conditions.
- The water retention can capture and temporarily retain firewater for proper management and disposal offsite. The dam will also provide attenuation of stormwater flows during large storm events.
- OWMP, to be prepared after construction but prior to operation, to identify and mitigate operational activities that may pose a risk to water quality, dictate the management and maintenance of the operational basins and define fire water management practices.

Therefore, there are no identified unacceptable residual surface water and groundwater impacts related to the project.

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Appendices

Appendix A

Registered bores

Table A: Summary of registered bores

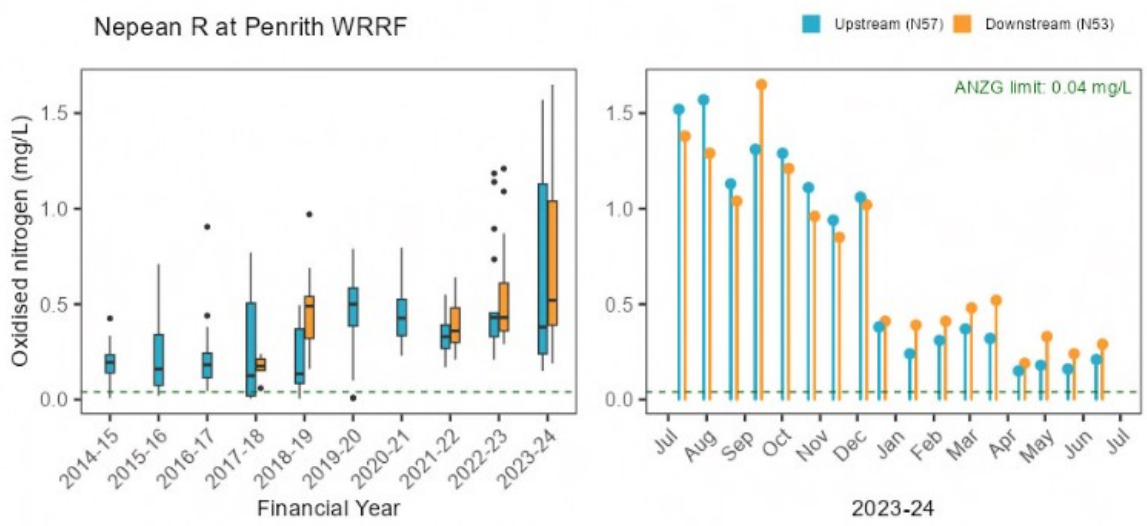
Pipe ID	Bore ID	Status	Easting	Northing	Use	Drilled depth (m)	Salinity (mg/L)	SWL (mBGL)	Yield (L/s)
GW102202.1.1	GW102202	FUN	286655	6264635	Monitoring			6.21 (1998)	
GW107900.1.1	GW107900	UNK	286376	6264924	Monitoring	10		7.00 (2005)	
GW110649.1.1	GW110649	UNK	285991	6264211	Monitoring	10		8.70 (2009)	
GW109866.1.1	GW109866	UNK	284763	6263527	Monitoring	12.5		9.719 (2006)	
GW109862.1.1	GW109862	UNK	284720	6263514	Monitoring	11		9.286 (2006)	
GW108484.1.1	GW108484	UNK	285738	6262409	Other	11	550 (2006)		
GW110647.1.1	GW110647	UNK	286226	6264281	Monitoring	10		8.10 (2009)	
GW109863.1.1	GW109863	UNK	284734	6263508	Monitoring	11.6		9.288 (2006)	
GW109864.1.1	GW109864	UNK	284734	6263527	Monitoring	11.850		9.633 (2006)	
GW115496.1.1	GW115496	FUN	285036	6264468	Monitoring	11.8		7.48 (2012)	
GW067493.1.1	GW067493	FUN	285552	6264945	Exploration	11.8			
GW110057.1.1	GW110057	UNK	286082	6264653	Monitoring	13.2		7.50 (2009)	
GW109667.1.1	GW109667	UNK	286158	6264450	Monitoring			13.40 (2008)	
GW102209.1.1	GW102209	FUN	286655	6264635	Monitoring	13.7		6.71 (1998)	
GW108898.1.1	GW108898	UNK	285694	6264490	Monitoring	14.6		9.50 (2008)	
GW107763.1.1	GW107763	UNK	286365	6264772	Water Supply	13.8		7.20 (2006)	
GW108897.1.1	GW108897	UNK	285613	6264270	Monitoring	15.5		11.0 (2008)	
GW102208.1.1	GW102208	FUN	286655	6264635	Monitoring	14.85		6.49 (1998)	
GW107762.1.1	GW107762	UNK	286407	6264616	Water Supply	11.60		7.00 (2005)	
GW108896.1.1	GW108896	UNK	286325	6264438	Monitoring	13.7		6.50 (2008)	
GW103048.1.1	GW103048	UNK	286110	6262406	Other	8.00		6.00 (1990)	
GW108042.1.1	GW108042	UNK	286759	6263761	Monitoring	8.00		6.4 (2006)	

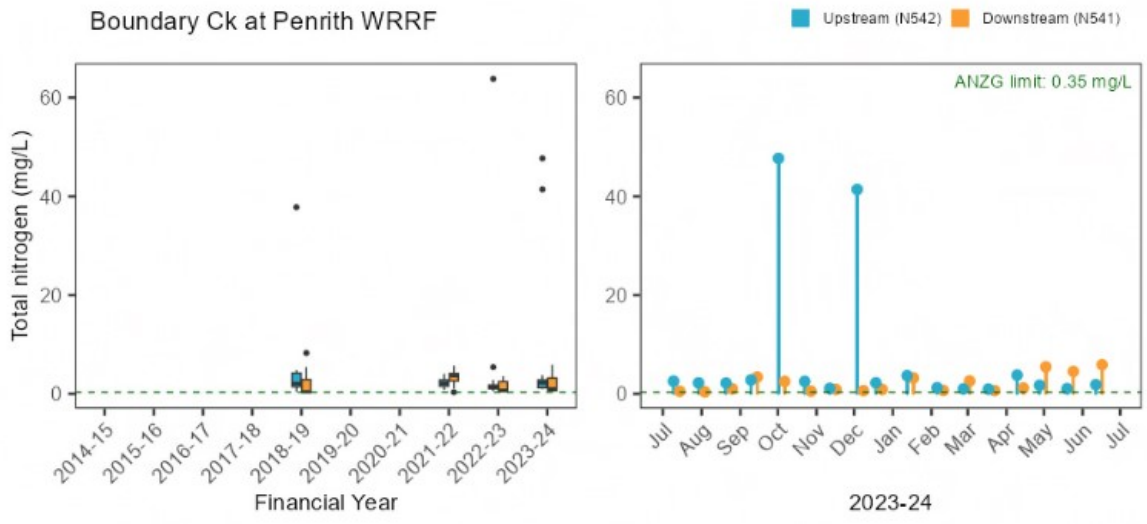
Pipe ID	Bore ID	Status	Easting	Northing	Use	Drilled depth (m)	Salinity (mg/L)	SWL (mBGL)	Yield (L/s)
GW102182.1.1	GW102182	FUN	286655	6264635	Monitoring	9.10		6.82 (1998)	
GW102206.1.1	GW102206	FUN	286655	6264635	Monitoring	12.00		7.07 (1998)	
GW107761.1.1	GW107761	UNK	286614	6264557	Water Supply	13.90		7.80 (2005)	
GW108041.1.1	GW108041	UNK	286724	6263735	Monitoring	7.50		6.70 (2006)	
GW102207.1.1	GW102207	FUN	286655	6264635	Monitoring	9.50		6.85 (1998)	
GW102180.1.1	GW102180	FUN	286654	6264635	Monitoring		400 (1998)	6.6 (1998)	
GW109669.1.1	GW109669	UNK	285656	6264408	Monitoring	15.60			
GW107899.1.1	GW107899	UNK	286425	6264924	Monitoring	10.0		7.00 (2005)	
GW107897.1.1	GW107897	UNK	286625	6264834	Monitoring	10.10		7.00 (2005)	
GW067495.1.1	GW067495	FUN	285514	6264906	Exploration	7.90			
GW067494.1.1	GW067494	FUN	285522	6264920	Exploration	16.30			
GW108899.1.1	GW108899	UNK	286667	6264528	Monitoring	14.60		7.00 (2008)	
GW102210.1.1	GW102210	FUN	286655	6264635	Monitoring	11.40		8.25 (1993)	
GW067496.1.1	GW067496	FUN	285514	6264902	Exploration	16.50			
GW108043.1.1	GW108043	UNK	286836	6263742	Monitoring	9.00		6.80 (2006)	
GW067497.1.1	GW067497	FUN	285489	6264901	Exploration	8.90			
GW107898.1.1	GW107898	UNK	286470	6264883	Monitoring	10.10		7.00 (2005)	
GW102183.1.1	GW102183	FUN	286655	6264635	Monitoring	10.50		7.050 (1998)	
GW116850.1.0	GW116850	USE	285368	6263354	Monitoring	90.20			
GW116849.1.1	GW116849	USE	285363	6263357	Monitoring	13.10			
GW029710.1.1	GW029710	UNK	286046	6262724	Water Supply	7.90			
GW108044.1.1	GW108044	UNK	286812	6263767	Monitoring	9.50		6.60 (2006)	
GW101178.1.1	GW101178	USE	285844	6262566	Other	11.20	180 (1998)	8.00 (1998)	
GW105512.1.1	GW105512	UNK	285849	6264287	Monitoring	15.00		9.60 (2003)	
GW114758.1.1	GW114758	FUN	286638	6264564	Monitoring	14.20			
GW111987.1.1	GW111987	FUN	286130	6262887	Monitoring	9.00			
GW108071.1.1	GW108071	UNK	286618	6264556	Monitoring	14.10			

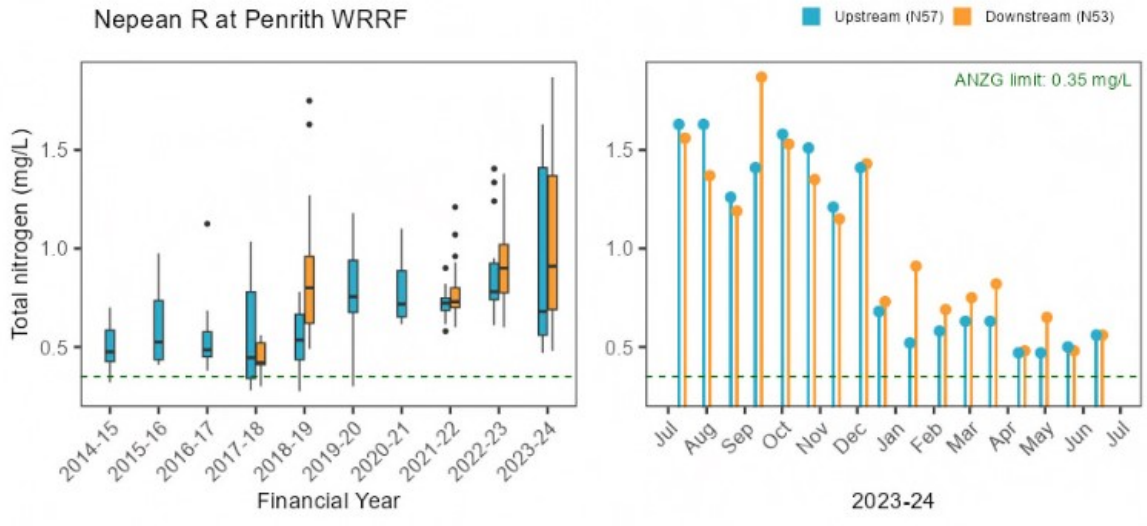
Pipe ID	Bore ID	Status	Easting	Northing	Use	Drilled depth (m)	Salinity (mg/L)	SWL (mBGL)	Yield (L/s)
GW108081.1.1	GW108081	UNK	286033	6264515	Monitoring	14.35		7.50 (2006)	
GW107307.1.1	GW107307	UNK	286100	6264649	Monitoring	13.20		7.50 (2005)	
GW107559.1.1	GW107559	UNK	286516	6264591	Monitoring	13.60		7.50 (2005)	
GW107565.1.1	GW107565	UNK	286751	6264687	Monitoring	13.80			
GW108072.1.1	GW108072	UNK	286660	6264574	Monitoring	14.20		6.00 (1996)	
GW106548.1.1	GW106548	UNK	285098	6263883	Other			6.00 (1996)	
GW107563.1.1	GW107563	UNK	286685	6264564	Monitoring	13.90			
GW107560.1.1	GW107560	UNK	286558	6264582	Monitoring	14.20		7.50 (2005)	
GW067423.1.1	GW067423	FUN	285791	6264819	Exploration	15.40			
GW107564.1.1	GW107564	UNK	286722	6264600	Monitoring	13.90		7.50 (2005)	
GW107562.1.1	GW107562	UNK	286649	6264556	Monitoring	14.60		7.50 (2005)	
GW067422.1.1	GW067422	FUN	285577	6264817	Exploration	16.20			
GW026231.1.1	GW026231	UNK	285724	6262162	Irrigation	8.50	1001-3000 (1966)	6.00	
GW116854.1.1	GW116854	USE	285191	6263887	Monitoring	324.00		7.30 (2020)	
GW107561.1.1	GW107561	UNK	286607	6264556	Monitoring	14.30		7.50 (2005)	
GW102213.1.1	GW102213	FUN	286655	6264635	Monitoring	13.60		8.470 (1993)	
GW102212.1.1	GW102212	FUN	286655	6264635	Monitoring	11.60		8.20 (1993)	
GW105513.1.1	GW105513	UNK	285665	6264464	Monitoring	16.00		6.100 (2003)	
GW109865.1.1	GW109865	UNK	284755	6263516	Monitoring	12.00		9.589 (2006)	
GW102181.1.1	GW102181	FUN	286655	6264635	Monitoring	9.30		6.500 (1998)	0.100 (1998)
GW110648.1.1	GW110648	UNK	286004	6264302	Monitoring	9.70		8.200 (2009)	
GW067498.1.1	GW067498	FUN	285485	6264901	Exploration	16.80			
GW065927.1.1	GW065927	UNK	284884	6264023	Other	15.60		3.30 (1991)	3.00 (1998)
GW102211.1.1	GW102211	FUN	286655	6264635	Monitoring	10.60		8.450 (1993)	
GW105511.1.1	GW105511	UNK	285826	6264430	Monitoring	14.50		8.300 (2003)	
GW105509.1.1	GW105509	UNK	286271	6264245	Monitoring	14.10		7.000 (2003)	
GW105514.1.1	GW105514	UNK	285662	6264356	Monitoring	15.65		5.80 (2003)	

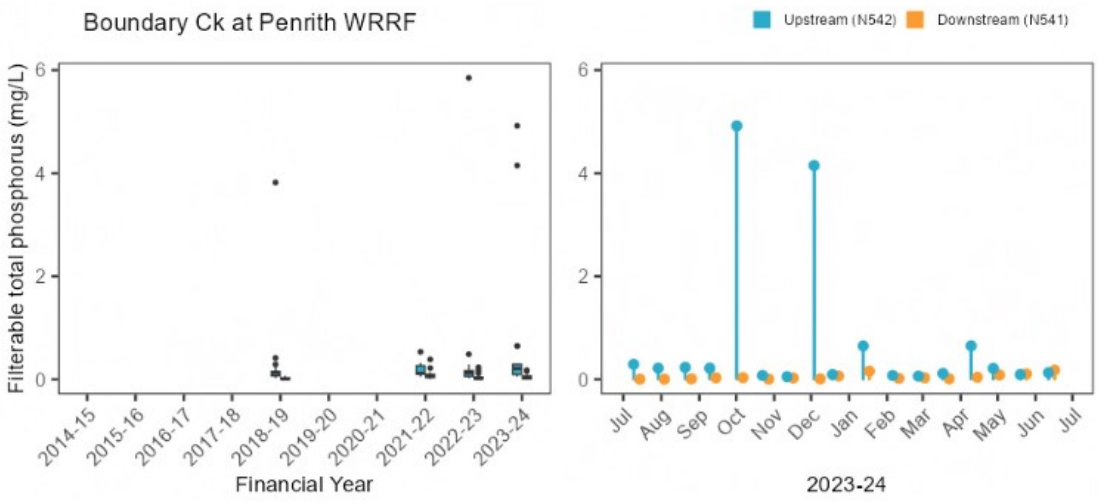
Pipe ID	Bore ID	Status	Easting	Northing	Use	Drilled depth (m)	Salinity (mg/L)	SWL (mBGL)	Yield (L/s)
GW105510.1.1	GW105510	UNK	286117	6264451	Monitoring	14.50		7.000 (2003)	
GW111989.1.1	GW111989	FUN	286157	6262897	Monitoring	9.00			
GW111988.1.1	GW111988	FUN	286134	6262904	Monitoring	9.00			
GW114760.1.1	GW114760	FUN	286675	6264625	Monitoring	13.80			
GW114759.1.1	GW114759	FUN	286626	6264567	Monitoring	13.70			
GW102239.1.1	GW102239	FUN	286655	6264635	Monitoring	9.40		6.780 (1998)	
GW040458.1.1	GW040458	UNK	286374	6264149	Irrigation	11.00			
GW063812.1.1	GW063812	UNK	285922	6264817	Monitoring	14.60			
GW040456.1.1	GW040456	UNK	286537	6264954	Monitoring	8.40			
GW040454.1.1	GW040454	UNK	286199	6265070	Monitoring	12.80			
GW040455.1.1	GW040455	UNK	286329	6265011	Irrigation	8.90			
GW040457.1.1	GW040457	UNK	286341	6264488	Monitoring	10.20			

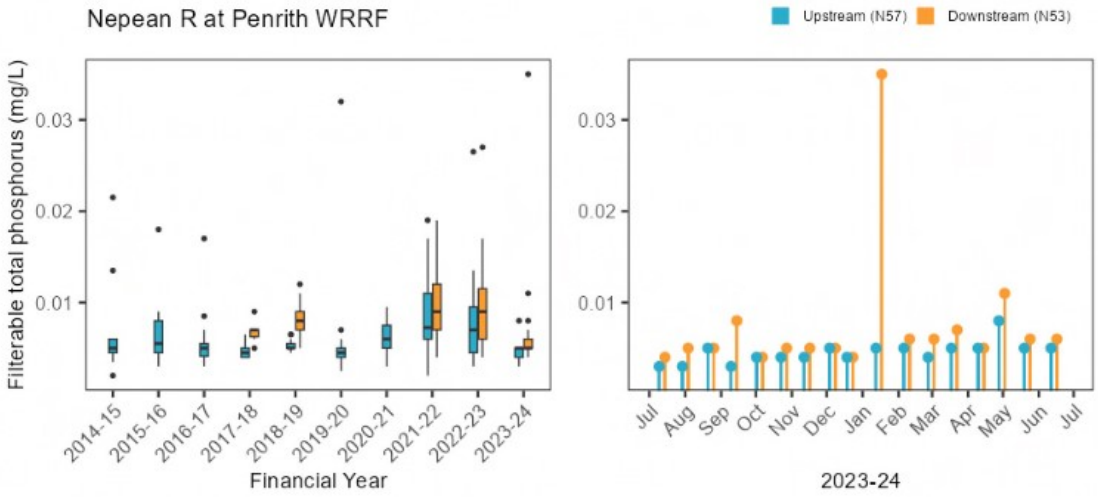
Appendix B
Boundary Creek and Nepean River Water Quality








Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
Filterable total phosphorus (mg/L)
0
2
4
6
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
Financial Year
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2023-24


Nepean R at Penrith WRRF
Upstream (N57)
Downstream (N53)
Filterable total phosphorus (mg/L)
0.01
0.02
0.03
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
Financial Year
Jul
Aug
Sep
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Nov
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Mar
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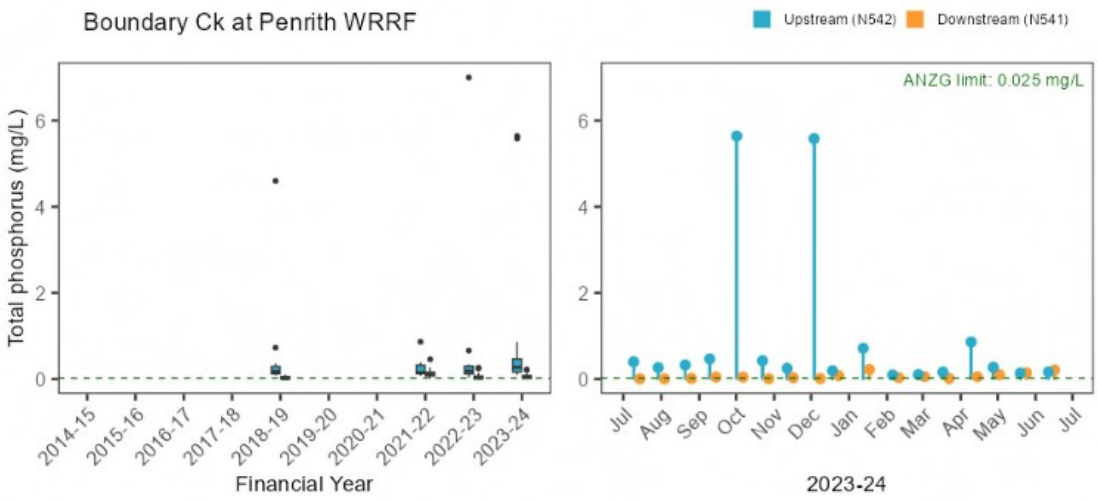
May
Jun
Jul
2023-24


Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
ANZG limit: 0.025 mg/L
Total phosphorus (mg/L)
0
2
4
6
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
Financial Year
Jul
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May
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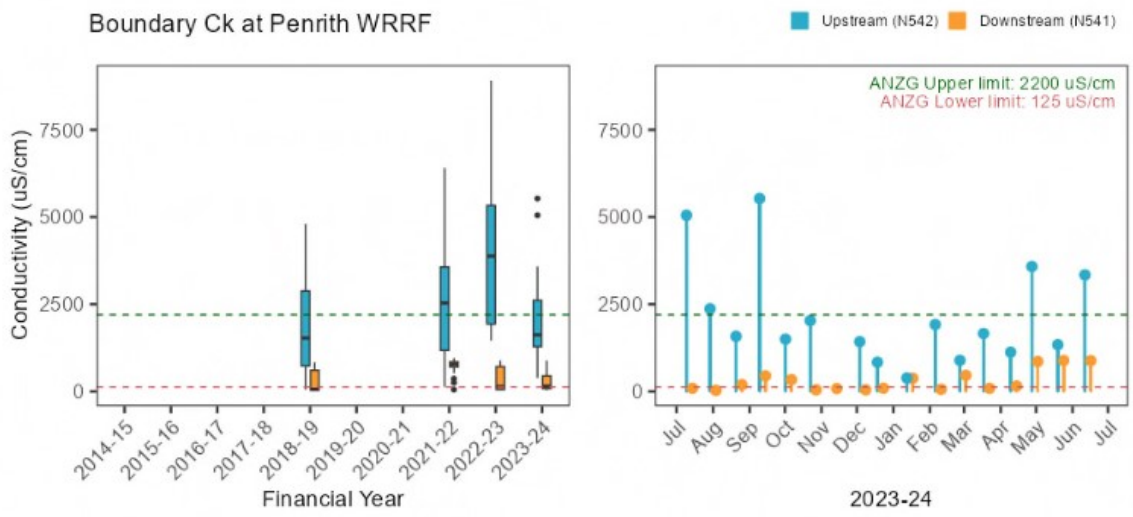
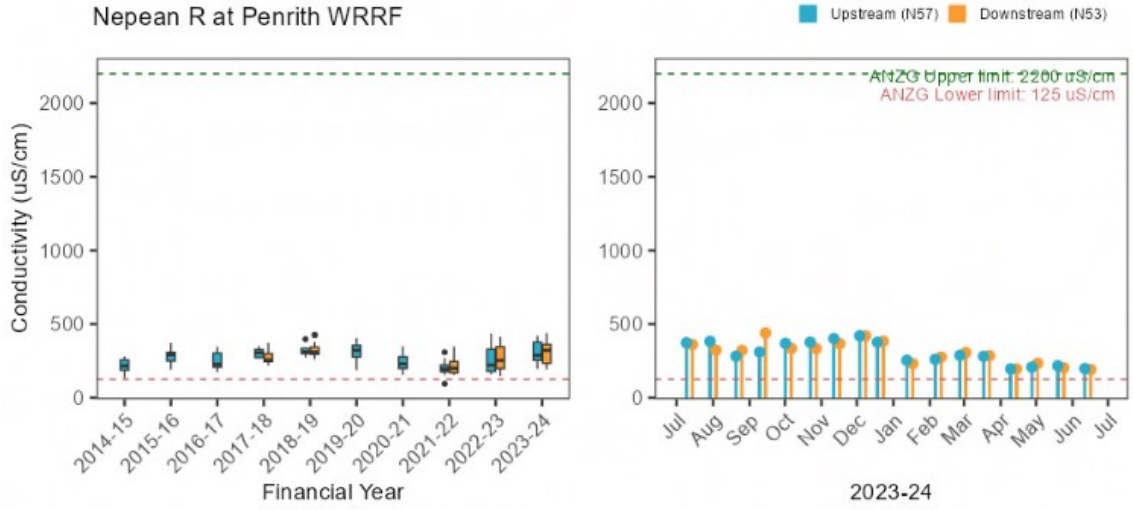
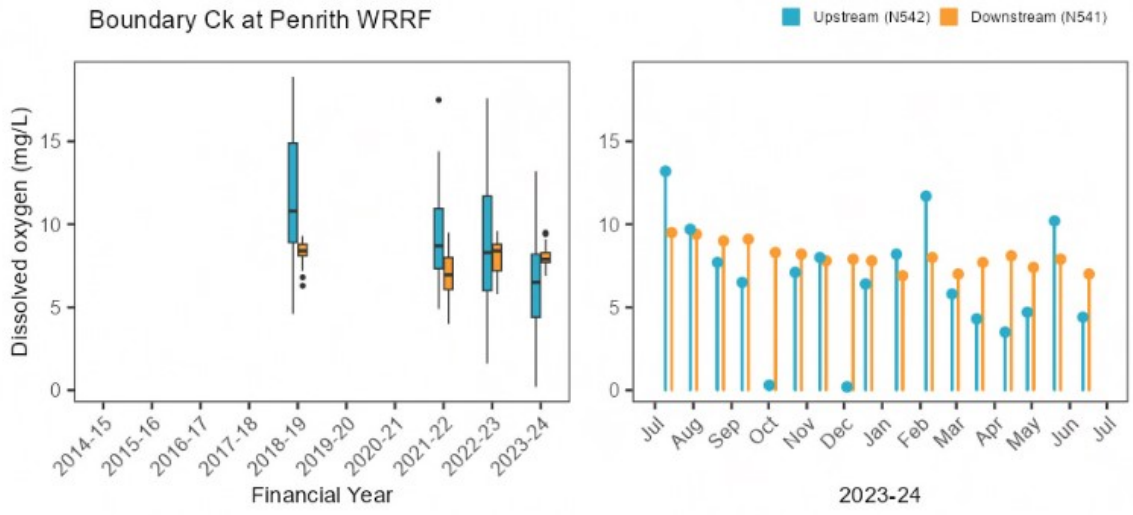
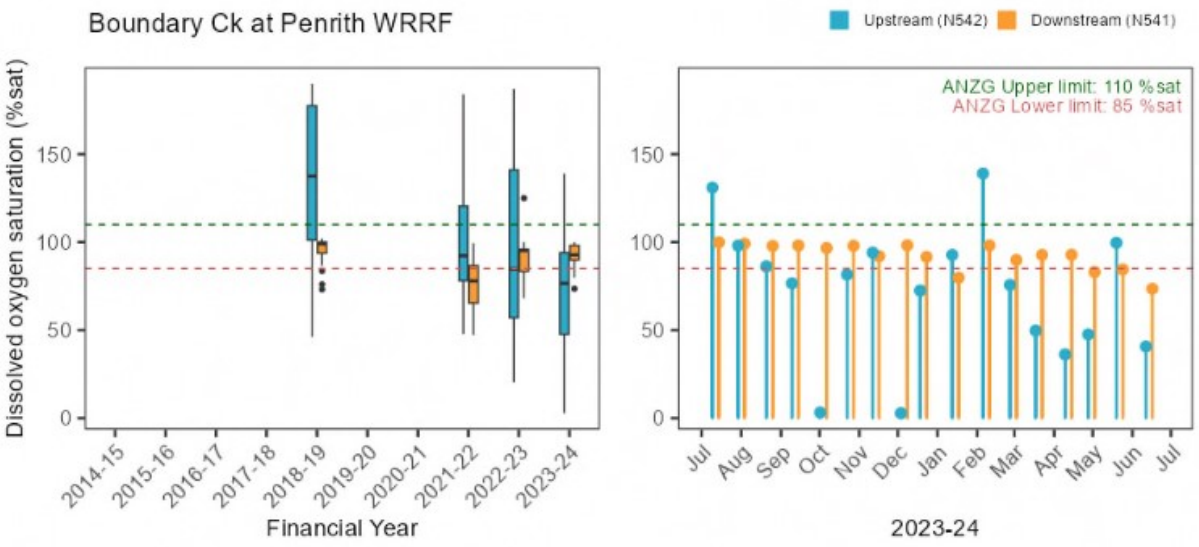
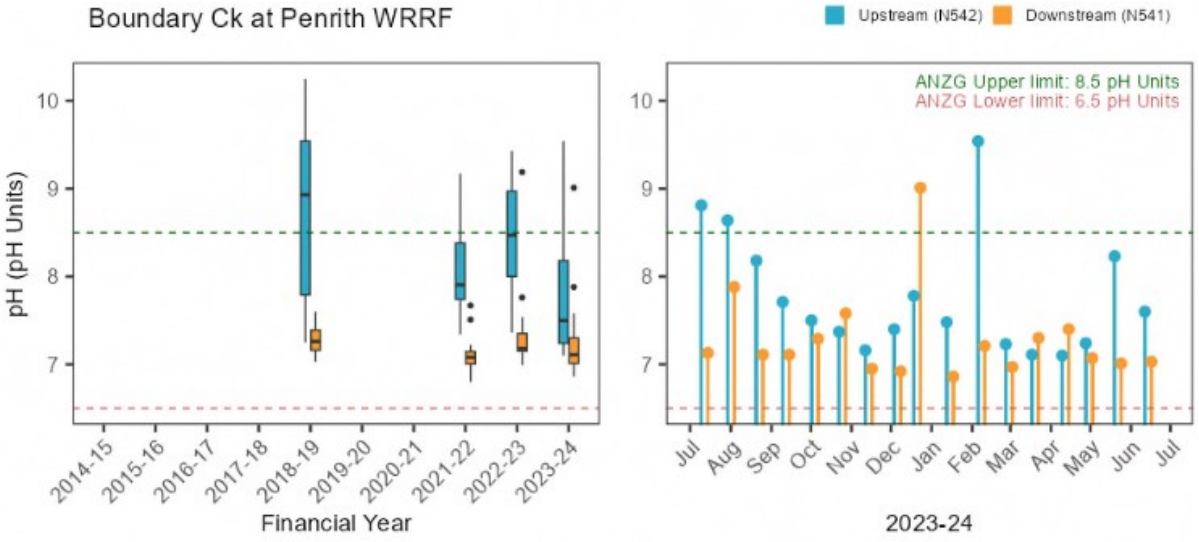
Jul
2023-24

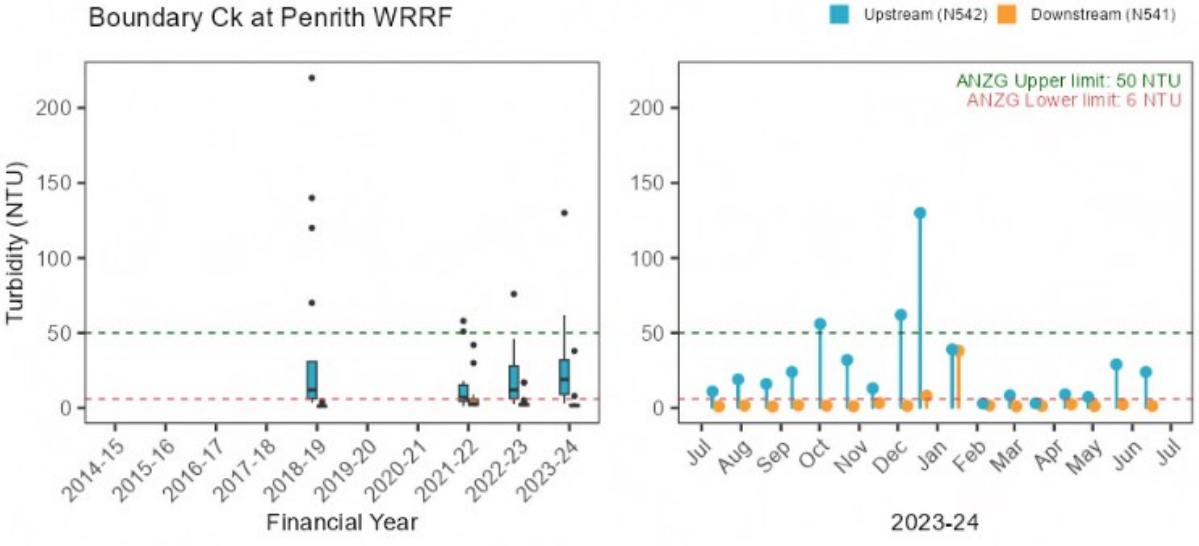

Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
Conductivity (uS/cm)
7500
5000
2500
0
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
Financial Year
ANZG Upper limit: 2200 uS/cm
ANZG Lower limit: 125 uS/cm
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2023-24


Nepean R at Penrith WRRF
Upstream (N57)
Downstream (N53)
Conductivity (uS/cm)
2000
1500
1000
500
0
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
Financial Year
ANZG Upper limit: 2200 uS/cm
ANZG Lower limit: 125 uS/cm
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2023-24


Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
Dissolved oxygen (mg/L)
15
10
5
0
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
2021-22
2022-23
2023-24
Financial Year
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2023-24


Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
Dissolved oxygen saturation (%sat)
ANZG Upper limit: 110 %sat
ANZG Lower limit: 85 %sat
Financial Year
2023-24


Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
pH (pH Units)
ANZG Upper limit: 8.5 pH Units
ANZG Lower limit: 6.5 pH Units
Financial Year
2023-24


Boundary Ck at Penrith WRRF
Upstream (N542)
Downstream (N541)
Turbidity (NTU)
ANZG Upper limit: 50 NTU
ANZG Lower limit: 6 NTU
Financial Year
2023-24

Appendix C
Water consultation

From: Helen Smith <Helen.Smith@endeavourenergy.com.au>
Sent: Wednesday, 8 October 2025 2:02 PM
To: Pilar Aberasturi
Cc: Albert Sunga; Susan Parratt; Simon Lawton
Subject: RE: Sydney Water services for the Ausconnex HV BESS project at Penrith Transmission Substation

Hi Pilar,
There is no contract as such with Sydney Water. As a State Gov't owned infrastructure provider, and the only entity that supply water, connection is deemed to be an agreement to pay for services.

Given the BESS is being constructed on an EE site, I assume there is a lease being put in place (as is the case for their offices at Glendenning and Hoxton Park) and water would be provided and paid for by EE under this arrangement.

I hope this is of use.

Thank you

Regards,

Helen Smith. Head Of Property

[redacted]

Level 40-42, 8 Parramatta Square, 10 Darcy Street
Parramatta NSW 2150. Dharug Country

endeavourenergy.com.au

Endeavour Energy respectfully acknowledges the Traditional Custodians on whose lands we live, work, and operate and their Elders past, present and emerging.

From: Preshen Moodley <Preshen.Moodley@ausconnex.com.au>
Sent: Tuesday, 7 October 2025 12:54 PM
To: Johann Coetzer; Sam Morath; Pilar Aberasturi
Subject: FW: Enquiry: Water Supply Services at Penrith

Hi all,

FYI.

Kind regards,
Preshen

From: Admin Galea <admin@pmgalea.com.au>
Sent: Tuesday, 7 October 2025 12:31 PM
To: Preshen Moodley <Preshen.Moodley@ausconnex.com.au>; Accounts PM Galea <accounts@pmgalea.com.au>
Subject: RE: Enquiry: Water Supply Services at Penrith

Good Afternoon,

Yes, we can supply this service for Penrith site.

Kind Regards,

Michelle Berardinelli
Manager
P & M Galea Plant Hire

w: (02) 9679 1606
e: admin@pmgalea.com.au
PO Box 3690
Rouse Hill NSW 2155

From: Preshen Moodley <Preshen.Moodley@ausconnex.com.au>
Sent: Tuesday, 7 October 2025 12:28 PM
To: Accounts PM Galea <accounts@pmgalea.com.au>; Admin Galea <admin@pmgalea.com.au>
Subject: Enquiry: Water Supply Services at Penrith

Good day,

We have a project starting at Penrith Transmission Substation.

May you kindly advise if P&M Galea are able to service this site for water cart services?
The site is just off Museum Drive in Penrith.

Appreciate your response.

Preshen Moodley | **Project Engineer**
[redacted]
E preshen.moodley@ausconnex.com.au
49 Glendenning Road, Glendenning NSW 2761

ausconnex.com.au

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Ausconnex respectfully acknowledges the Traditional Custodians on whose lands we live, work, and operate and their Elders past and present.

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873

Level 11, 73 Miller Street
North Sydney 2060 Australia

PO Box 1319
North Sydney NSW 2059
Australia

T +61 2 9465 5599
F +61 2 9465 5598
E sydney@aurecongroup.com
W aurecongroup.com

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