EnergyCo

September 2023

Central-West Orana Renewable Energy Zone Transmission project

Technical paper 16 – Contamination

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Central-West Orana Renewable Energy Zone Transmission project
Technical paper 16 – Contamination

EnergyCo

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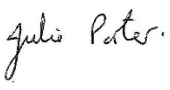
Reviewed by:	Julie Porter	18/09/2023	
Approved by:	Paul Greenhalgh	18/09/2023	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Glossary and abbreviations

Term/acronym	Description
Alluvial	Sediments deposited by flowing water.
Alluvium	A general term for unconsolidated deposits of inorganic materials (clay, silt, sand, gravel, boulders) deposited by flowing water.
Aquifer	Rock or sediment in a formation, group of formations or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.
Bore	Artificially constructed or improved groundwater cavity used to access or recharge water from an aquifer. Interchangeable with borehole, piezometer.
Borehole	Includes a well, excavation, or other artificially constructed or improved groundwater cavity which can be used to intercept an aquifer, collect an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer. Interchangeable with a bore, well, piezometer.
Central-West Orana REZ (CWO REZ)	A geographic area of approximately 20,000 square kilometres centred on the regional towns of Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and transmission infrastructure to deliver energy to electricity consumers.
Clay	Deposit of particles with a diameter of less than 0.002 mm, typically contains variable amounts of water within the mineral structure and exhibits high plasticity.
Conceptual model	A simplified and idealised representation of the physical contamination setting to explain a system's contamination pathways.
Confined aquifer	An aquifer bounded above and below by impervious (confining) layers. In a *confined aquifer*, the water is under sufficient pressure so that when wells are drilled into the aquifer, measured water levels rise above the top of the aquifer.
Construction area	The area that would be directly impacted by construction of the project including (but not limited to) transmission towers and lines, brake and winch sites, access roads to switching stations and energy hubs, access tracks to and along the easement, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds and laydown and staging areas.
Contamination study area	The study area for the contamination assessment comprises a 500 metre buffer surrounding the construction area. The project would be located within the contamination study area; however, the full area would not be subject to direct impacts.
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second. Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (e.g., metres per second).
Draw-down	The change in groundwater level in a bore, or the change in water table elevation in an unconfined groundwater system, due to the extraction of groundwater.

Term/acronym	Description
Detailed design	The stage of design where project elements are designed in detail, suitable for construction.
Earthworks	All operations involved in loosening, excavating, placing, shaping, and compacting soil or rock.
Enabling works	Activities that would be carried out before the start of substantial construction in order to make ready the key construction sites (including workforce accommodation camps and compounds), facilitate the commencement of substantial construction, manage specific features or issues and collect additional information required to finalise the design and construction methodology.
Fluvial	Synonymous with alluvial. Refer to alluvial for definition.
Formation	A general term used to describe a sequence of soil or rock layers.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface, i.e., the water table marks the upper surface of groundwater systems.
Groundwater resource	Groundwater available for beneficial use, including human usage, aquatic ecosystems, and the greater environment.
Hydrogeology	The study of the interrelationships of geological materials and processes with water, especially groundwater.
Impact	An event that disrupts ecosystem, community, or population structure and alters the physical environment, directly or indirectly.
Monitoring bore	A bore used to monitor groundwater levels or quality.
Operation area	The area that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs, maintenance facilities and permanent access tracks to the easements.
Permeability	The ease with which a fluid can pass through a porous medium and is defined as the volume of fluid discharged from a unit area of an aquifer under unit hydraulic gradient in unit time (metres per day).
(the) project	The Central-West Orana REZ Transmission project as described in the Environmental Impact Statement.
Run-off	All surface and subsurface flow from a catchment, but in practice refers to the flow in a river, i.e., excludes groundwater not discharged into a river.
Sensitive receivers	Sensitive receivers may include aquatic ecosystems, aquaculture areas, residential dwellings, schools, and recreation areas.
Standing water level	The height to which groundwater rises in a bore after it is drilled and completed, and after a period of pumping when levels return to natural atmospheric or confined pressure levels.
Water table	The surface in an unconfined aquifer or confining bed at which the pore water pressure is atmospheric; it can be measured by installing shallow wells extending a few feet into the zone of saturation and then measuring the water level in those wells.
ANZECC	Australian and New Zealand Environment and Conservation Council

Term/acronym	Description
ASS	Acid sulfate soils
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BOM	Bureau of Meteorology
CEMP	Construction and Environment Management Plan
EPL	Environment Protection Licence
EIS	Environmental impact statement
GIS	Graphical information systems
MW	Monitoring Well
NATA	National Association of Testing Authorities
NGIS	National groundwater information system
NSW EPA	New South Wales Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbons
PFAS	Per- and Poly-fluorinated Alkyl Substances
pH	Unit of measurement for acidity and alkalinity
PSI	Preliminary Site Investigation
SALIS	Soil and Land Information System
SEARs	Secretary's environmental assessment requirements
SWMP	Soil and Water Management Plan
TRH	Total Recoverable Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UXO	unexploded ordnance
WSP	WSP Australia Pty Ltd

Executive summary

This technical paper documents the assessment of contamination impacts from the construction and operation of the Central-West Orana Renewable Energy Zone Transmission project (the project) and has been prepared to support and inform the Environmental Impacts Statement (EIS) for the project.

The impacts have been assessed in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) and against the relevant legislation and guidelines as they apply to contamination.

Project overview

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage, supported by high voltage transmission infrastructure. Energy Corporation of NSW (EnergyCo) is proposing the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations required to connect new energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project). The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) and extends generally north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts), and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the rest of the network. Importantly, the development of renewable energy generation projects in the Central-West Orana Rez is the sole responsibility of private generators and subject to separate planning and environmental approvals.

Legislative and policy context

Contamination impacts to and from the project have been assessed in accordance with the relevant legislation and guidelines. Key legislation considered as part of this assessment is the *Contaminated Land Management Act 1997 (NSW)*.

Methodology

This technical paper assesses the impacts of potential contamination during construction and operation of the project. The assessment has included a desktop review of available information and databases, and consolidation of the data to identify potential areas of interest and concern. This assessment is adequate to assess typical environmental impacts and provide recommendations for mitigation measures. Recommendations would be subject to refinement as the project progresses through the detailed design stage and validation undertaken during construction.

Potential impacts

Based on the available information, the construction area did not appear to be affected by broad-scale contamination, consequently the risk of exposure to soil contamination is generally low. Much of the construction area is undisturbed native vegetation and open grazing land with minimal areas of contamination concern identified. Several farm dams were identified which represent a medium risk for isolated contamination associated with the accumulation of nutrients and pesticides from adjacent agricultural activities. Given the absence of any significant groundwater contamination sources and potential contaminants in soil, the potential for significant groundwater contamination beneath the construction area is also considered to be low.

High and medium risk contamination sources were identified within the contamination study area associated with three mine sites (Ulan, Moolarben, and Wilpinjong coal mines). These areas of contamination concern have been assessed to pose a low to high risk during construction. Operational impacts are considered to be low and would be managed within an operational environmental management plan.

Management measures

Recommended mitigation measures, as detailed in this technical paper, would ameliorate, or minimise any expected impacts to generally acceptable levels. Recommended mitigation measures are detailed in Chapter 7. Any residual risks will be managed by a CEMP. Should unexpected contamination be identified during the site works appropriate management and remediation options would need to be identified through the unexpected contamination finds protocol.

1 Introduction

1.1 Background

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage projects, supported by transmission infrastructure. A REZ connects renewable energy generation and energy storage systems to transmission infrastructure via energy hubs, requiring the coordination of power generation, power storage and transmission infrastructure. By doing so, REZs capitalise on economies of scale to deliver affordable, reliable and clean electricity for homes, businesses and industry in NSW.

The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020*. As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector.

The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

The proposed amendment is consistent with the NSW Network Infrastructure Strategy (EnergyCo, 2023) which identifies options to increase network capacity to 4.5 gigawatts initially under Stage 1 (which would be based on the infrastructure proposed in this assessment) and up to six gigawatts by 2038 under Stage 2 (which would require additional infrastructure beyond the scope of this assessment, and subject to separate approval). The proposed amendment also supports recent modelling by the Consumer Trustee in the draft 2023 Infrastructure Investment Objectives Report (AEMO, 2023) showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.

Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner under the *Electricity Infrastructure Investment Act 2020*, and is responsible for the development and delivery the Central-West Orana REZ. EnergyCo is responsible for coordinating REZ transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment.

EnergyCo is seeking approval for the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

1.2 Purpose of this paper

This technical paper assesses the potential impacts from the contamination in relation to the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS).

This technical paper has been prepared to address the relevant Secretary's environmental assessment requirements (SEARs) for the project issued by the Secretary of the NSW Department of Planning and Environment (DPE) for the project on 7 October 2022, and the supplementary SEARs on 2 March 2023. The SEARs relevant to the impacts due to contamination are presented in Table 1-1.

This assessment comprises a preliminary site (also referred to as Phase 1) investigation which assesses the potential for contamination to exist based on a desktop study.

Table 1-1 SEARs relevant to this paper

Reference	Assessment requirement	Location where it is addressed
Land	an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos, acid sulfate soils and salinity in the vicinity of the site);	Chapter 4, 5 and 6 Section 5.1 (risk assessment)

1.2.1 Related technical papers

This technical paper is linked to the assessments completed in the following technical papers:

- Technical paper 14 – Hydrology and water quality assessment of impacts to surface water
- Technical paper 17 – Groundwater: assessment of impacts to groundwater from the project.

1.3 Project overview

The project comprises the construction and operation of the new electricity transmission infrastructure, energy hubs and switching stations within the Central-West Orana REZ. The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts), and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the NEM. A detailed description of the project, including a description of key project components, the construction methodology and how it would be operated is provided in Chapter 3 of the EIS.

1.3.1 Features

The project would comprise the following key features:

- a new 500 kV switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV transmission network
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including potential battery storage at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, supported on towers, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation and storage projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure
- underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- microwave repeater sites at locations along the alignment, as well as outside of the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network. The Botobolar site will would be subject to assessment at the submissions report stage

- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area, (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)
- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This includes adjustments to Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station and other locations where there is an interface with Transgrid's network.

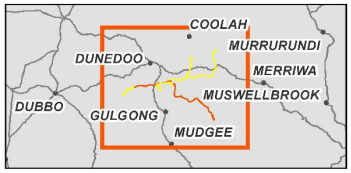
1.3.2 Location

The project is located in central-west NSW within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs). It extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma. The location of the project is shown in Figure 1-1.

Figure 1-1
The project

Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Indicative microwave repeater site (Botobolar)
- Existing substation
- Existing transmission line
- State road
- Railway
- Watercourse
- Water body
- Local government area
- NPWS estate



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:500,000
Data sources: WSP 2023, EnergyCo, NSWSS

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1.3.3 Timing

Construction of the project would commence in the second half of 2024, subject to NSW Government and Commonwealth planning approvals, and is estimated to take about four years. The project is expected to be commissioned/energised (i.e. become operational) in late 2027.

1.3.4 Construction

Key construction activities for the project would occur in the following stages:

- enabling works
- construction works associated with the transmission lines
- construction works associated with energy hubs and switching stations
- pre-commissioning and commissioning of the project
- demobilisation and rehabilitation of areas disturbed by construction activities.

Excavation and land forming works within the construction area would be required for transmission line tower construction, site preparation works at the energy hubs and switching station sites to provide level surfaces, to create trenches for drainage, earthing, communications infrastructure and electrical conduits, and to construct and upgrade access tracks.

Construction vehicle movements would comprise heavy and light vehicles transporting equipment and plant, construction materials, spoil and waste from construction facilities and workforce accommodation camp sites. There would also be additional vehicle movements associated with construction workers travelling to and from construction areas and accommodation camp sites. These movements would occur daily for the duration of construction.

To support the construction of the project, a number of construction compounds would be required including staging and laydown facilities, concrete batching plants, workforce accommodation camps and construction support facilities. The main construction compounds would be established as enabling works and demobilised at the completion of construction. The size of the construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, an estimated workforce of up to around 1,800 people would be required.

1.3.5 Operation

During operation, the project would transfer high voltage electricity from the Central West-Orana REZ to the NEM. Permanent project infrastructure would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Regular inspection and maintenance activities are expected to include:

- regular inspection (ground and aerial) and maintenance of electrical equipment and easements
- fault and emergency response (unplanned maintenance)
- general building, asset protection zone and landscaping maintenance
- fire detection system inspection and maintenance
- stormwater maintenance
- remote asset condition monitoring
- network infrastructure performance monitoring.

Operation of the project would require the establishment of transmission line easements. These easements would be around 60 metres for each 330 kV transmission lines and 70 metres for each 500 kV transmission lines. Where network infrastructure is collocated, easement widths would increase accordingly (for example, a twin double circuit 500 kV transmission line would have an easement about 140 metres wide). Vegetation clearing would be required to some extent for the full width of the transmission line easement, depending on the vegetation types present.

1.4 Structure of the report

The structure and content of this paper is as follows:

- Chapter 1 – Introduction (this chapter)
- Chapter 2 – Legislative and policy context: Provides an overview of the regulatory context for the assessment
- Chapter 3 – Methodology: Describes the methodology adopted for this assessment
- Chapter 4 – Existing environment: Describes the existing environment with respect to the contamination investigation
- Chapter 5 – Construction assessment : Describes the potential construction impacts associated with the project
- Chapter 6 – Operation: Describes the potential operational impacts associated with the project
- Chapter 7 – Recommended management and mitigation measures: Details recommended mitigation and management measures to minimise contamination impacts
- Chapter 8 – References: Identifies the key reports and documents used to generate this report.

The appendices to this report are:

- Appendix A– Factual investigations map
- Appendix B – Unexpected finds protocol

1.5 Limitations

The assessment is based on a model developed by specialist contaminated land consultants from WSP and data from the accompanying WSP Create, an online system. No physical site inspection or survey has been carried out. Therefore, the assessment is based on datasets which were available at the date of the assessment and findings from available investigations. These datasets are continually updated as more information becomes available, and additional data obtained in the future may change the outcome of the assessment. As such, no expressed warranty is given by WSP in relation to the accuracy or completeness of the data reported, the actual state or condition of the construction area, or the suitability of the site for any current or proposed use.

The datasets in the WSP Create portal were selected to provide an indication of the presence of contamination on and surrounding the construction area. However, they may not identify all historical uses and activities which may have caused the site and/or its surrounds to become contaminated. In particular, many sites are impacted by the presence of asbestos in fill material from unknown sources usually associated with poor demolition practices, for which a dataset is not available.

The assessment provides an indication of the likelihood of contamination to be present at, or impact, the construction area. It does not constitute advice as to the value of the construction area, or the suitability of the construction area for purposes other than the project. It also does not consider any environmental investigations or remediation works which may have been undertaken across the contamination study area as this information was not available to WSP during the phase 1 investigation.

2 Legislative and policy context

2.1 Setting the context

Environmental planning approval for the project is required in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project is a controlled action and therefore requires Commonwealth assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure (SSI) and Critical State significant infrastructure (CSSI). On 23 November 2020, the Minister for Planning made the *Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020* (the Order). The Order declares the whole Central-West Orana REZ Transmission project to be CSSI.

This chapter provides the legislative and policy context relevant to the Preliminary Site Investigation and includes:

- relevant SEARs for the project presented in Table 1-1, issued on 7 October 2022
- relevant requirements in legislation and other plans, policies, standards, and guidelines including:
  - (NSW) *Protection of the Environment Operations Act 1997* (POEO Act)
  - (NSW) *Contaminated Land Management Act 1997* (CLM Act)
  - *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP)
  - *National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013* (NEPM 2013)
  - *National Water Quality Management Strategy* (NWQMS)
  - *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)
  - *Acid Sulfate Soil Manual* (ASSMAC, 1998)
  - *Managing Asbestos in or on Soil guide* (SafeWork NSW, 2014).

2.2 NSW legislation

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act establishes a framework for the assessment and approval of developments in NSW. It also provide for the making of environmental planning instruments, including state environmental planning policies (SEPPs) and local environmental plans (LEPs), which determine the permissibility and approval pathway for development proposals and form a part of the environmental assessment process.

2.2.2 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CLM Act) is part of the management framework for contaminated land in NSW. The CLM Act enables the NSW Environment Protection Authority (the EPA) to respond to and manage site contamination when it considers that contamination is significant enough to require regulation. Site contamination requires regulation under the CLM Act when a site is declared "significantly contaminated land" (defined as land described in a notice having effect under Section 11 of the CLM Act) or when land is subject to a management order or an approved voluntary management project. Lands within the contamination study area have not been declared "significantly contaminated land" and are not subject to a management order.

The CLM Act outlines the circumstances in which notification to the Environment Protection Authority is required in relation to the contamination of land. This may become relevant during construction of the project if contamination is encountered.

Section 105 of the CLM Act allows the EPA to make or approve guidelines for the purposes connected with the objectives of the CLM Act. Contaminated sites not regulated by the EPA can be managed through the planning process by the relevant planning consent authority.

The EPA holds records of sites that have been notified under Section 60 of the CLM Act or otherwise reported to the EPA. This assessment includes a search of the record of sites held by EPA to identify sites which may impact soil and/or groundwater quality within the construction area.

2.3 Policy, standards and guidelines

2.3.1 National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013

The NEPM 2013 is made under the *National Environment Protection Council Act 1994* and is given effect by individual legislation and guidelines in each state and territory. The NEPM 2013 is approved by the EPA under Section 105 of the CLM Act. The purpose of the measure is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community, which includes regulators, site assessors, environmental auditors, landowners, developers, and industry.

The desired environmental outcome for the NEPM 2013 is to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

Authorities at local and state government level that consent to development or changes in land use consider the land's suitability for its intended use. To determine if a site is suitable, a site's history of use and whether it is indicative of potential contamination should be considered.

Under the NEPM 2013, site contamination assessment is generally carried out in stages involving progressively more detailed levels of data collection and analysis, such as preliminary (Phase 1) site investigations, detailed site investigations and site-specific risk assessment.

This technical paper is a preliminary (Phase 1) site investigation, which assesses the potential for contamination to exist based on a desktop study and review of previous reports/assessments undertaken within the contamination study area.

In general, as per the guidance in the NEPM 2013, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In assessing the contamination, the site assessor (if required) and others should consider the preferred hierarchy of options for site clean-up and/or management which is outlined in Table 2-1.

Table 2-1 Hierarchy of clean-up options (NEPM 2013)

Preference	Option
1	On-site treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level.
2	Off-site treatment of excavated soil, so that the contamination is destroyed, or the associated risk is reduced to an acceptable level, after which soil is returned to the site.
If the above is not practicable:	
3	Consolidation and isolation of the soil on-site by containment with a properly designed barrier.
4	Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.
Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy is required.	

When deciding which option to choose, the sustainability (environmental, economic, and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option.

2.3.2 National Water Quality Management Strategy

The *National Water Quality Management Strategy* (NWQMS) (Australian Government, 2018) aims to protect the nation's water resources by improving water quality while supporting the businesses, industry, environment, and communities that depend on water for their continued development. The main policy objective of the NWQMS is to achieve sustainable use of water resources, by protecting and enhancing their quality, while maintaining economic and social development.

The NWQMS includes water quality guidelines that define desirable ranges and maximum levels for specific parameters that can be allowed (based on scientific evidence and judgement) for specific uses of waters or for protection of specific values. They are generally set at a low level of contamination to offer long-term protection of environmental values. The NWQMS water quality guidelines include the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) and the *Australian Drinking Water Guidelines* (NHMRC, 2011).

2.3.3 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) is a key guideline within the NWQMS that is used to identify catchment and watercourse specific water quality management goals. These guidelines are an updated version of the previous guidelines referred to as the ANZECC 2000 guidelines.

The ANZG 2018 guidelines provide a process for assessing existing water quality conditions and developing water quality objectives to sustain current or likely future community values for water resources. Default guideline values for parameters are provided for different community values as generic starting points for assessing water quality where site specific information is not available. The default guideline values are used to evaluate the existing water quality conditions against long term water quality goals.

The ANZG 2018 guidelines provide the most up to date databases to derive guideline values for toxicants and sediments in aquaculture and aquatic foods, physical and chemical stressors, and guideline values for agricultural water users. Where the ANZG 2018 does not provide a value, the values as used in the previous ANZECC 2000 guidelines still apply.

The default guideline values have not been designed for direct application in activities such as discharge licences, recycled water quality or stormwater quality. These values are provided for various levels of protection of watercourses which are considered when describing the existing water quality and key indicators of concern. The level of protection applied in this assessment when assessing ambient water quality is for slightly disturbed to moderately disturbed ecosystems.

2.3.4 Acid Sulfate Soil manual

Acid sulfate soils (ASS) are naturally occurring soils, sediments, or organic substrates (e.g., peat) that are formed under waterlogged conditions. These soils contain iron sulphide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However, if the soils are drained, excavated, or exposed to air by a lowering of the water table, the sulphides react with oxygen to form sulfuric acid.

The management of ASS is coordinated by the NSW Acid Sulfate Soil Management Advisory Committee (NSW ASSMAC). This Committee is made up of representatives from various government organisations and other affected parties. The Committee published the *Acid Sulfate Soil Manual* (ASSMAC, 1998) to provide best practice guidance in the assessment and management of projects in areas potentially affected by ASS in NSW.

The manual sets out a process (refer to Figure 2-1) which has been adopted for this assessment to decide whether ASS is present on-site and how to mitigate potential impacts.

When works involving the disturbance of soil or a change in groundwater levels are proposed, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils. The purpose of the preliminary assessment is:

- to establish the characteristics of the proposed works
- to establish whether ASS is present on the site and if they are at such concentrations to warrant the preparation of an acid sulfate soil management plan (ASSMP)
- to provide information to assist in designing a soil and water assessment program.

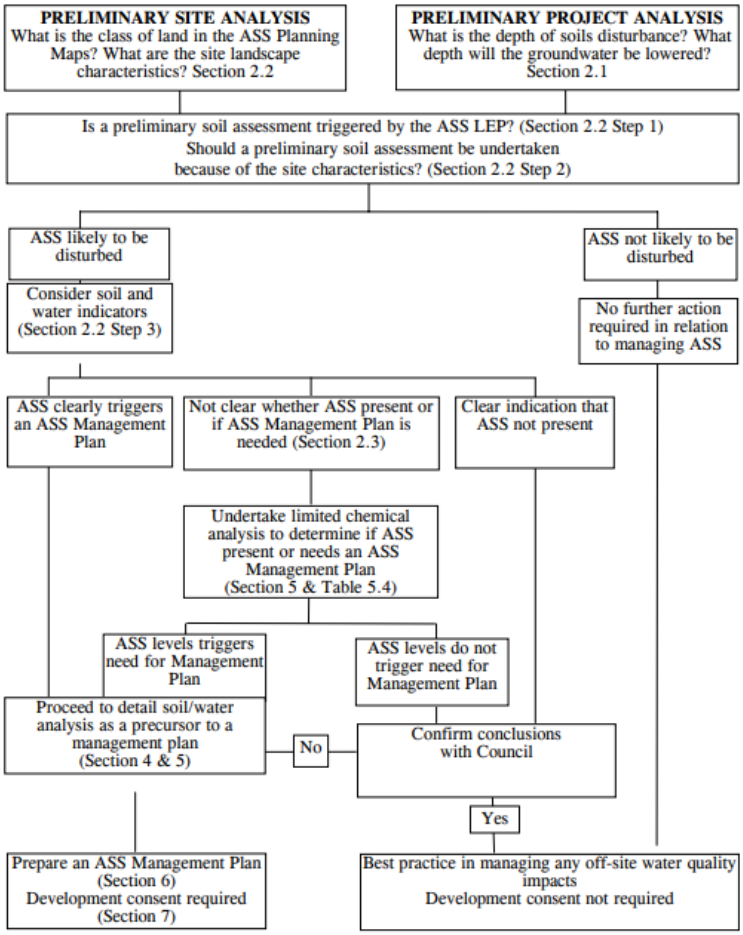


Figure 2-1 Preliminary Assessment Phase from the Acid Sulfate Soil Manual (New South Wales – Acid Sulfate Soil Management Advisory Committee, 1998)

2.3.5 *Managing asbestos in or on soil*

The *Managing Asbestos in or on Soil* guide (SafeWork NSW, 2014) provides general guidance on the assessment of asbestos in soil. Managing asbestos in soil has implications for the current and future occupants of the land/or any worker employed on the site. The principles underlying the guidance in this document are those endorsed by the NSW Heads of Asbestos Coordination Authorities (HACA) and contained in the NSW Asbestos Blueprint (SafeWork NSW, 2017). Work health and safety, land use planning and environmental legislation, and the amended NEPM 2013 are referenced where they apply.

The NEPM 2013 emphasises that the assessment and management of asbestos contamination should consider the condition of the asbestos materials, the potential for damage, and the resulting release of asbestos fibres. Bonded Asbestos in sound condition represents a low risk to human health. However, both friable and fibrous asbestos materials have a significantly higher potential to generate, or be associated with, free asbestos fibres, and may represent a significant human health risk if disturbed and fibres are made airborne.

The objective of the approach outlined in *Managing Asbestos in or on Soil* guide is to ensure that proportionate and practicable controls are applied per regulatory requirements and a manner commensurate with actual risk.

2.3.6 Other guidelines

A number of other guidelines, which are relevant to the management of contamination, were considered in the preparation of this technical paper and presented in Table 2-2.

Table 2-2 Other guidelines

Guideline	Consideration of guideline in this technical paper
Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia (WA Department of Health, 2009)	The guidelines provide a framework and best practice for the assessment, remediation, and management of asbestos-contaminated sites. The guidelines would need to be considered **if** the preparation of an asbestos management plan for the project is identified as being required as a result of an unexpected find(s) during construction works.
Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015)	The guidelines detail circumstances in which contamination at a site triggers the requirement to notify the NSW EPA. The guidelines are made under Section 105 of the CLM Act. The duty to report lies with landowners and those responsible for the contamination. The triggers would need to be considered if contamination is encountered within the project study area.
Guidelines for the NSW Site Auditor Scheme (3rd edition) (EPA, 2017)	The guidelines describe the obligations of accredited site auditors undertaking site audits in NSW. The guidelines are made under Section 105 of the CLM Act. These guidelines would need to be considered if reports are required to be prepared that may be reviewed by a site-auditor (e.g., investigation report or remediation action plan). This would only occur as a result of certain unexpected find incidents and the need would be determined at that time.
Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004)	The guidelines provide best practice guidance on erosion controls that need to be implemented during construction. The guidelines would need to be considered during the preparation of the Construction Environmental Management Plan (CEMP) and associated Soil and Water Management Plan (SWMP) for the project.
Per- and Poly-fluorinated Alkyl Substances (PFAS) National Environmental Management Plan 2.0 (Department of Agriculture, Water and the Environment, 2020)	The PFAS National Environmental Management Plan (NEMP) establishes a practical basis for nationally consistent environmental guidance and standards for managing PFAS contamination. The plan has been developed by all jurisdictions and recognises the need for implementation of best practice regulation through individual jurisdictional mechanisms. It represents a how-to guide for the investigation and management of PFAS contamination and waste management.

3 Methodology

3.1 Contamination study area

The project involves the construction and operation of high-voltage electricity transmission infrastructure, consisting of new 500 kV and 330 kV transmission lines and related infrastructure including energy hubs and switching stations, that would allow renewable energy generation and storage projects in the Central-West Orana REZ to connect to the existing transmission network. The project would be constructed within the construction area which refers to the area that would be directly impacted by construction of the project including (but not limited to) transmission towers and lines, brake and winch sites, access roads, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds and laydown and staging areas.

For the purposes of this assessment the project would be located within the contamination study area. The contamination study area for this EIS comprises the construction area of the project with a 500 metre (m) buffer.

The contamination study area and surrounding context is provided in Figure 3-1.

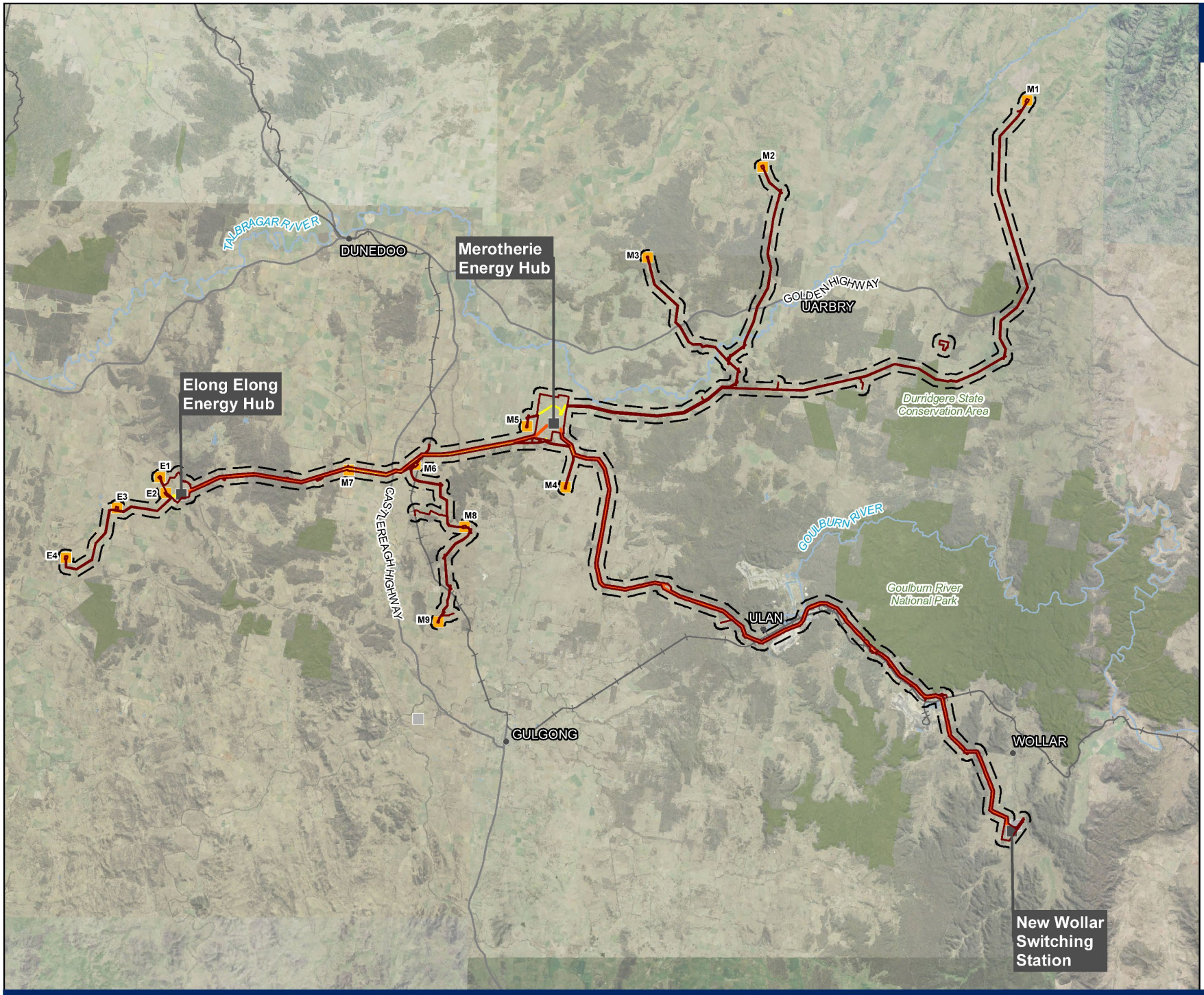
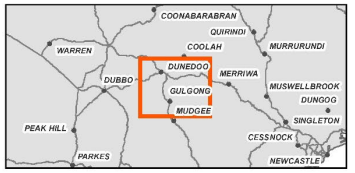


Figure 3-1
Contamination study area

Legend

- Contamination study area
- Construction area
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing substation
- State road
- Railway
- Watercourse
- Water body
- NPWS estate



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3.2 Methodology

3.2.1 Approach to assessment

This technical paper constitutes a preliminary site investigation, and the assessment methodology that has been used to prepare it is in general accordance with the framework for assessment of site contamination outlined in the NEPM 2013. The NEPM 2013 states that 'the preliminary investigation and initial assessment of site contamination should consider the possibility of all forms of potential contamination based on past use'. The preliminary contamination investigation should be sufficient to identify whether there is potential for contamination to exist on the land subject to assessment. Depending on the proposed use of the land subject to assessment, and the results of initial site history investigations, the assessment of a site may involve both preliminary and detailed investigations. Many site investigations proceed in multiple stages due to the complexity of the site and the discovery of unexpected contamination. For the purpose of this technical paper, the staged process presented in NEPM 2013 is summarised in Figure 3-2.

This assessment also includes a qualitative assessment of the potential for the project to cause contamination during construction and operation.

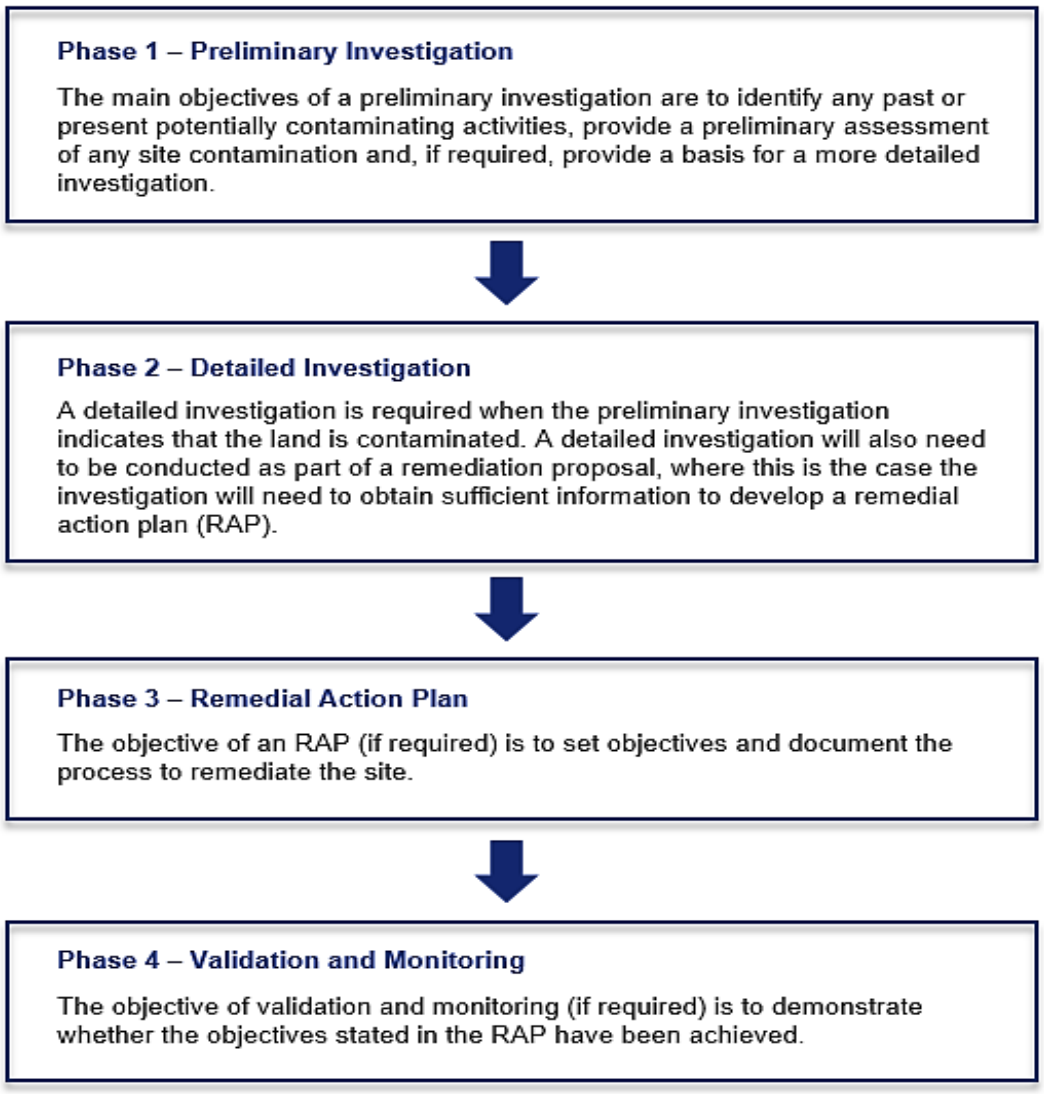


Figure 3-2 Staged site investigation process

3.2.2 *Preliminary site investigation methodology*

This technical paper comprises a preliminary (also referred to as Phase 1) site investigation which assesses the potential for contamination to exist based on a desktop study and review of any available previous investigation reports.

This preliminary contamination assessment comprises of the following:

- a review of the results of intrusive investigations undertaken by EnergyCo for the project
- identification of potential areas of ASS, soil salinity and naturally occurring asbestos which may be disturbed by the project in accordance with identified guidelines from Chapter 2
- a review of publicly available information to identify current or historical potentially contaminating land uses and subsequent identification of potential areas of contamination concern
- identification and assessment of potential sources of contamination, pollution linkages and receivers (S-P-R) to determine a preliminary conceptual site model (CSM) associated with the construction and operation of the project to inform the impact assessment of the project
- a construction phase impact assessment which identifies potential contamination impacts based on the current understanding of the existing contamination potential of the land within which the project is located, and the likely construction methodology as included and assessed in the EIS. A qualitative risk ranking is used to determine whether these potential impacts during construction are significant
- an operational phase impact assessment which identifies whether any long-term operational or maintenance activities have the potential to impact on land suitability
- development of recommended mitigation measures to avoid, minimise and manage potential contamination impacts from construction and operation of the project, as relevant.

In preparing this technical paper, the following sources of information were reviewed:

- Databases to identify areas of known and potential contamination, including:
  - Department of Defence database for unexploded ordnance (UXO)
  - Department of Primary Industries register of cattle dip sites
  - NSW EPA PFAS Investigation database
  - NSW EPA register of contaminated sites and list of notified sites, under sections 58 and 60 of the CLM Act, for sites located within two kilometres of the contamination study area
  - NSW EPA's environment protection licence records under Section 308 of the POEO Act
  - NSW Government database of former gasworks sites.
- Publicly available data and web-based information searches, background information relevant to the study area, survey data, and topography including:
  - historical aerial photographs from the NSW Government Land and Property Information website
  - Australian Soil Resource Information System (maintained by the Commonwealth Scientific and Industrial Research Organisation (CSIRO))
  - geology of the construction area (Geological Survey of New South Wales 1983)
  - NSW Soil and Land Information System
  - NSW Government acid sulfate soils risk mapping
  - NSW Government's Heads of Asbestos Coordination Authorities naturally occurring asbestos risk mapping
  - maps published by the Geological Survey of NSW, former Department of Conservation and Land Management, and Australian Soils Resource Information System; and
  - a review of EIS documents for surrounding major projects and monitoring data from the Wilpinjong, Moolarben and Ulan coal mines.

3.3 Risk identification

Potential contamination risks associated with construction and operation were identified and rated according to likelihood, consequence, and overall level of risk, in general accordance with:

- AS/NZS ISO 31000:2009 Risk management – Principles and guidelines.

3.3.1 Qualitative risk ranking

The assessment includes a preliminary contamination risk evaluation (considering the potential for risks without the implementation of appropriate controls or remediation) to understand the potential risk of the identified areas of contamination concern. The risk evaluation uses concepts of likelihood of the risk occurring and the consequence of the risk. Categories and definitions for the likelihood of contamination to be present based on the assessment of current regulated activities, and historical land uses/activities at the subject site (located within the contamination study area) is described in Table 3-1. Consequence categories are described immediately below the table.

The risk matrix presented in Table 3-2 combines likelihood and consequence to consider the construction risk associated with source pathway receptor scenarios.

Table 3-1 Likelihood for land contamination to be present

Likelihood	Description	Basis for ranking
High	Contamination potentially present at concentrations above the relevant guideline criteria and widespread.	The available information indicates that the location within the construction area: — is currently identified as being contaminated on a public register of contaminated sites maintained by a regulator or has been the subject of an activity which is frequently associated with contamination.
Medium	Contamination potentially present at concentrations above the relevant guideline criteria and limited in extent.	The available information indicates that the location within the construction area: — is or has been the subject of an activity which in some circumstances is known to be associated with contamination — has been historically filled with imported material, the origin of which is unknown; and/or — has groundwater records indicating the potential for contamination. The available information indicates that land within 500 m of the construction area: — is currently identified as being contaminated on a public register of contaminated sites maintained by a regulator — is or has been the subject of an activity which is frequently associated with contamination — has groundwater records indicating the potential for contamination — is identified as land that may be affected by naturally occurring asbestos or serpentine minerals.

Likelihood	Description	Basis for ranking
Low	Contamination unlikely to be present above relevant guideline criteria and limited in extent.	The location within the construction area has been partially cleared for agricultural and/or infrastructure (including roads) purposes, however no distinct contamination sources have been identified. The available information does not indicate that land within 500 m of the construction area: — is currently identified as being contaminated on a public register of contaminated sites maintained by a regulator — is or has been the subject of an activity which is frequently associated with contamination — has groundwater records indicating the potential for contamination — is identified as land that may be affected by Naturally occurring asbestos or serpentine minerals.
Insignificant	No contamination sources identified	The available information indicates that the location within the construction area, or land within 500 m of the construction area is generally undisturbed bushland.

The consequence/pathway has been qualitatively classified as:

- Minor: minor localised levels of environmental impact or low levels of human exposure below the occupational exposure scenarios.
- Moderate: significant localised environmental impact or exposure to humans above occupational exposure scenarios.
- Significant: off-site environmental impact or an immediate and/or long term harm to human health or the environment.

A qualitative assessment and ranking of construction risk has been completed in Table 5-1 by assessing the pollutant linkages in the CSM and identifying a range of potential hazards. Potential risk associated with unexpected contamination finds have not been assessed. The following risk categories have been assigned:

- **Low risk**: impact can be managed by implementing standard construction management practices in accordance with relevant guidelines.
- **Medium risk**: contamination specific management plans and controls are required.
- **High risk**: engineered controls and/or environmental/health monitoring are required.

Table 3-2 Risk assessment matrix

Consequence/pathway	Likelihood			
	Insignificant	Low	Medium	High
Minor	Low	Low	Low	Medium
Moderate	Low	Low	Medium	High
Significant	Low	Medium	High	High

4 Existing environment

This chapter outlines the conditions of the existing environment as it relates to contamination.

4.1 Topography

The project lies at the top of the Macquarie and Hunter River catchments with the catchment divide occurring between the New Wollar Switching station and the Merotherie Energy Hub. From the catchment divide the land slopes away to the west towards the Talbragar and Macquarie River, and towards the east the land slopes towards the Goulburn and Hunter Rivers. The slopes vary across the construction area for the project due to it traversing several catchments as well as the catchment divide. The elevation across the project varies from a minimum of 350 metres to 700 m Australian Height Datum.

4.2 Soils and geology

4.2.1 Soil landscapes

The soils in the construction area (refer Table 4-1) are comprised of self-mulching black earth soils and generally mapped as chromosols, kurosols, and vertosols according to Australian Soil Classification (CSIRO, 2016). Published soil mapping (the soil landscapes) across the construction area indicates that the regional geology and soils are expected to be predominantly in situ and colluvial materials derived from parent rock. The predominant soil types are typically loam and clay or a mixture of the two. Figure 4-1 shows the soil landscapes mapped across the construction area.

Table 4-1 Soil landscapes within the construction area

Soil landscape	Basic soil composition	Potential for erosion, sodicity and salinity
Ant Hill	Shallow to deep and well to moderately drained black, red, and brown Chromosols and Dermosols on crests and side slopes.	Low to high erosion hazard, increasing to high in sloped areas. Low salinity potential.
Bald Hill	Soils derived from basic parent material and are clayey with high to moderate fertility.	Low erosion potential, increasing to moderate to high erosion hazard on slopes when surface cover is low. Salinity is unlikely to occur.
Balladoran	Generally, very sandy soils formed on quartz sandstone; some clayey soil in depressions which usually have sodic subsoils.	Moderate erosion hazard, increasing to a high hazard in areas subject to cultivation. Drainage depressions are susceptible to erosion due to sodic subsoils, and severe gully erosion can occur when these subsoils are exposed. Low to moderate salinity potential.
Barigan Creek	Yellow Podzolic Soils comprised of dark reddish-brown fine sandy loam.	Moderate erosion hazard, with high hazard potential occurring in areas where surface cover is low or under cultivation. Isolated high levels of salinity occur along some drainage lines and depressions.

Soil landscape	Basic soil composition	Potential for erosion, sodicity and salinity
Belowrie	Red earths comprised of dull reddish-brown loam.	Low to moderate erosion hazard where surface cover is maintained, increasing to high hazard in areas where surface cover is low or under cultivation. Low levels of salinity.
Crowee	Yellow and brown earths comprising brownish-black sandy loam with weak structure.	Moderate to very high erosion hazard. Potential for low levels of salinity. These areas are typically associated with drainage lines, depressions, footslope terraces and lower slopes and rarely associated with mid- and upper-slopes.
Dapper Hill	Yellow Soloths comprising dark yellowish-brown sandy loam to loamy sand.	Moderate to high erosion hazard, but very high erosion hazard where surface cover is low or under cultivation, or in drainage lines. Isolated low levels of salinity occur along some drainage lines and depressions.
Dexter	Siliceous Sands comprising dark brown to brown sandy loam to clayey sand.	Low to high erosion hazard, with high hazards associated steep slopes. Salinity issues are unlikely to occur.
Goonoo	Generally, very sandy soils formed on quartz sandstone; some clayey soil in depressions which usually have sodic subsoils.	Moderate to high erosion hazard, with higher erosion hazard occurring where surface cover is low or flows are concentrated. Soils in drainage depressions are susceptible to gully erosion without adequate protection from high runoff. Drainage depressions contain dense sodic subsoils. Low levels of salinity, with occurrences confined along drainage lines and depressions.
Home Rule	Siliceous Sands comprising Loose brown to dark brown loamy sand; small angular stones of quartz and felspar.	Moderate to high erosion hazard, increasing to very high erosion hazard on slopes and where surface cover is low. Soils are susceptible to gully erosion without adequate protection from high runoff. Subsoils in drainage depressions and lower slopes are sodic. Potential for low levels of salinity. These areas are typically associated with drainage lines, depressions, footslopes and lower slopes and rarely associated with mid- and upper-slopes.
Lees Pinch	A mixture of Shallow Siliceous Sands, shallow acid soils, and yellow earths.	Moderate to high erosion hazard, with high erosion hazard occurring on slopes and where surface cover is low. Low levels of salinity.
Munghorn Plateau	A mixture of yellow earths comprising dark brown light sandy clay loam which shows organic influence; and Siliceous Sands comprising bright yellowish-brown to very dark brown, sandy loam to fine sandy loam.	Moderate to very high erosion hazard, with higher hazards on slopes and where surface cover is low. Soils in drainage depressions are susceptible to gully erosion without adequate protection from high runoff. Salinity issues are unlikely to occur.

Soil landscape	Basic soil composition	Potential for erosion, sodicity and salinity
Rouse	A mixture of yellow earths comprising dark brown light sandy clay loam which shows organic influence; and Siliceous Sands comprising bright yellowish-brown to very dark brown, sandy loam to fine sandy loam.	Moderate to high erosion hazard, with higher hazard occurring where surface cover is low or flows are concentrated. Soils drainage depressions are susceptible to gully erosion without adequate protection from high runoff. Sodic subsoils are present, and severe gully erosion may occur when subsoils are exposed. Low levels of salinity. These areas are typically associated with drainage lines, depressions, footslopes and lower slopes and rarely associated with mid- and upper-slopes.
Spring Ridge	A mixture of shallow siliceous sands, and yellow Soloths comprising dark yellowish-brown sandy loam to loamy sand.	Moderate to high erosion hazard. Soils are highly susceptible to gully erosion without adequate protection from high runoff. Salinity is unlikely to occur.
Surface Hill	Non-calcic brown soils comprised dark reddish-brown fine sandy loam.	Moderate to low erosion hazard, but erosion hazard increases to high in sloped areas, particularly where soil cover is poor. Salinity is unlikely.
Talbragar	A mixture of Black earths and non-calcic brown soils; both comprised of well-structured clays.	Soils have moderate potential for erosion, but is generally a low erosion hazard due to topography. Isolated low levels of salinity occur along some drainage lines and depressions.
Tucklan	Andesite, basalt and associated shale, tuff, and siltstone. Comprised primarily of Euchrozems with minor rises of red Podzolic soils and non-calcic brown soils (Dr2.22).	Low to moderate erosion hazard, but can be high in sloped areas and where areas have low surface cover or are under cultivation. Isolated low levels of salinity occur along some drainage lines and depressions.
Turill	A mixture of Earthy Sands and yellow soloths comprised of brown clayey sand, and dark brown sandy loams respectively.	Low to high erosion hazard, but high to very high erosion hazard where surface cover is low or in areas under cultivation. Soils are susceptible to gully erosion due to sodic subsoils. High levels of salinity in localised areas, with occurrences confined along drainage lines and depressions.
Ulan	Yellow Podzolic Soils on lower slopes and drainage lines with patches of yellow Solodic Soils/Solonetz in association with salt scalds.	High to very erosion hazard on slopes in areas where surface cover is low and under cultivation. Soils in drainage depressions are susceptible to gully erosion without adequate protection from high runoff as the subsoils are often sodic. Potential for high levels of salinity. These areas are typically associated with drainage lines, depressions, footslopes and lower slopes and rarely associated with mid- and upper-slopes.

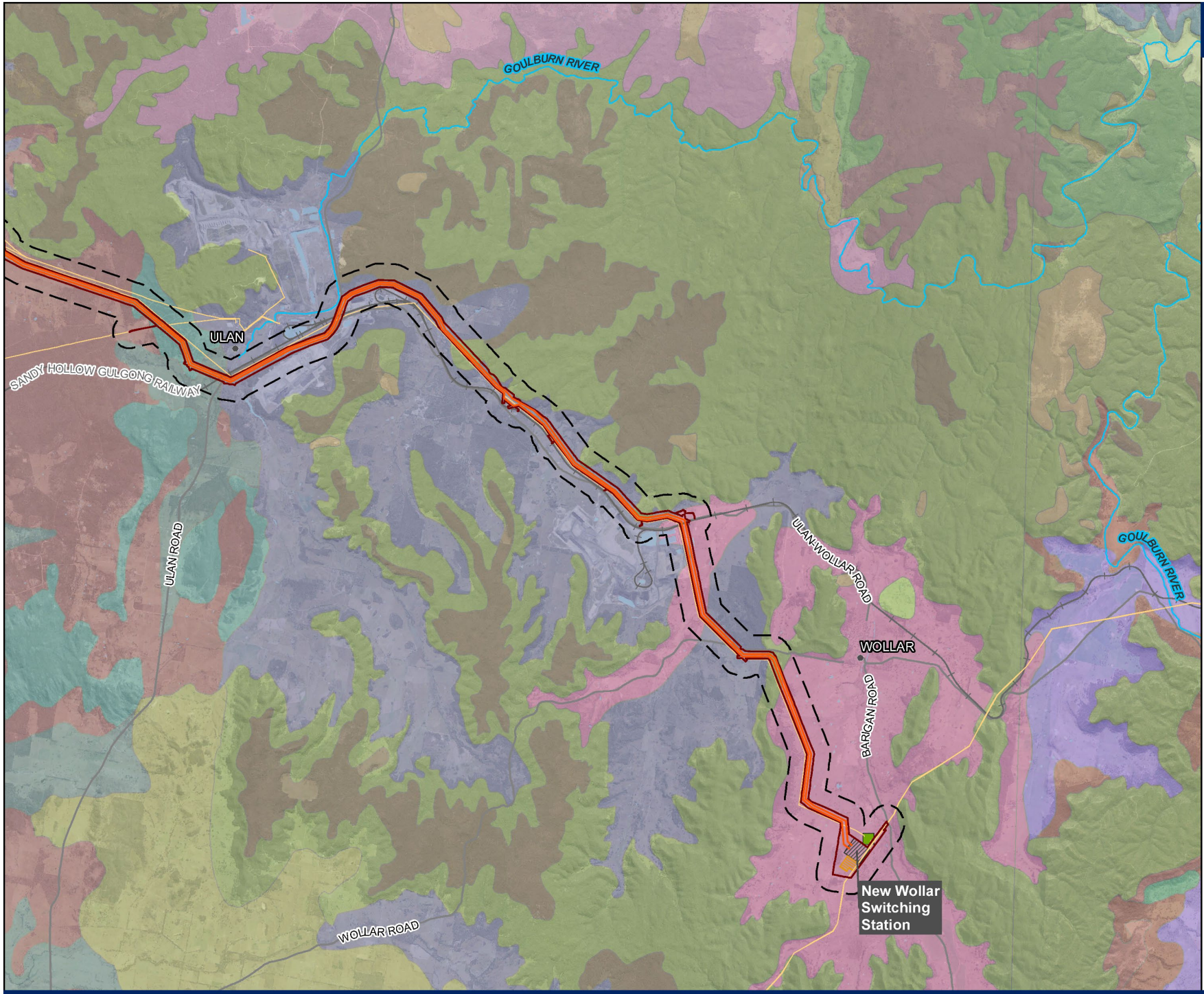


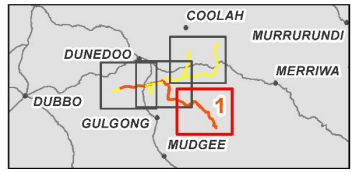
Figure 4-1
Major soil landscapes
Page 1 of 4

Legend

- Contamination study area
- Construction area
- Construction compound
- Energy hub / 500 kV switching station
- Existing Transgrid Wollar Substation
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Soil landscapes

- Bald Hill
- Balladoran
- Barigan Creek
- Benjang
- Botobolar
- Crowee
- Dexter
- Goonoo
- Growee
- Home Rule
- Lees Pinch
- Munghorn Plateau
- Murrumbo
- Ogilvie
- Roscommon
- Rouse
- Sandy Hollow
- Talbragar
- Turill
- Ulan
- Wappinguy



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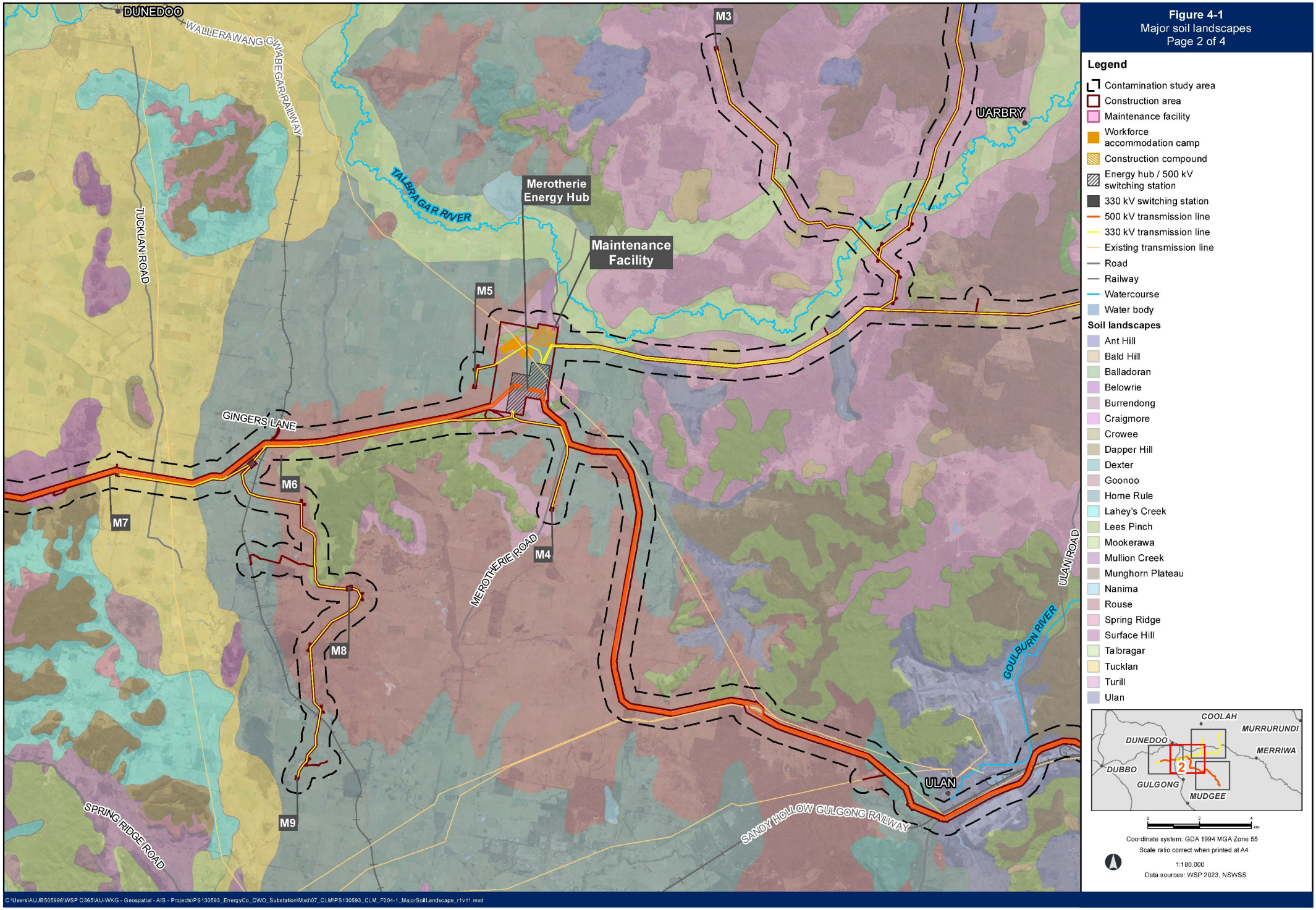

Figure 4-1
Major soil landscapes
Page 2 of 4

Legend

- Contamination study area
- Construction area
- Maintenance facility
- Workforce accommodation camp
- Construction compound
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Soil landscapes

- Ant Hill
- Bald Hill
- Balladoran
- Belowrie
- Burrendong
- Craigmore
- Crowee
- Dapper Hill
- Dexter
- Goonoo
- Home Rule
- Lahey's Creek
- Lees Pinch
- Mookerawa
- Mullion Creek
- Munghorn Plateau
- Nanima
- Rouse
- Spring Ridge
- Surface Hill
- Talbragar
- Tucklan
- Turill
- Ulan

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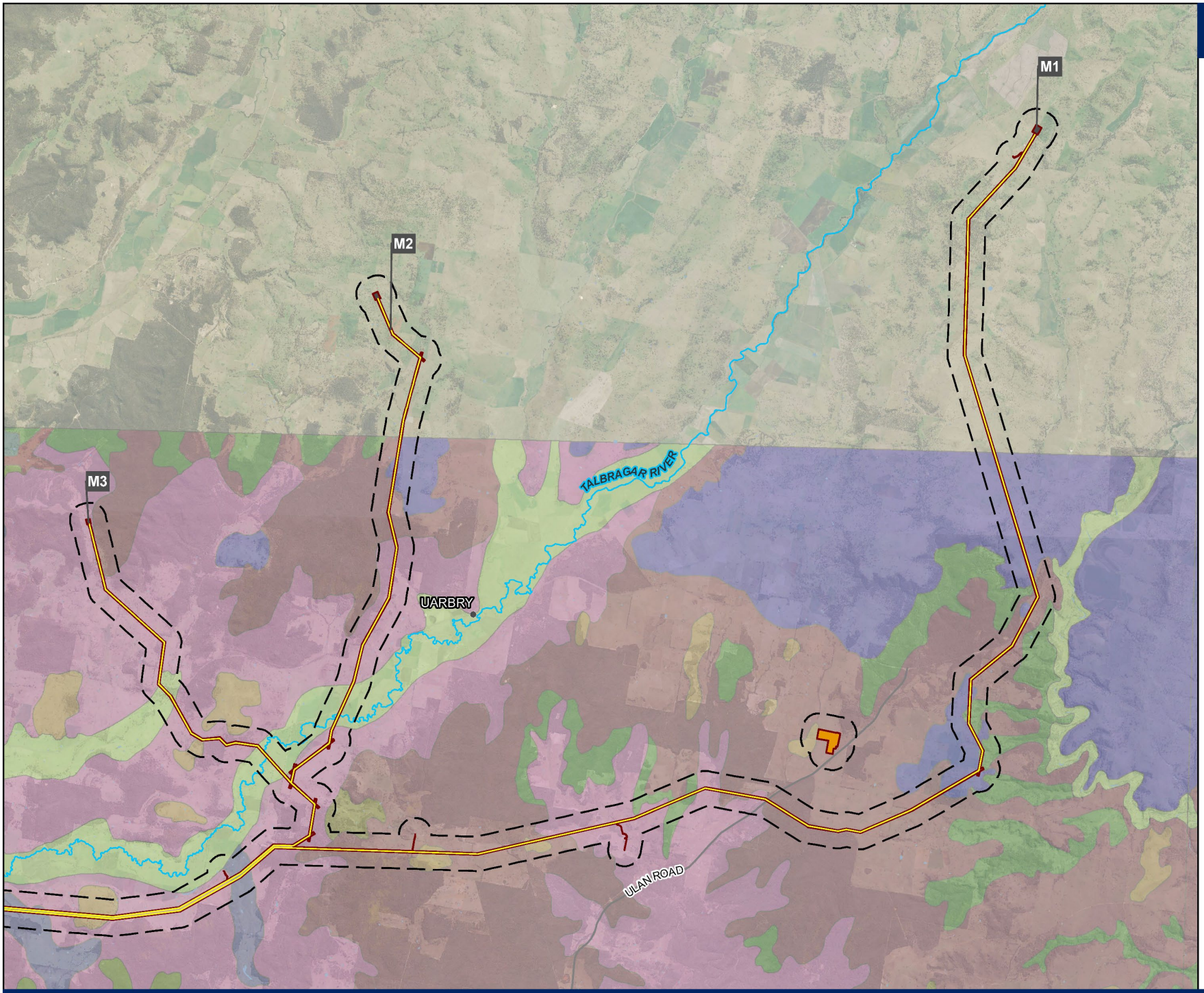


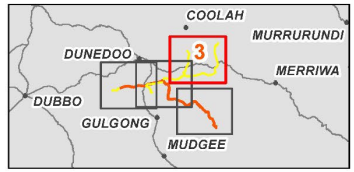
Figure 4-1
Major soil landscapes
Page 3 of 4

Legend

- Contamination study area
- Construction area
- Workforce accommodation camp
- 330 kV switching station
- 330 kV transmission line
- Road
- Watercourse
- Water body

Soil landscapes

- Ant Hill
- Bald Hill
- Balladoran
- Bow
- Crowee
- Goonoo
- Home Rule
- Kindamindi
- Lees Pinch
- Rouse
- Talbragar
- Turill
- Ulan



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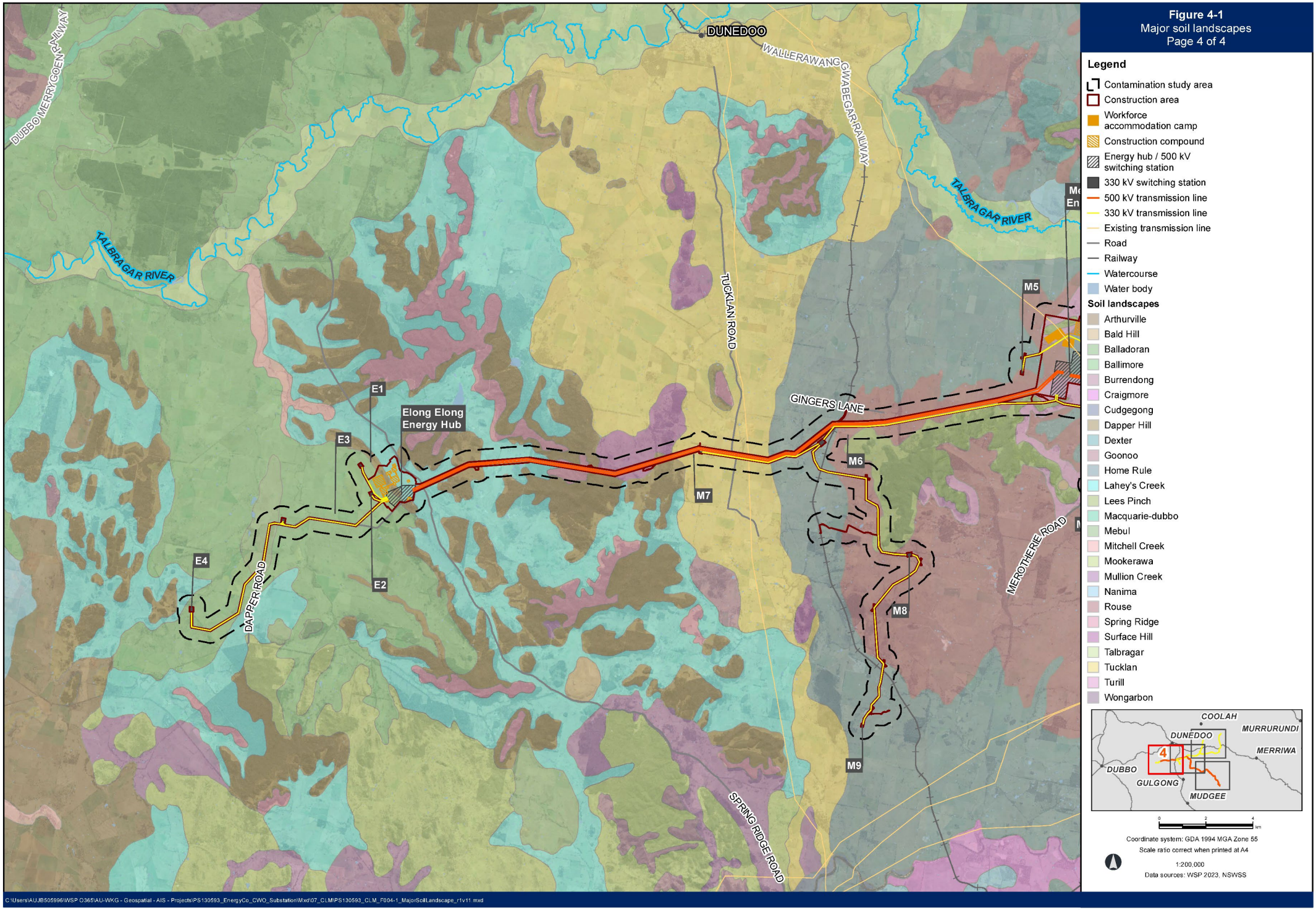
DUNEDOO
WALLERAWANG GWABEGAR RAILWAY
DUBBO MERRYGOEN RAILWAY
TALBRAGAR RIVER
TALBRAGAR RIVER
TUCKLAN ROAD
GINGERS LANE
M5
M6
M7
M8
M9
E1
E2
E3
E4
Elong Elong Energy Hub
DAPPER ROAD
MEROTHERIE ROAD
SPRING RIDGE ROAD
Figure 4-1
Major soil landscapes
Page 4 of 4
Legend
Contamination study area
Construction area
Workforce accommodation camp
Construction compound
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
Soil landscapes
Arthurville
Bald Hill
Balladoran
Ballimore
Burrendong
Craigmore
Cudgegong
Dapper Hill
Dexter
Goonoo
Home Rule
Lahey's Creek
Lees Pinch
Macquarie-dubbo
Mebul
Mitchell Creek
Mookerawa
Mullion Creek
Nanima
Rouse
Spring Ridge
Surface Hill
Talbragar
Tucklan
Turill
Wongarbon
COOLAH
MURRURUNDI
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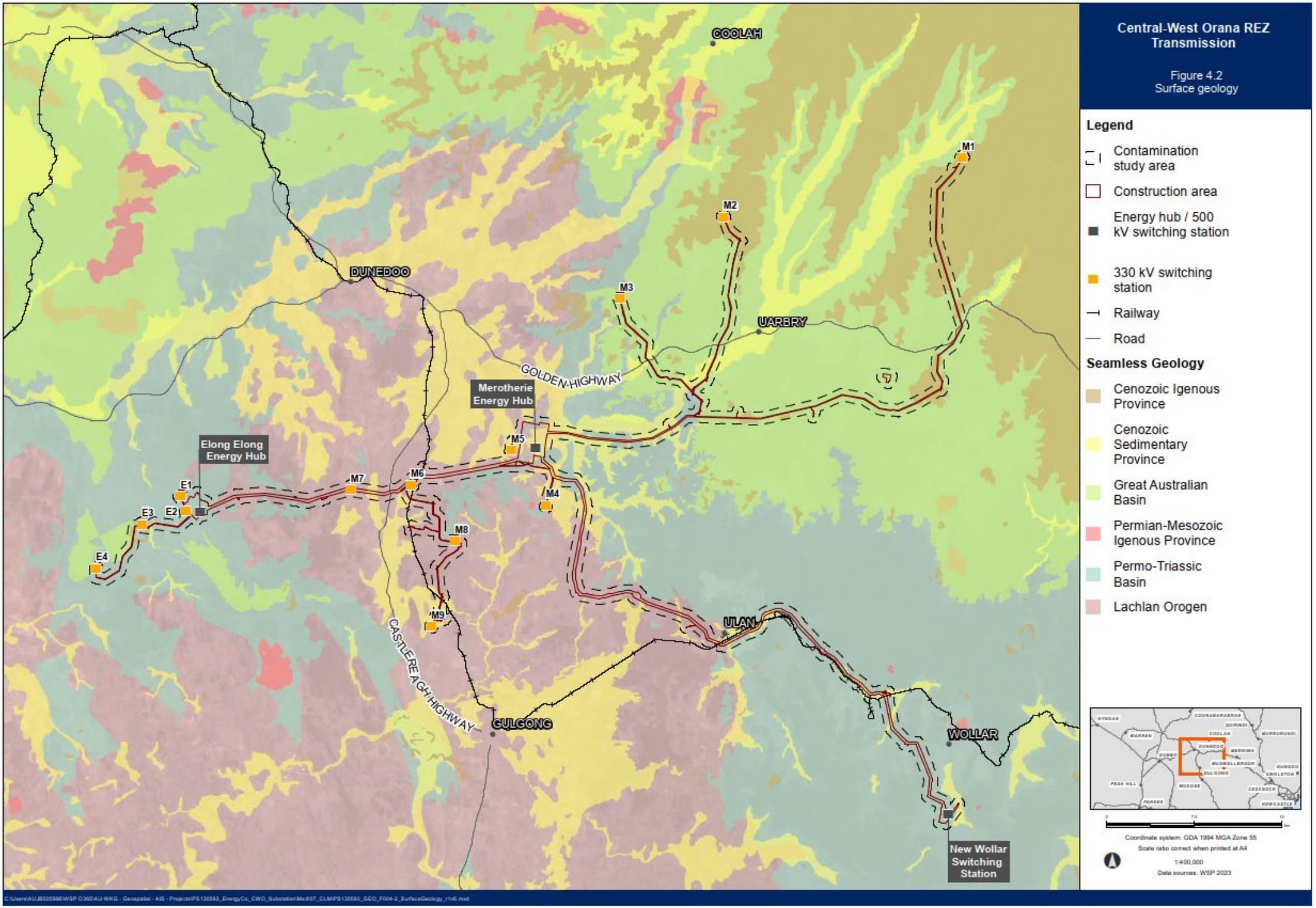
4.2.2 Regional geology

Surface geology covers the geological layers between the surface and Australian bedrock. Deeper geological layers were not considered relevant to the assessment.

The NSW seamless geology dataset (Colquhoun, et al., 2021) indicates that the surface geology in the contamination study area consists of a range of geological layers/provinces shown on Figure 4-2 and described in Table 4-2.

Table 4-2 Geological layers/provinces in the study area

Geological layer/province	Description
Cenozoic Sedimentary Province	Cenozoic sedimentary alluvial surface sediments are associated with creeks and drainage lines. The discontinuous deposits along the valley floors and generally consists of fine to coarse grained sands and gravels in a silt/clay matrix, although some clean sand and gravel deposits are also present.
Cenozoic Igneous Province	The Cenozoic Igneous Province lies in the north-eastern sections of the study area. This province contain basalt due to volcanic activity during the Cenozoic period. The fractured basalt of the Liverpool Ranges Basalt is highly dissected and overlies the Sydney Basin sandstone units in the north-western region of the Hunter Valley.
Great Australian Basin	The Great Australian Basin is a sedimentary basin which, within the study area, primarily consists of sandstone, siltstone, mudstone and thin coal seams.
Permo-Triassic Basins	The Permo-Triassic basin sediments exist at surface in the eastern half of the study area near Wollar and also near the Elong Elong Energy Hub. The sediment includes pebbly to medium grained quartz sandstone, red-brown and green mudstone, and lenses of quartz conglomerate. Coal bearing rocks are located close to surface in the south-eastern parts of the study area (near Wollar), near the Ulan, Moolarben and Wilpinjong coal mines.
Lachlan Orogen	The Lachlan Fold Belt, part of the Lachlan Orogen, is present at surface in the central part of the construction area. The surface geology consists of strongly sedimentary rocks, cherts, siltstones and mafic volcanic basalts and rhyolites, and plutonic granitic intrusions.


COOLAH
DUNEDOO
UARBRY
GOLDEN HIGHWAY
CASTLEREAGH HIGHWAY
GULGONG
ULAN
WOLLAR
Merotherie Energy Hub
Elong Elong Energy Hub
New Wollar Switching Station
M1
M2
M3
M4
M5
M6
M7
M8
M9
E1
E2
E3
E4
Central-West Orana REZ Transmission
Figure 4.2
Surface geology
Legend
Contamination study area
Construction area
Energy hub / 500 kV switching station
330 kV switching station
Railway
Road
Seamless Geology
Cenozoic Igenous Province
Cenozoic Sedimentary Province
Great Australian Basin
Permian-Mesozoic Igenous Province
Permo-Triassic Basin
Lachlan Orogen
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:400,000
Data sources: WSP 2023

4.2.3 Soil salinity and sodicity

Dryland salinity is the accumulation of salts in the soil surface and in groundwater in non-irrigated areas. Salinity is commonly caused by the mobilisation of salts in the soil profile by surface water or groundwater. The broad processes for groundwater mobilisation include groundwater recharge (or deep drainage), groundwater movement or groundwater discharge.

The contamination study area is generally mapped as having a low salinity potential, however evidence of salting has been mapped near the Ulan, Moolarben and Wilpinjong coal mines. The saline soil conditions mapped on DPE, 2022 are presented in Figure 4-3. The Ulan and Turill soil landscape is also associated with high levels of salinity, however occurrences in the Turill and Ulan soil landscapes are likely to be confined to drainage lines or depressions and/or footslopes and lower slopes.

Dryland salinity may also be caused by the exposure of naturally saline soils such as hypersaline clays. Saline soils can often also be sodic soils (soils with an exchangeable sodium percentage (ESP) of more than six per cent). Soil landscapes commonly associated with sodic soils include Balladoran, Goonoo, Home Rule, Rouse, Turill and Ulan soil landscapes (refer to Section 4.2.1). Soil sodicity can lead to:

- reduced flow of water through soil—which limits leaching and can cause salt to accumulate over time and the development of saline subsoils
- dispersion in the soil surface, causing crusting and sealing, which then impedes water infiltration
- dispersion in the subsoil, accelerating erosion, which can cause the appearance of gullies and tunnels.

4.2.4 Acid sulfate soils

Acid sulfate soils (ASS) and potential acid sulfate soils (PASS) are naturally occurring soils containing iron sulphides. On exposure to air, iron sulphides oxidise and create sulfuric acid. This increase in acidity can result in the mobilisation of aluminium, iron, and manganese from the soils.

Acid sulfate soil risk mapping is shown in Figure 4-4, which shows acid sulfate risk classifications for land within and in the vicinity of the contamination study area. The risk classifications are based on the NSW Government acid sulfate soil risk mapping.

The published digital geographical information system (GIS) and the CSIRO Australian Soil Resource Information System indicates that there is a low or extremely low probability of acid sulfate soils being present within the contamination study area. There is a potential for localised areas of acid sulfate soils in low lying waterlogged areas i.e. surrounding creeks or dams.

4.2.5 Naturally occurring asbestos

The term “naturally occurring asbestos” refers to the mineral as a natural component of soils or rocks as opposed to asbestos in commercial products, mining, or processing operations. Naturally occurring asbestos can be released from rocks or soils by routine human activities, such as construction, or natural weathering processes. If naturally occurring asbestos is not disturbed, and fibres are not released into the air, then it is not a health risk. Asbestos is a commercial and industrial term describing a group of specific silicate minerals that forms bundles of long, very thin mineral fibres. The form and structure of these fibres are called asbestiform. In addition to asbestos, there are additional minerals that are asbestiform, including winchite and richterite that are not technically considered asbestos. Asbestos is most commonly found in three rock types: serpentinites, altered ultramafic rocks, and some mafic rocks. The NSW government’s Heads of Asbestos Coordination Authorities (HACA) has published digital GIS data on naturally occurring asbestos. Depending on the probability of naturally occurring asbestos being present, NSW has been mapped into low, medium, or high potential regions.

The published digital GIS data indicates the potential presence of asbestos containing geology approximately 10 km to the west of the construction area (the area southwest of the Elong Energy Hub). GIS data indicates that the Oakdale formation includes tremolite and minor chrysotile. The entire Group could contain asbestos within mafic rock that are faulted – although the overall potential is low. The available mapping does not indicate any occurrences of expected naturally occurring asbestos minerals or serpentine and amphibole occurrence within the contamination study area. Naturally occurring asbestos (NOA) risk mapping is presented in Figure 4-5, which shows areas of potential NOA for land within and in the vicinity of the contamination study area. The risk classifications are based on the NSW Government NOA risk mapping including the NSW Government confidence in the data.

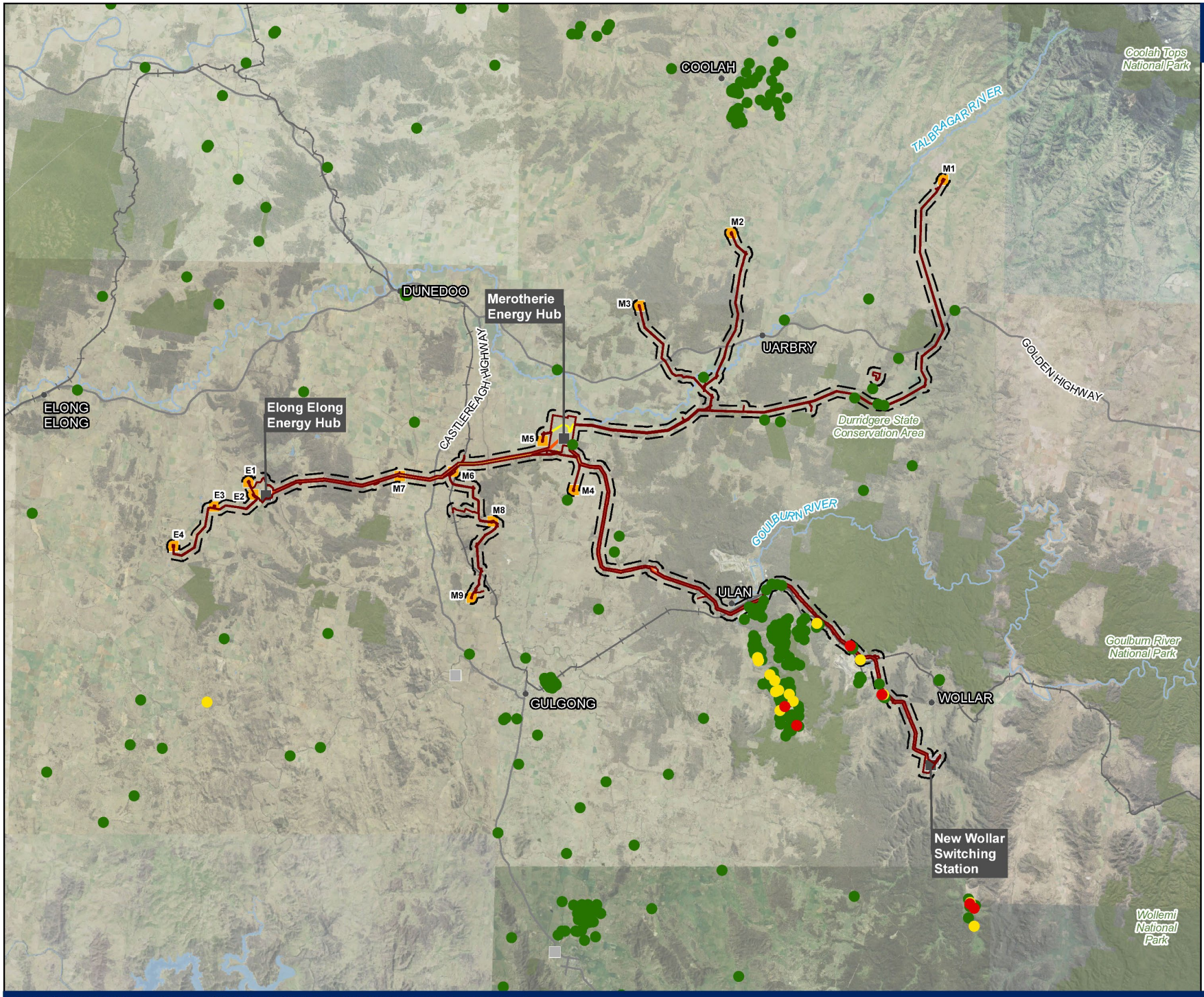


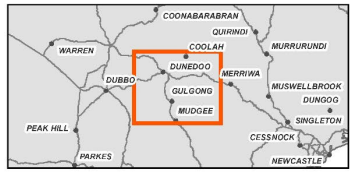
Figure 4-3
Presence of saline soils across the study area

Legend

- Contamination study area
- Construction area
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing substation
- State road
- Railway
- Watercourse
- Water body
- NPWS estate

Soil Profile Salinity

- Strongly evident
- Salting evident
- No salting evident



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:500,000
Data sources: WSP 2022 / 2023

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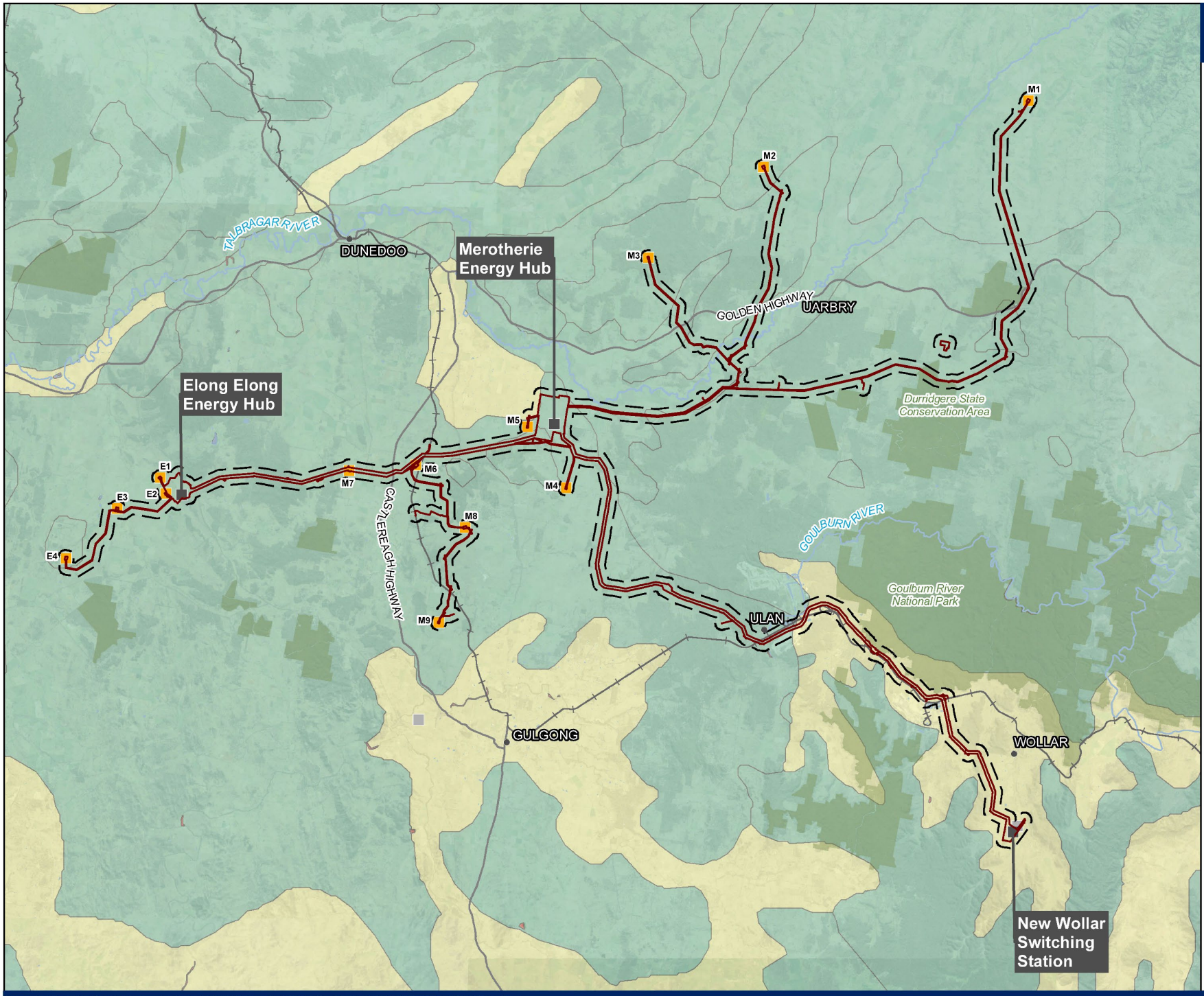


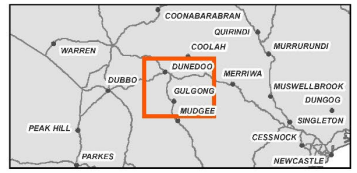
Figure 4-4
Presence of acid sulfate soils across the study area

Legend

- Contamination study area
- Construction area
- Energy hub / 500 kV switching station
- 330 kV switching station
- Existing substation
- State road
- Railway
- Watercourse
- Water body
- NPWS estate

Acid Sulfate Soil

- High Probability/Very Low Confidence
- Low Probability/Very Low Confidence
- Extremely Low Probability/Very Low Confidence



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:400,000
Data sources: WSP 2023, CSIRO, NWSS

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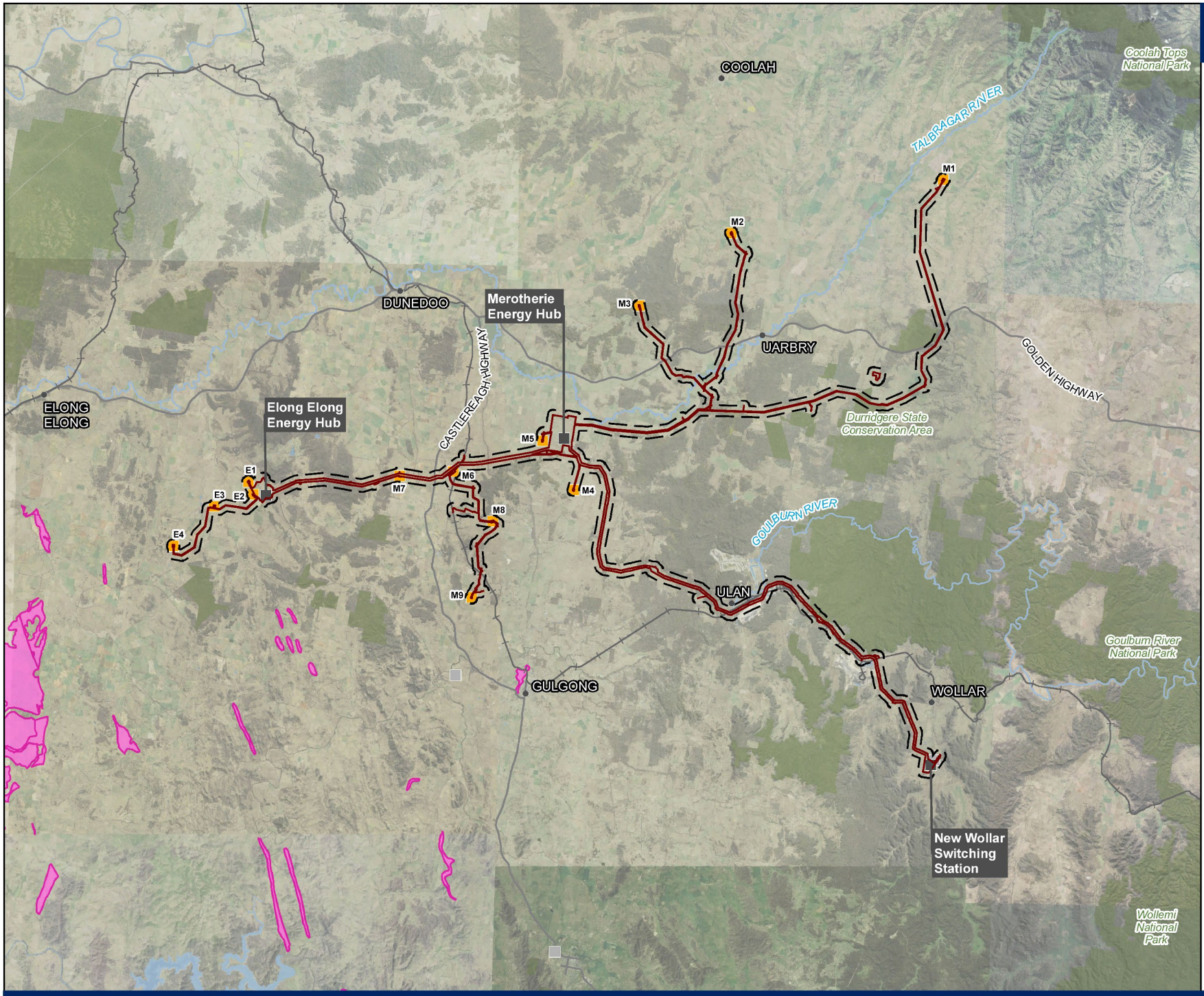
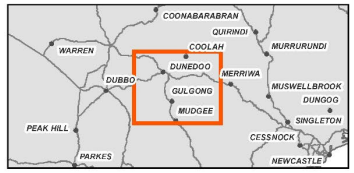


Figure 4-5
Presence of naturally occurring asbestos across the study area

Legend

- Contamination study area
- Construction area
- Energy hub / 500 kV switching station
- 330 kV switching station
- Existing substation
- State road
- Railway
- Watercourse
- Water body
- NPWS estate
- Potential naturally ocurring asbestos (NOA)



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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Data sources: WSP 2023, NSWSS

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4.3 Hydrogeology

4.3.1 Groundwater sources

There are eight groundwater sources throughout the construction area. The Water Sharing Plans and groundwater sources including aquifer type and productivity category within the study area are listed in Table 4-3. Groundwater throughout the construction area exists in alluvial, fractured, and porous rock aquifers. Both highly or less productive groundwater sources occur in the construction area, depending on the yields and groundwater quality. Groundwater sources are shown on Figure 4-6 and groundwater productivity is shown on Figure 4-7.

Table 4-3 Groundwater source productivity within the study area

Water Sharing Plan	Groundwater source	Management zone	Aquifer category	Productivity
NSW Murray Darling Basin Porous Rock Groundwater Sources 2020	Sydney Basin MDB Groundwater Source	Sydney Basin MDB (Other) Management Zone	Porous rock	Highly productive
	Gunnedah-Oxley Basin MDB Groundwater Source	Gunnedah-Oxley Basin MDB (Other) Management Zone	Porous rock	Less productive
NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	Liverpool Ranges Basalt MDB Groundwater Source	N/A	Fractured rock	Highly productive
	Lachlan Fold Belt MDB Groundwater Source	Lachlan Fold Belt MDB (Other) Management Zone	Fractured rock	Highly productive
North Coast Fractured and Porous Rock Groundwater Sources 2016	Sydney Basin-North Coast Groundwater Source	N/A	Porous rock	Less productive
	Oxley Basin Coast Groundwater Source	N/A	Porous rock	Less productive
	Liverpool Ranges Basalt Coast Groundwater Source	N/A	Fractured rock	Highly productive
Macquarie-Castlereagh Groundwater Sources 2020	Talbragar Alluvial Groundwater Source	N/A	Alluvial	Highly productive

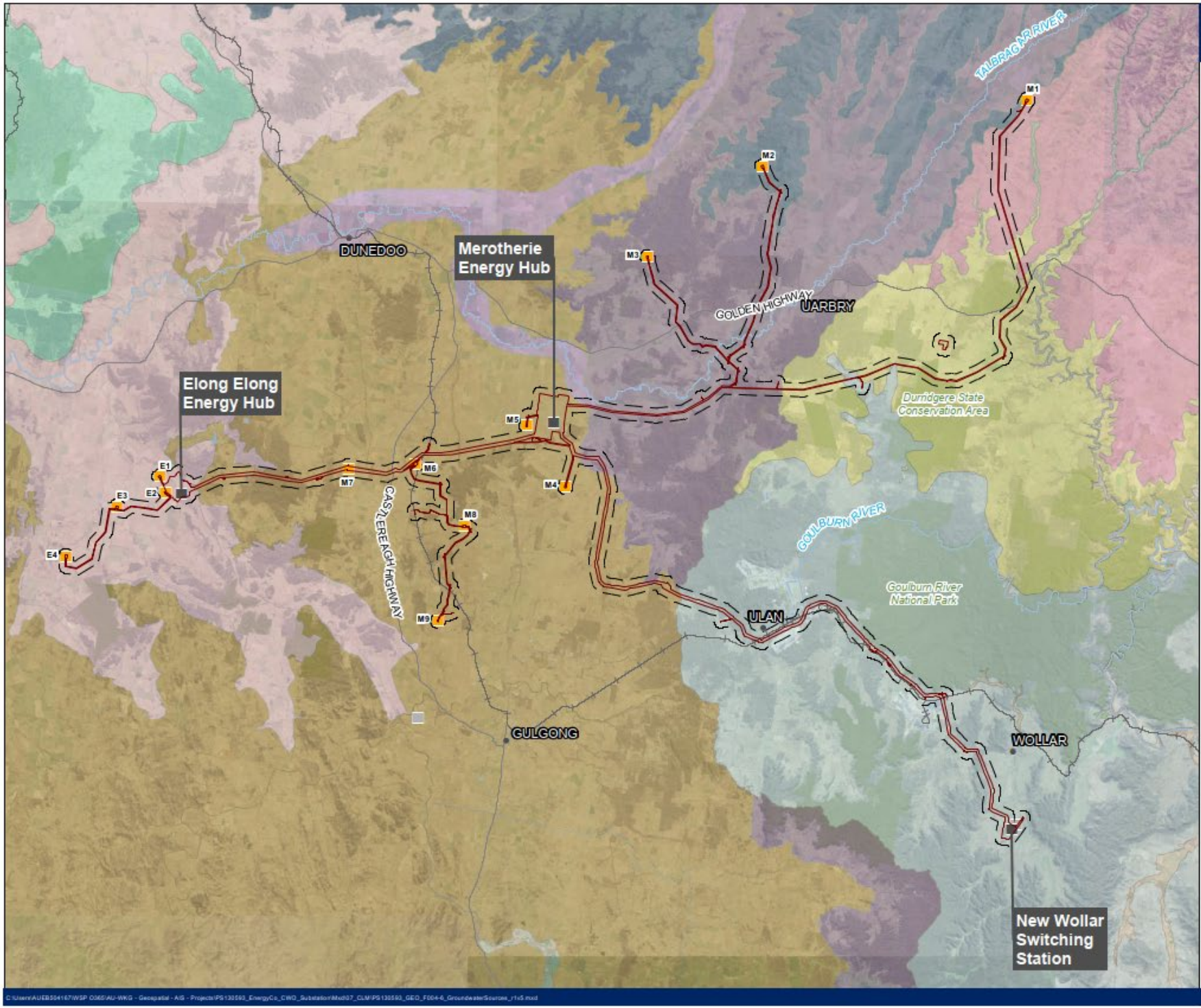


Figure 4-6
Groundwater sources

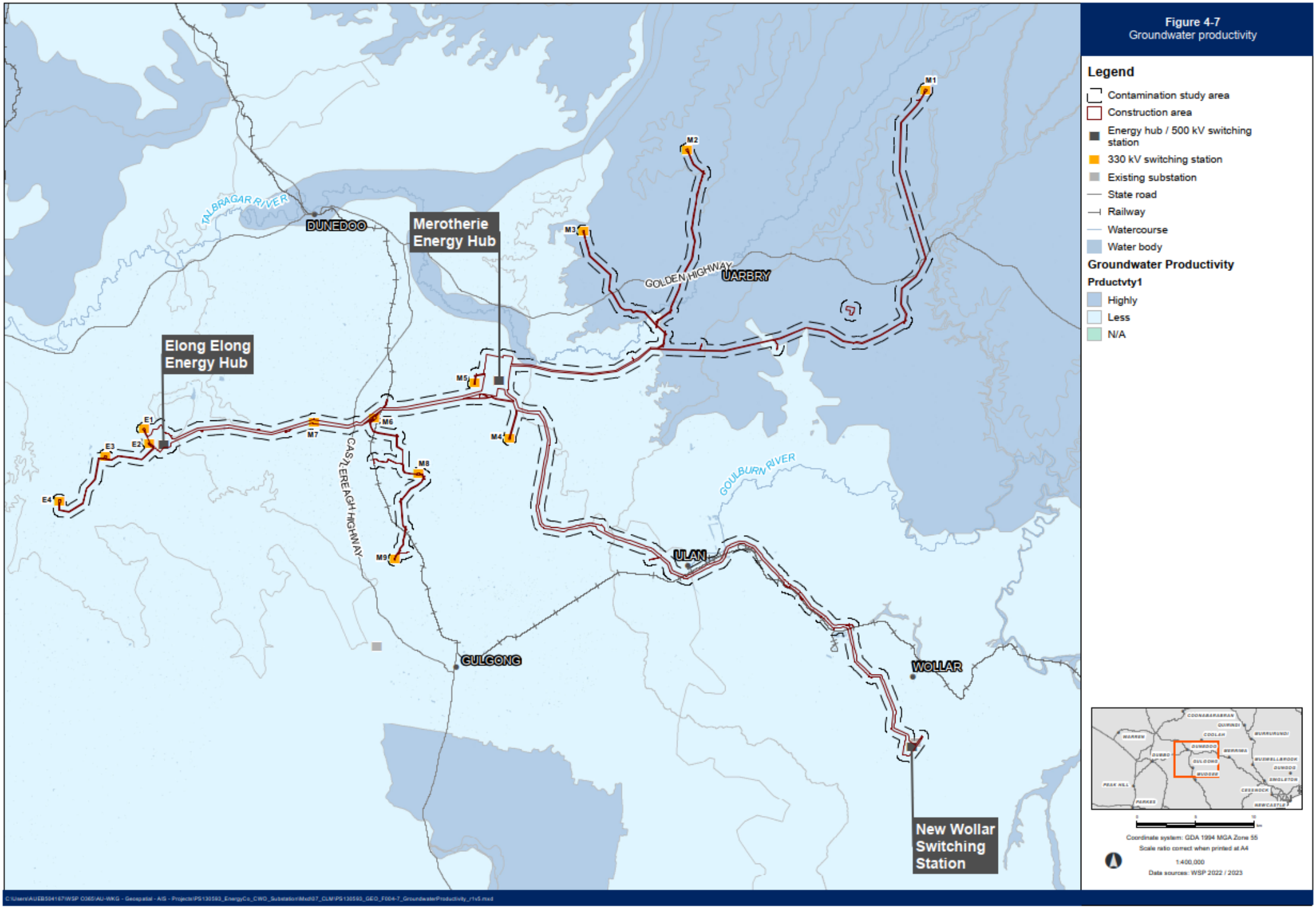
Legend

- Contamination study area
- Construction area
- Energy hub / 500 kV switching station
- 330 kV switching station
- Existing substation
- State road
- Railway
- Watercourse
- Water body
- NPWS estate

Water Sharing Plan Groundwater Sources

- **Macquarie-Castlereagh Groundwater Sources 2020** - Talbragar Alluvial Groundwater Source
- **NSW Great Artesian Basin Groundwater Sources 2020** - Southern Recharge Groundwater Source
- **NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020** - Lachlan Fold Belt MDB Groundwater Source
- **NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020** - Liverpool Ranges Basalt MDB Groundwater Source
- **NSW Murray Darling Basin Porous Rock Groundwater Sources 2020** - Gunnedah-Oxley Basin MDB Groundwater Source
- **NSW Murray Darling Basin Porous Rock Groundwater Sources 2020** - Sydney Basin MDB Groundwater Source
- **North Coast Fractured and Porous Rock Groundwater Sources 2016** - Liverpool Ranges Basalt Coast Groundwater Source
- **North Coast Fractured and Porous Rock Groundwater Sources 2016** - Oxley Basin Coast Groundwater Source
- **North Coast Fractured and Porous Rock Groundwater Sources 2016** - Sydney Basin-North Coast Groundwater Source

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:400,000
Data sources: WSP 2022 / 2023


Merotherie Energy Hub
Elong Elong Energy Hub
New Wollar Switching Station
DUNEDOO
UARBRY
ULAN
GULGONG
WOLLAR
GOLDEN HIGHWAY
CASTLEREAGH HIGHWAY
GOULBURN RIVER
TALBRAGAR RIVER
M1
M2
M3
M4
M5
M6
M7
M8
M9
E1
E2
E3
E4
Figure 4-7
Groundwater productivity
Legend
Contamination study area
Construction area
Energy hub / 500 kV switching station
330 kV switching station
Existing substation
State road
Railway
Watercourse
Water body
Groundwater Productivity
Prductvty1
Highly
Less
N/A
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:400,000
Data sources: WSP 2022 / 2023

4.3.1.1 Alluvial

The Talbragar Alluvial Groundwater Source is made up of alluvial sediments. These sediments form an extensive alluvial fan deposited along the Coolaburragundy and Talbragar Rivers, comprised of clay, silt, sand and coarse gravel. These deposits are generally shallow, forming unconfined aquifers that are responsive to rainfall and streamflow. Groundwater flow is generally a subdued reflection of topography and follows the surface water drainage systems. Discharge would mainly occur via evapotranspiration, where the groundwater is close to surface, groundwater baseflow to creeks and streams, groundwater extraction by various groundwater users (bores, mines and quarries), and aquifer flow through.

4.3.1.2 Porous rock

Porous rock aquifers are part of a sedimentary basin system, such as the Gunnedah-Oxley Basin, and Sydney Basin. Flow of groundwater is largely governed by both primary porosity with water movement around the rock grains, as well as secondary porosity with water movement through fractures made up of a combination of joints, bedding plane separation, faults and cavities within the rock mass. The ability to transmit usable quantities of water depends on the continuous interconnection of these higher permeability features.

Recharge to these systems is primarily through infiltration from rainfall, runoff and surface water within the outcropping areas. However, inflow can also occur from downward percolation of groundwater from overlying permeable strata that coincides with layers of the sedimentary sequences that have sufficient permeability for groundwater exchange to occur.

The Gunnedah-Oxley Basin groundwater source has overlying systems that include several alluvial units, such as the Liverpool Ranges Basalt. There is limited information on the degree of connection between the Gunnedah-Oxley Basin, the Murray-Darling Basin (MDB) and the overlying strata, however in areas where the basalt and alluvial systems, there is expected to be potential for groundwater exchange to occur. There has been minimal demand for groundwater from the Gunnedah-Oxley Basin MDB due to the limited yields generally achievable.

Due to the high variation in relief and incised nature of the Sydney Basin strata, conceptually local groundwater flow may provide a degree of baseflow to streams and creeks, although there is limited information within the MDB catchment. The bore yields from rocks of the Sydney Basin are typically in the order of 1L/s and of variable salinity dependent on the strata being intercepted by the bore.

4.3.1.3 Fractured rock

The Lachlan Fold Belt is one of the most extensive of the groundwater systems and ranges from the Great Dividing Range through to the western rangelands around Cobar. It provides stock and domestic groundwater supplies. Groundwater is stored and moves through fractures, joints, bedding plains, faults and cavities within the rock mass. Fractured rock aquifers may be discontinuous at a scale of a few to tens of metres and not locally interconnected or may be continuous at a regional scale because some local fractures can be connected to a regional fracture network. Typically, the surface water systems within the area are considered to be in low hydraulic connection with groundwater in the fractured rock.

4.3.2 Groundwater levels and flow

Available groundwater level information from registered works approvals (WaterNSW, 2022) and geotechnical and contaminated land site investigation provide an indication of the groundwater levels across the construction area. Groundwater level information throughout the construction area is sparse, with a search of the WaterNSW real-time water data website identifying 17 private water bores with groundwater level measurements recorded on driller logs. These are provided in Table 4-4. Groundwater level from project geotechnical and contaminated land site investigations are provided in Table 4-5. The location of the sites is shown on Figure 4-8.

The depth to water through the study area, is spatially variable and ranges from 0.65 metres to 51 metres below the surface. The depth to water depends on the underlying geology and the recharge and discharge in the local areas. Groundwater flow in the unconfined aquifers is generally a subdued reflection of topography with topographic high and low points dictating flow directions and creating localised flow systems. Groundwater levels in the south-eastern section of the construction area are influenced by extraction from the Ulan, Wilpinjong and Moolarben coal mines. There is insufficient data to comment on seasonal variation of groundwater levels within the study area.

Table 4-4 Groundwater levels recorded from drillers logs (WaterNSW, 2022)

GW number	Easting[1]	Northing[1]	Use type	Depth to water (mBGL)
GW024776	769870	6421057	Stock watering	1
GW078165	772661	6416820	Stock watering	1.92
GW080124	769060	6421572	Unknown	0.2
GW080401	773008	6416178	Monitoring bore	2.63
GW080403	772865	6416461	Monitoring bore	1.35
GW080404	772447	6417465	Monitoring bore	1.58
GW080408	769664	6421161	Monitoring bore	1.82
GW080410	769924	6420991	Monitoring bore	2.6
GW080411	770635	6419801	Monitoring bore	2.62

(1) Coordinates relate to GDA94 Zone MGA55

Table 4-5 Groundwater levels recorded from project field investigations

Groundwater monitoring well	Depth to water (mBGL)
BH05-PR	5.91
BH06-PR	14.80
Borehole number	**Estimated depth to water during drilling* (mBGL)**
BH01-PR	4.0
BH03-CFG	2.6
BH04-CFG	0.8
BH05-CFG	3.0
BH05-PR	10.4
BH06-PR	1.5
BH09-M2U	2.0
BH09-U2B	2.4
BH10-CFG	8.9
BH11-EEEH	1.5
BH13-EEEH	2.0
BH14-EEEH	4.0

Note: mBGL – metres below ground level

* Groundwater depth noted from geotechnical logs

4.3.3 Groundwater quality

Available groundwater quality information from registered works approvals (WaterNSW, 2022) and contaminated land site investigation provides an indication of the groundwater quality across the construction area. The search of the WaterNSW real-time water data website identified six private bores with groundwater quality recorded. These are provided in Table 4-6 and shown on Figure 4-9. The data is very limited and is concentrated close to the mining areas at the Ulan, Wilpinjong and Moolarben coal mines, in the south-eastern portion of the contamination study area. Groundwater quality from the project investigations (refer to Technical paper 17 – Groundwater) are provided in Table 4-7.

Measured groundwater quality across the study area, is fresh to brackish, with salinity (as total dissolved solids [TDS]) ranged from 400 mg/L to 4,970 mg/L. Groundwater quality depends on the underlying geology, surface water runoff quality (that is recharged into the underlying aquifers) in the local areas. The groundwater in the study area has been used for most purposes such as stock and domestic, industrial, irrigation and water supply. There is insufficient data to comment on seasonal variation of groundwater quality within the study area.

Table 4-6 Registered bores with quantitative groundwater quality records (average)

Work number	Salinity as TDS (mg/L)
GW024778	1,300
GW080410	407
GW080404	406
GW080408	400

Note: TDS – Total dissolved solids. Mg/L – milligrams per litre

Table 4-7 Groundwater quality recorded from project field investigations

Borehole number	Salinity as TDS (mg/L)
BH05-PR	4970
BH06-PR	625

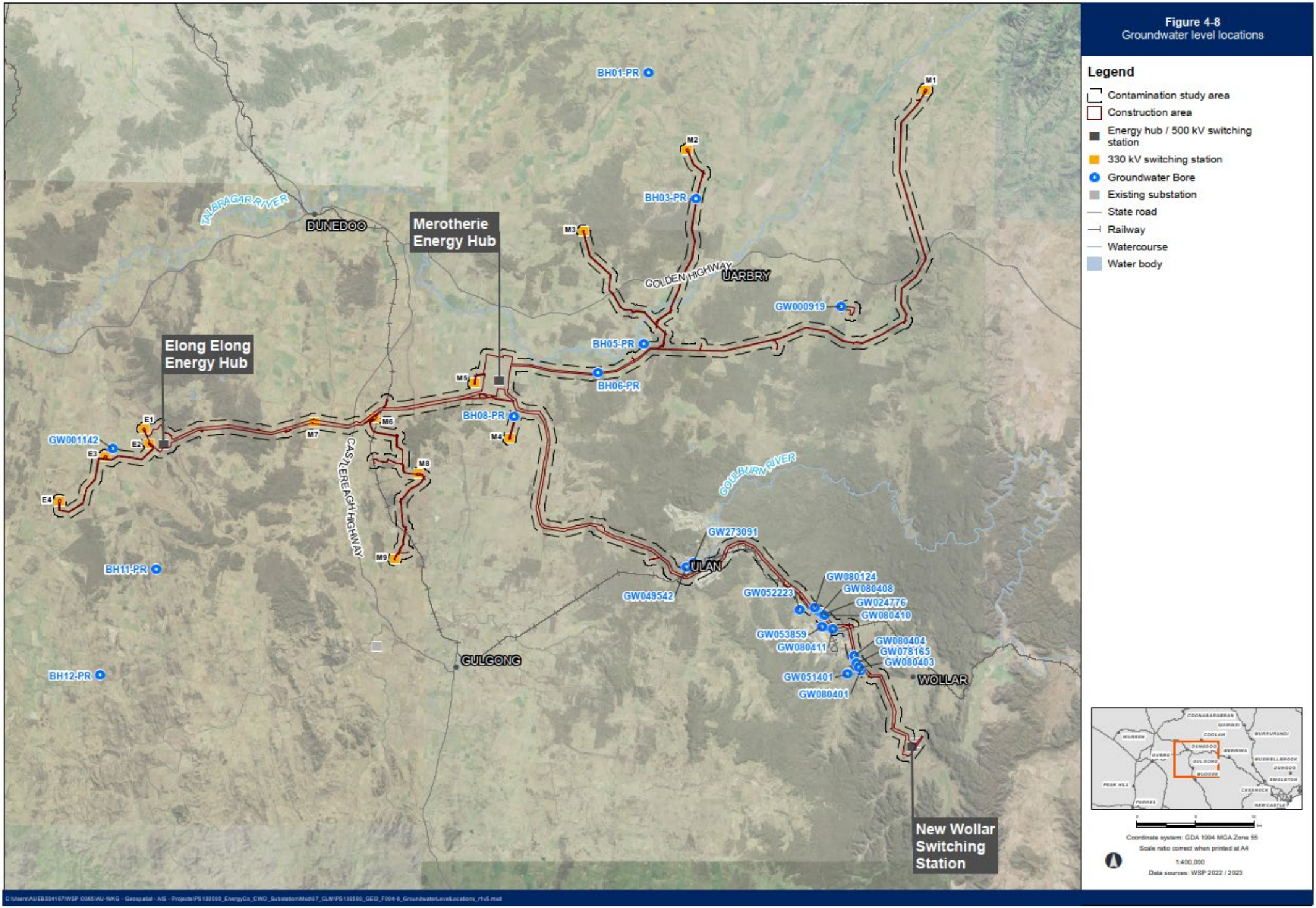
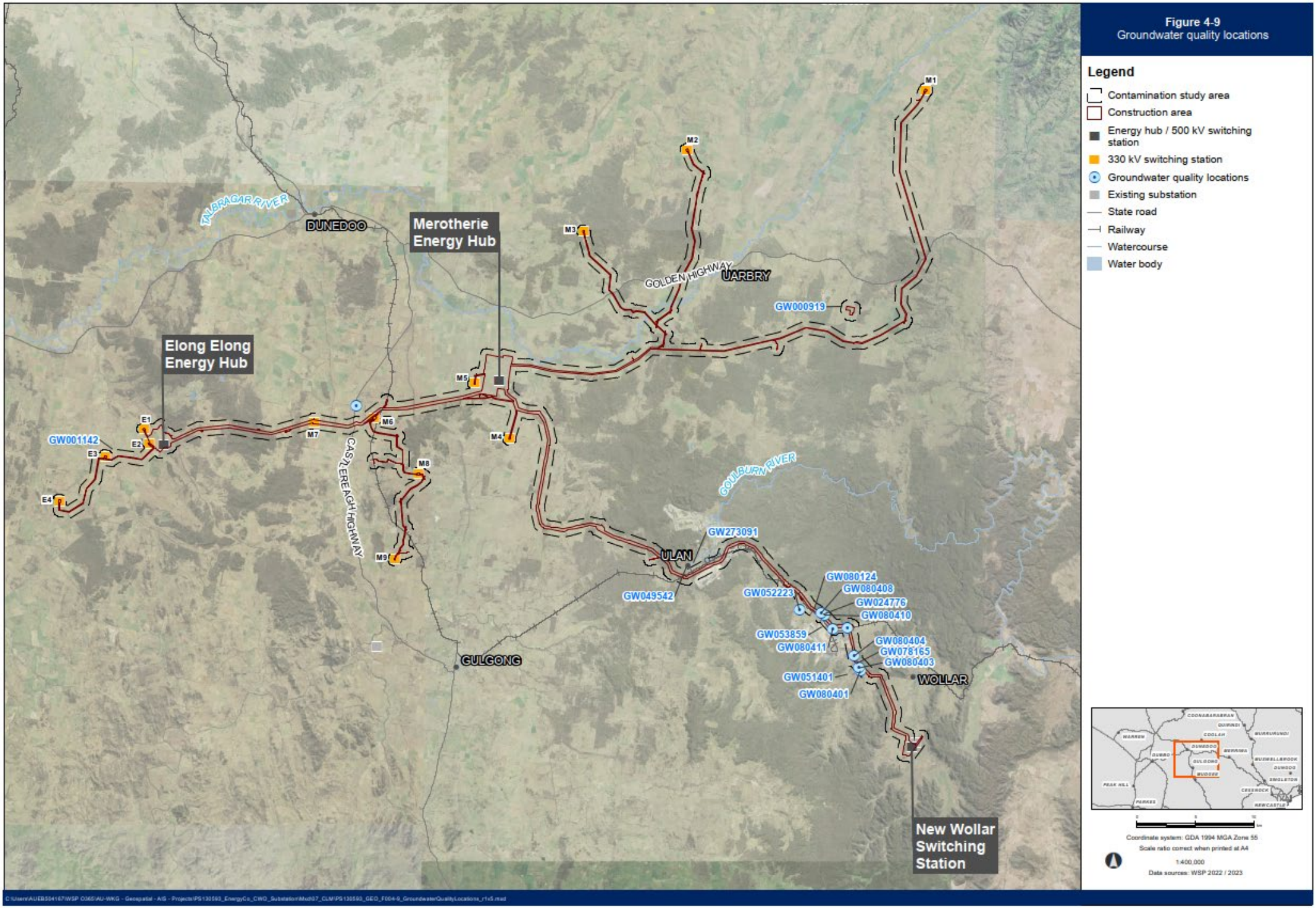


Figure 4-8
Groundwater level locations
Legend
Contamination study area
Construction area
Energy hub / 500 kV switching station
330 kV switching station
Groundwater Bore
Existing substation
State road
Railway
Watercourse
Water body
BH01-PR
BH03-PR
BH05-PR
BH06-PR
BH08-PR
BH11-PR
BH12-PR
GW000919
GW001142
GW273091
GW049542
GW052223
GW080124
GW080408
GW024776
GW080410
GW053859
GW080411
GW080404
GW078165
GW080403
GW051401
GW080401
M1
M2
M3
M4
M5
M6
M7
M8
M9
E1
E2
E3
E4
Merotherie Energy Hub
Elong Elong Energy Hub
New Wollar Switching Station
DUNEDOO
UARBRY
ULAN
GULGONG
WOLLAR
GOLDEN HIGHWAY
CASTLEREAGH HIGHWAY
TALBRAGAR RIVER
GOULBURN RIVER
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:400,000
Data sources: WSP 2022 / 2023


Merotherie Energy Hub
Elong Elong Energy Hub
New Wollar Switching Station
DUNEDOO
TALBRAGAR RIVER
GOLDEN HIGHWAY
UARBRY
GW000919
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M2
M3
M4
M5
M6
M7
M8
M9
E1
E2
E3
E4
GW001142
CASTLEREAGH HIGHWAY
GOULBURN RIVER
ULAN
GW273091
GW049542
GW052223
GW080124
GW080408
GW024776
GW080410
GW053859
GW080411
GW080404
GW078165
GW080403
GW051401
GW080401
GULGONG
WOLLAR
Figure 4-9
Groundwater quality locations
Legend
Contamination study area
Construction area
Energy hub / 500 kV switching station
330 kV switching station
Groundwater quality locations
Existing substation
State road
Railway
Watercourse
Water body
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:400,000
Data sources: WSP 2022 / 2023

4.4 Groundwater receivers

4.4.1 Registered groundwater users

Registered groundwater works within the contamination study area were identified using WaterNSW continuous water monitoring network website (WaterNSW, 2022) and the Bureau of meteorology's national groundwater information system (BoM, 2022). The number of registered groundwater works and types within the contamination study area are presented in Table 4-8.

Table 4-8 Groundwater users identified within the study area

Beneficial use	Study area	Construction area
Stock and domestic	19	2
Unknown (use not listed)	1	0
General use	1	0

A full list of registered groundwater works within the construction area is provided in Technical paper 17 – Groundwater.

4.4.2 Groundwater Dependent Ecosystems

A review of the BoM Groundwater Dependent Ecosystems Atlas (GDE Atlas) (BoM 2022) was undertaken to identify all known to occur within the contamination study area. Within the study area, there are 23 registered groundwater users identified within the study area. There are also 17 unique high priority terrestrial GDE's (that occur in 316 locations) and five high priority aquatic GDE's (six in the Macquarie-Bogan river catchment and two in the Hunter river catchment). A detailed assessment of the potential impacts of the project on GDE's is provided in the Technical paper 4 – Biodiversity Development Assessment Report.

4.5 General site land use

Land use across the contamination study area has been analysed using 2017 NSW land use GIS data (DPIE, 2020). Relevant areas of land use are summarised in Table 4-9.

Of the transmission line alignment, the Wollar – Merotherie connection is dominated by grazing of both modified pastures and native vegetation with some minimal use land, but little cropping (DPIE, 2020). The Coolah connection, the Cassilis connection and the western part of the Merotherie – Elong Elong connection also have a similar mix of agricultural land uses. There are also substantial coal mining areas around Moolarben and Ulan on the Wollar – Merotherie connection.

The Coolah connection, the eastern part of the Merotherie – Elong Elong connection and the Tallawang south connection also have a high proportion of grazing of modified pastures, grazing of native vegetation and minimal use land, but have a higher proportion of cropping than the areas described above.

The construction area west of the Elong Elong Energy Hub (including Cobbora north connection, Cobbora west connection and Goolma connection) is dominated by cropping land use. However, in any particular year the 'cropping' area may include a substantial portion which is in a pasture phase of the cropping rotation.

Irrigated cropping is undertaken on parts of the Talbragar River floodplain. However, no irrigation areas are recorded in the construction area.

Grazing of cattle and sheep (for wool and meat) is common throughout the study area.

Table 4-9 Land uses identified within the study area

Land use (DPIE, 2020)	Construction area (ha)	Proportion	Operation area (ha)	Proportion
Agricultural land uses				
2.1.0 Grazing native vegetation	1,119	28.9%	863	32.1%
3.2.0 Grazing modified pastures	1,631	42.1%	1,075	40.0%
3.3.0 Cropping	803	20.7%	499	18.6%
Sub-total – Agriculture	**3,553**	**91.8%**	**2,436**	**90.7%**
Conservation and natural environments	197	5.1%	167	6.2%
Residential and farm infrastructure	18	0.5%	11	0.4%
Transport, utilities & communication	5	0.1%	3	0.1%
Mining	85	2.2%	61	2.3%
Water (lakes, rivers, etc)	12	0.3%	10	0.4%
Total	**3,870**	**100.00%**	**2,687**	**100.00%**

Note on Table 4.8: Individual amounts are approximate and may not sum to the amount of the totals due to rounding.

4.6 Zoning

The contamination study area is primarily zoned RU1 Primary Production under the applicable Local Environmental Plans. Other key zones in the study area include:

- RU5 Village (a small area at Ulan)
- RU3 Forestry (areas at Dunedoo and Turill)
- R5 Large Lot Residential (a small area at Tallawang)
- C1 National Parks and Nature Reserves (along the southwestern border of Goulburn River
- National Park and south-eastern border of a section of Durridgere State Conservation Area)
- C3 Environmental Management (areas at Ulan, Wollar, Barneys Reef, Cope, Cumbo and Merotherie)
- IN3 Heavy Industrial (small areas at Ulan).

The objectives of the RU1 zone are as follows:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area
- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones.

This information assists in identifying past uses of the study area and is part of the site identification required in the NEPM 2013.

4.7 Database search results

A review of a database search of potential current and former contaminant sources in the vicinity of the site main project alignment is presented in Table 4-10 below.

Table 4-10 Search of potential current and former contaminant sources

Item	Details
List of NSW contaminated sites notified to EPA	A search of the NSW EPA contaminated land database was conducted in September 2022, which revealed that there has been no record of written notices issued within the contamination study area under the CLM Act. One site within the contamination study area; the Glencore Ulan Coal Mine hast been notified to the EPA under Section 60 of the CLM Act, requiring a duty to report contaminated sites section. While no additional information is available on the nature of this reporting, the contamination on-site is listed as not requiring regulation under the CLM Act. Source: List of NSW contaminated sites notified to EPA, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/contaminated-land/notified-and-regulated-contaminated-land/list-of-notified-sites – Accessed June 2023.
Current NSW EPA licensed activities	There are three sites within the contamination study area that currently hold an Environment Protection Licence to undertake scheduled activities and/or scheduled development work under the POEO Act as detailed below: — Ulan Coal Mines, 4505 Ulan Road, Ulan, NSW, 2850 (Licence No: 394) — Wilpinjong Coal Mine, 1676 Ulan-Wollar Road, Wilpinjong NSW 2850 (Licence No: 12425) — Moolarben Coal Operations Pty Ltd, 12 Ulan Road, Mudgee NSW 2850 (Licence No: 12932). Ulan Coal Mine, Wilpinjong Coal Mine, and Moolarben Coal Mine are licensed for Coal works, and mining for coal. All sites have extensive dust, groundwater, and surface water monitoring programs stipulated as part of their license conditions. Surface water monitoring programs are primarily focused on monitoring the discharge of dewatering flows from the mine. There are two sites within a 1 km buffer of the contamination study area that currently hold an Environment Protection Licence to undertake scheduled activities and/or scheduled development work under the POEO Act as detailed below: — Orica Explosives – Ulan Mine Site, Ulan Road, Ulan, NSW 2850 (Licence No: 4443) — Dronvisa Quarry, 12 Ulan-wollar Road Ulan NSW 2850 (Licence No: 21765). Orica Explosives is located within the Ulan Mine Site and is licensed to produce explosives. Under the licence conditions, there is a requirement to monitor concentration of pollutants discharged. The Orica site is located outside of the contamination study area. Dronvisa Quarry is located within the Ulan Mine Site and is licensed to crushing, grinding or separating quarried source material and mining for minerals. Under the licence conditions, there are requirements to monitor concentration of pollutants discharged. Dronvisa Quarry site is located outside of the contamination study area.

Item	Details
	Source: POEO Public Register: Search for Licenses, New South Wales Environment Protection Authority https://apps.epa.nsw.gov.au/prpoeoapp/Detail.aspx – Accessed June 2023.
Clean Up and Penalty Infringement Notices	There are no sites within the contamination study area that have a record of notice issued by the EPA under Section 55 of the POEO Act. A penalty infringement notice was served on Moolarben Coal Operations Pty Ltd on 11 May 2012. The reason for the penalty infringement notice was identified as "contravene any condition of license – not noise – operation". Source: Contaminated Land: Records of Notice, New South Wales Environment Protection Authority http://app.epa.nsw.gov.au/prclmapp/searchregister.aspx – Accessed June 2023.
Former licensed activities, now revoked or surrendered	There are no former licensed activities under the POEO Act, now revoked or surrendered within the contamination study area. The mine sites have been subject to a number of license variation during their operation. Source: Former Licensed Activities, New South Wales Environment Protection Agency https://apps.epa.nsw.gov.au/prpoeoapp/Detail.aspx – Accessed June 2023.
Delicensed activities still regulated by the NSW EPA	There are no delicensed activities regulated by the EPA within the contamination study area. Source: POEO Public Register: Delicensed Premises Search, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/licensing-and-regulation/public-registers/about-prpoeo/unlicensed-premises-epa-reg – Accessed June 2023.
Former gasworks	There are no former gas works within the contamination study area. Source: Contaminated Land: Location of former gasworks sites, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/contaminated-land/other-contamination-issues/former-gasworks-sites – Accessed June 2023.
National waste management site data base	There are two sites within a 0.5 km buffer of the contamination study area that are currently registered and are operational under the National Waste Management Site Database as detailed below: — Cassilis Transfer Station – 9756 Golden Highway, NSW 2329 (200 m north of the construction area) (Database ID NSW00281) — Ulan Transfer Station, 35 Bent Street Ulan NSW 2850 (400 m north of the construction area) (Database ID NSW01318). Source: Waste Management Facilities, Australian Government Geoscience Australia https://ecat.ga.gov.au/geonetwork/srv/api/records/147594 – Accessed June 2023.
NSW EPA PFAS investigation program	There are no sites within the vicinity of the contamination study area listed on the EPA PFAS investigation program. Source: PFAS investigation program, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/contaminated-land/pfas-investigation-program – Accessed June 2023.

Item	Details
UXO database review	There are no mapped UXO areas within the contamination study area. Source: Department of Defence Unexploded Ordnance database, http://52.65.9.125/ – Accessed June 2023.
Cattle dips	No cattle dips were identified within the contamination study area. Source: Department of Primary Industries Cattle Dip Site Locator, https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-and-protozoal-diseases/ticks/cattle-dip-site-locator – Accessed June 2023.

4.8 Historical aerial photography review

Available historical aerial photographs from Spatial Collaboration Portal (2022) were reviewed for the contamination study area. Land uses in the contamination study area don't appear to have significantly changed since the 1960s with minor exceptions. A review of aerial photography of the contamination study area did not identify any areas of potential historical filling or stockpiling as would typically be indicated by large embankments or scarring outside of the mine footprints.

4.8.1 Historical coal mine operations

Mining operations within the construction area have included open cut, highwall and underground mining areas. The Ulan Coal Mine, Moolarben Coal Mine, and Wilpinjong Coal Mine are active coal mining operations in the western coalfields and are located between the Merotherie energy hub and New Wollar switching station. Coal deposits were reportedly first worked in the 1920's. Underground mining reportedly began in the early 1940s providing coal to domestic power stations.

The Moolarben Coal Mine is located adjacent to the southern and eastern boundaries of the Ulan Coal Mine and comprises underground and open cut mining operations. The Wilpinjong Coal Mine is an open cut operation, located approximately 7 kilometres to the south-east of the Ulan Coal Mine. Other extractive industries outside of the contamination study area in the region include rock and clay mining including the adjacent Kaolin clay and sandstone mine and council road base quarry; with additional minerals mining activities in the area including mining for dolomite, ironstone, limestone, and magnetite.

Agricultural grazing was the primary land use prior to mining operations between the Merotherie Energy Hub and New Wollar Switching Station. According to publicly available mine closure plans, the primary objective of rehabilitation and revegetation of the post-mining footprints, in particular the open cut construction footprints, will be to create a stable final landform, which is self-sustaining with native vegetation community's characteristic of the pre-mining composition, with a post mining land and soil capability Class 6 landscape. Future land use would likely consist of grazing and conservation.

4.9 Areas of contamination concern

Table 4-11 provides an overview of the areas of contamination concern located within the contamination study area, and the associated contaminants of concern. The identification of areas of contamination concern does not represent actual contamination incidents or contamination conditions within the construction area. It is a statement of the potential for contamination to be present based on historical records and existing land uses and represents a worst-case scenario.

Table 4-11 Identified areas of contamination concern within the contamination study area

Areas of contamination concern	Reason for concern	Potential sensitive receivers	Potential contaminants of concern	Likelihood for contamination
Existing Wollar substation site	Spills from maintenance activities on-site and leaks from site transformers. Potential leaks associated with fuel/transformer oil storage.	— Construction/maintenance workers — Aquatic ecosystems — Terrestrial ecosystems near the substation — Off-site agricultural users on adjacent farming land.	— Poly chlorinated biphenyls (PCBs) — Benzene, toluene, ethylbenzene, xylene, and naphthalene (collectively referred to as BTEXN) — Total recoverable hydrocarbons (TRH).	High
Existing towers and transmission line infrastructure	Spills from maintenance activities on site, asbestos paints on tower infrastructure.	— Construction/maintenance workers — Terrestrial ecosystems — Aquatic ecosystems — Off-site agricultural users on adjacent farming land.	— BTEXN — TRH — Asbestos — Pesticides.	Low
Farm structures	Historical uncontrolled earthworks/filling and building structures previously demolished/ degraded. Storage of agricultural chemicals and potential leaks associated with site works.	— Construction/maintenance workers — Aquatic ecosystems — Terrestrial ecosystems — Agricultural users.	— Heavy metals — Asbestos — Polycyclic Aromatic Hydrocarbons (PAH) — Pesticides — TRH.	Medium

Areas of contamination concern	Reason for concern	Potential sensitive receivers	Potential contaminants of concern	Likelihood for contamination
Farm dams	Historical uncontrolled earthworks/filling. Accumulation of nutrients and pesticides from adjacent cropping activities.	— Construction/maintenance workers — Aquatic ecosystems — Terrestrial ecosystems — Agricultural users.	— Heavy metals — BTEX — Pesticides — TRH — Nutrients — E. coli (and faecal bacteria).	Medium
Areas of active cropping/ cleared agriculture land	Historical uncontrolled earthworks/filling. Potential leaks associated with site works, nutrients and pesticides from cropping activities.	— Construction/maintenance workers — Terrestrial ecosystems — Aquatic ecosystems — Agricultural users.	— Heavy metals — Pesticides — TRH — PAH — Nutrients.	Low
Existing roadways and rail corridors	Spills from vehicles, and maintenance activities on site.	— Construction/maintenance workers — Terrestrial ecosystems — Aquatic ecosystems — Off-site agricultural users on adjacent farming land.	— BTEXN — TRH — PAH — Asbestos — Pesticides.	Low
Mining lease areas – Coal	Uncontrolled earthworks, spills from activities on-site, dumping of wastes, mine tailings.	— Construction/maintenance workers — Aquatic ecosystems — Terrestrial ecosystems — Off-site agricultural users on adjacent farming land.	— Acid mine drainage — Heavy metals — Polycyclic Aromatic Hydrocarbons (PAH) — TRH — Methane — High carbon material (HCM).	High

4.9.1 Mining lease information

Towards the south-eastern extent of the construction area between the Merotherie Energy Hub and New Wollar switching station, the proposed transmission alignment would cross the Wilpinjong Coal Mine through an area known as Pit 4. This area has previously been mined and backfilled. Reference to the *Wilpinjong Coal Pty Limited – Rehabilitation Management Plan* (Wilpinjong Coal Pty Limited, 2022) indicated that overburden from the active cuts has been placed within the pit as backfill. Anecdotal information provided by Peabody suggests that this material is considered HCM and contains low level coal which is not suitable for offsite export. Spontaneous combustion is a recognised hazard associated with HCM. Spontaneous combustion is the process by which certain materials can ignite as a result of internal heat which arises spontaneously due to reactions liberating heat faster than it can be lost in the environment.

In the remediated areas of Pit 4, excavation may encounter HCM which needs to be managed. Excavations in potential HCM soils risk exposure to spontaneous combustion which is currently managed on site by starving oxygen supply to HCM i.e., burying under fill. Potential HCM cannot be used as fill material at the surface level, and needs to be appropriately capped. The location of HCM within remediated areas of the Wilpinjong Coal Mine is unknown as it has not yet been subject to survey for the purpose of this project. According to information presented within the *Rehabilitation Management Plan* (Wilpinjong Coal Pty Limited, 2022) topsoil across remediated areas is likely to be very shallow and limited to a 0.15 m to 0.3 m layer.

The alignment passes east of the tailings dams on the Wilpinjong Coal Mine. Anecdotal information indicates that after an initial drying period of two years, approx. 5–7 m of coarse fill is pushed over the dams, then topsoiled and landscaped.

North of the Wilpinjong Coal Mine the proposed transmission alignment also intersects the periphery of the mining lease areas for the Ulan Coal Mine and the Moolarben Coal Mine.

Stage 1 at the Moolarben Coal Mine has been operating for several years and at full development will comprise three open cut mines (OC1, OC2, and OC3), a longwall underground mine (UG4), and mining related infrastructure (including coal processing and transport facilities)[1]. Stage 2 at the Moolarben Coal Mine has commenced and at full development will comprise one open cut mine (OC4), two longwall underground mines (UG1 and UG2), and mining related infrastructure. The construction area crosses the underground mine UG4 mains access which runs in a south-west direction under Ulan Road (between UG1 and UG4).

The Ulan Coal Mine operates two underground mines (Ulan West and Ulan Underground). The construction area does not interface with any of the Ulan Coal mining operations or former rehabilitation areas[2].

The coal mining areas which intersect the study area are shown in Figure 4-10. The mining and exploration authorisations, issued in accordance with the *Mining Act 1992*, by the Department of Resources and Energy (DRE) are listed in Table 4-12.

1 YANCOAL, September 2020 *Moolarben Coal Mining Operations Plan*

2 Glencore, November 2017 *Ulan Coal Mines Pty Ltd Mining Operations Plan 2017 to 2024*

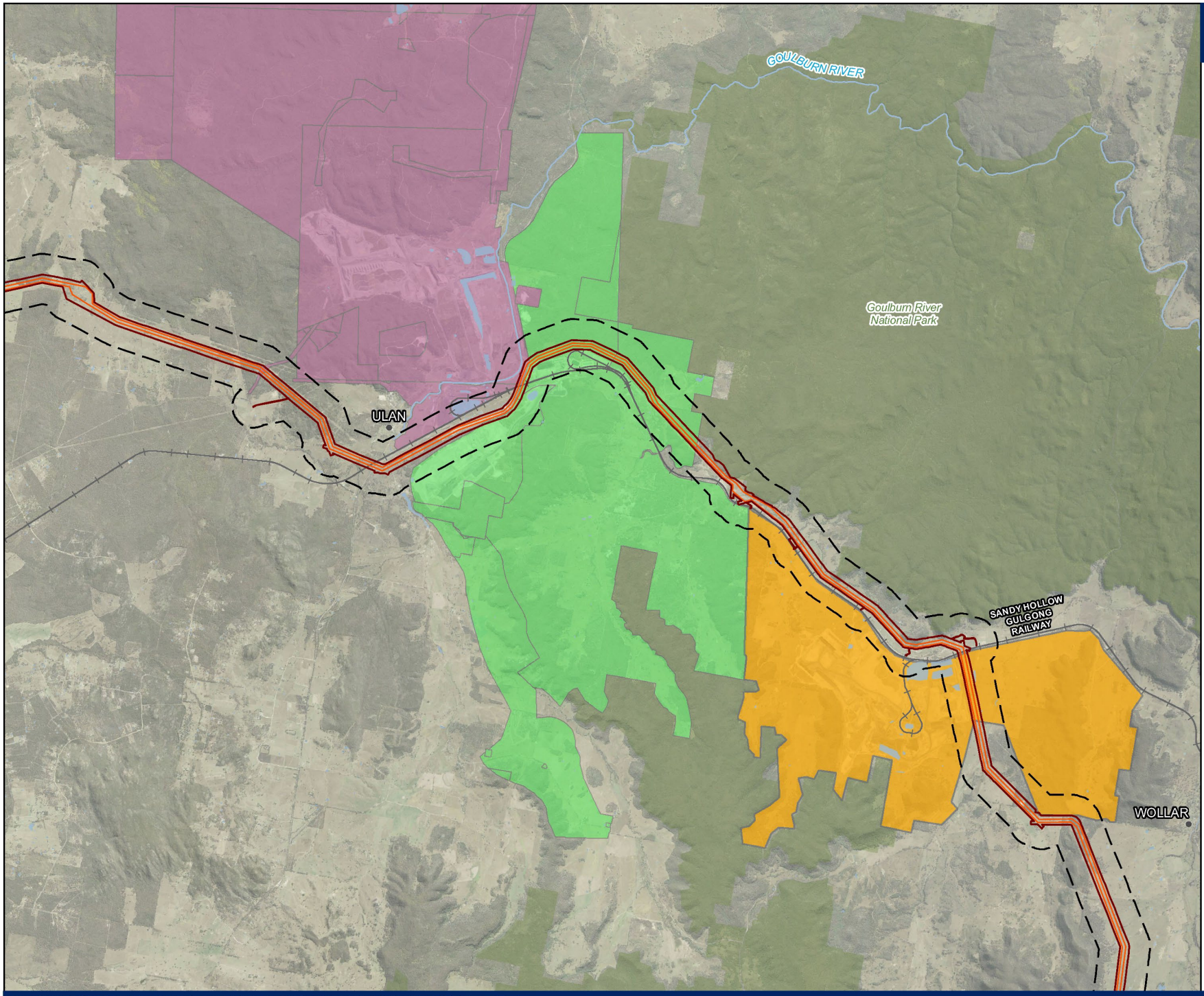


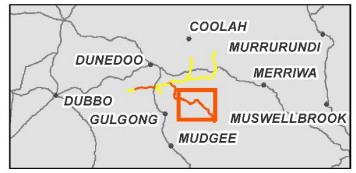
Figure 4-10
Mine lease areas

Legend

- Contamination study area
- Construction area
- 500 kV transmission line
- Railway
- Watercourse
- Water body
- NPWS estate

Mining Lease Area

- Wilpinjoing mine
- Moolarben mine
- Ulan mine



0 2 4 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:125,000
Data sources: WSP 2023, NSWSS

C:\Users\AUJB505996\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\07_CLM\PS130593_CLM_F004-10_MiningLeases_r1v6.mxd

Table 4-12 Mining and Exploration Titles within the vicinity of the contamination study area

Mining or Exploration Title	Area of operation
Consolidation Coal Lease (CCL) 741	Ulan Surface Operations
Mining Purpose Lease 315	Ulan Underground (Surface Lease)
Mining Lease 1341	Ulan Underground
Mining Lease 1365	Ulan Underground (Surface Lease)
Mining Lease 1366	Ulan Underground (Surface Lease)
Mining Lease 1467	Ulan Underground (Surface Lease)
Mining Lease 1468	Ulan Underground
Mining Lease 1511	Ulan Underground (Surface Lease)
Mining Lease 1554	Ulan Underground (Surface Lease)
Mining Lease 1656	Ulan Underground (Surface Lease)
Mining Lease 1697	Ulan Open Cut
Mining Lease 1754	Ulan Surface Operations
Mining Lease 1798	Ulan Open Cut
Mining Lease 1799	Ulan Surface Operations
Mining Lease Application (ML470)	Ulan Open Cut
Exploration Licence 5573	Ulan Underground
Exploration Licence 7542	Ulan West
Exploration Licence 8687	Ulan West
Exploration Licence Application 5922	Ulan West
Mining Lease 1605	Moolarben Open Cut
Mining Lease 1606	Moolarben Open Cut
Mining Lease 1628	Moolarben Open Cut
Mining Lease 1691	Moolarben Open Cut
Mining Lease 1715	Moolarben Open Cut
Exploration License 6288	Moolarben Open Cut
Exploration License 7074	Moolarben Open Cut
Exploration License 7073	Moolarben Open Cut
Mining Lease 1573	Wilpinjong Coal Open Cut
Mining Lease 1779	Wilpinjong Coal Open Cut
Mining Lease 1895	Wilpinjong Coal Open Cut
Exploration License 6169	Wilpinjong Coal Open Cut
Exploration License 7091	Wilpinjong Coal Open Cut

4.9.2 Coal mine methane

Coal mine methane refers to methane released from the coal and surrounding rock strata due to mining activities. In underground mines, coal mine methane can create an explosion hazard for miners, so it is actively removed by ventilation systems.

The construction area generally traverses the underground mine operations, however, the construction area does cross the underground mine UG4 mains access which runs in a south-west direction under Ulan Road (between UG1 and UG4).

4.9.3 Acid mine drainage

Acid rock drainage occurs naturally within some environments as part of the rock weathering process but is exacerbated by large-scale earth disturbances characteristic of mining. In some mines, the liquid that drains from coal stocks, coal handling facilities, coal washeries, and coal waste tips can be highly acidic, and in such cases needs to be treated as acid rock drainage. This liquid often contains highly toxic metals, such as copper or iron. These, combined with reduced pH, can have a detrimental impact on the stream's aquatic environments.

At Wilpinjong Coal Mine, surface water runoff is isolated and diverted around disturbed areas through the construction of water diversion bunds. Runoff from disturbed areas is diverted into on-site water retention dams. A Reverse Osmosis (RO) plant treats all water from the retention dams before it is discharged to Wilpinjong Creek. Water at the Moolarben Coal Mine is stored in surface dams, open cut pits, mining voids (when available) and sediment dams. Water storages will be progressively constructed as mining operations progress. Surface water infrastructure has been designed to facilitate the diversion of clean water (i.e. run-off from undisturbed or rehabilitated catchments) away from the active open pit where practicable.

4.9.4 Environment Protection Licences – Audit results

The water quality discharge from Moolarben, Wilpinjong and Ulan coal mines is subject to conditions as outlined in their respective Environment Protection Licences (EPL) as regulated by the New South Wales Environment Protection Authority (EPA) in accordance with the POEO Act.

Each mine is required to have a licence for their discharge of water into the environment, which includes specific limits and conditions to ensure that the water quality meets the relevant standards.

Each mine is required to regularly monitored a range of water quality parameters and report to the EPA via an Environmental Monitoring and Audit Report to ensure compliance with relevant water quality standards.

Moolarben, Wilpinjong and Ulan Coal Mines report their water quality monitoring results as a requirement of the EPL which all reported to be largely compliant. However, the key parameters of electrical conductivity (EC) and total suspended solids (TSS) were the common parameters where exceedances were reported. The EPL monitoring results are discussed in further detail in Technical paper 14 – Hydrology and water quality.

4.10 Intrusive investigation findings

Geotechnical and contamination investigations were undertaken for the project in 2022 and 2023. The applicable guidelines and outcomes of the investigation are described below.

4.10.1 Adopted guideline criteria

4.10.1.1 Soils

To assess the presence and extent of soil contamination within the contamination study area, the NEPM (2013), which provides health investigation levels (HILs) and health screening levels (HSLs) for the assessment of impacted soil was considered. As the purpose of this investigation was to assess the site against potential risks both during the construction phase, and for future site users:

- the 'HIL C' criteria for recreational/open space land use were conservatively adopted since land adjacent to the project is accessible to the public in parts, and
- 'HIL-D' criteria for commercial/industrial land use was considered for construction workers.

The NEPM (2013) provides ecological screening levels (ESLs) for TRH and BTEX compounds, and ecological investigation levels (EILs) for metals and organic substances, which are applicable for the assessment of potential risk to terrestrial ecosystems from these contaminants. The ESLs apply to different land use scenarios, and to coarse- and fine-grained soils. The EILs depend on specific soil physicochemical properties and land use scenarios. ESLs/EILs generally apply to the top 2 metres of soil. For this investigation, urban residential and public open space values, and commercial industrial land use were adopted. Based on the known soil strata of the study areas, the criteria for coarse-texture soil were used. The most conservative soil properties were applied for the purpose of calculating EILs for the site.

4.10.1.2 Surface water

Schedule B1 of the NEPM (2013) defines surface water investigation levels (SWILs) that have been developed for a broad range of metals and organic contaminants in water. SWILs are applicable for assessing human health and ecological risk from direct contact (including consumption) with water. SWILs were based on the following guidelines:

- Australian and New Zealand Conservation Council/Agriculture, and Resource Management Council of Australia and New Zealand 2000, National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality. This guideline has been superseded by an online resource prepared by the Australian and New Zealand Governments (ANZG) in 2018
- National Health and Medical Research Council (NHMRC)/National Resource Management Ministerial Council (NRMMC) 2011, Australian Drinking Water Guidelines 6 (ADWG) (Version 3.5, updated August 2018); and
- NHMRC 2008, Guidelines for Managing Risk in Recreational Waters.

Trigger values for the protection of 95% of freshwater water species were selected for the majority of contaminants, except where contaminants are potentially bio-accumulative, in which case the trigger values for the protection of 99% of species was adopted.

4.10.1.3 Groundwater

Schedule B1 of the NEPM (2013) defines groundwater investigation levels (GILs) that have been developed for a broad range of metals and organic contaminants in water. GILs are applicable for assessing human health and ecological risk from direct contact (including consumption) with water. GILs are based on the following guidelines:

- Australian and New Zealand Conservation Council/Agriculture, and Resource Management Council of Australia and New Zealand 2000, National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality. This guideline has been superseded by an online resource prepared by the Australian and New Zealand Governments (ANZG) in 2018
- National Health and Medical Research Council (NHMRC)/National Resource Management Ministerial Council (NRMMC) 2011, Australian Drinking Water Guidelines 6 (ADWG) (Version 3.5, updated August 2018); and
- NHMRC 2008, Guidelines for Managing Risk in Recreational Waters.

Trigger values for the protection of 95% of freshwater water species were selected for the majority of contaminants, except where contaminants are potentially bio-accumulative in which case the trigger values for the protection of 99% of species was adopted.

4.10.2 WSP Golder (2022a) Central-West Orana Renewable Energy Zone – Contamination Factual Report – Energy Hubs (Packages A and C)

EnergyCo engaged Golder Associates Pty Ltd (WSP Golder) to provide geotechnical and contamination site investigation services to inform the reference design and the environmental assessment for the project. A total of 25 intrusive investigation locations distributed across the project were undertaken including eight (8) boreholes (BH), twelve (12) large diameter auger boreholes (LDA), and five (5) test pits (TP). Surface water samples were collected as grab samples from surface water adjacent to Cassilis Road, Talbragar River on the Golden Highway, Ross Crossing Bridge, Talbragar River on Blue Springs Road, Talbragar River on Merotherie Road and Cudgegong River on Goolma Road. The sampling program was generally consistent with the NEPM (2013).

Soil analysis reported TRH, BTEXN, PAHs, pesticide and PCBs concentrations below the laboratory limit of reporting (LOR); and heavy metal concentration levels below the adopted site assessment criteria. Asbestos containing material was not detected in any samples. The analytical results for soil samples indicated low potential for gross contamination across the project.

The analytical results for the surface water samples indicated that all heavy metals concentration levels were below the adopted site assessment criteria; and concentrations of inorganic contaminants of potential concern (COCP) were below the adopted assessment criteria for all samples except for hardness. Hardness exceeded the aesthetic guidelines in four samples collected from Talbragar River, SW1, SW2, SW3 and SW4.

4.10.3 WSP Golder (2023) Central-West Orana Renewable Energy Zone – Contamination Factual Report – Transmission Alignment (Packages B, D, E)

EnergyCo engaged WSP Golder to complete geotechnical and contamination site investigation services to inform the reference design and the environmental assessment for the project. As part of these works a total of 78 intrusive investigation locations were excavated including seventy-three (73) boreholes (BH) and five (5) test pits (TP) investigation locations (map provided in Appendix A). The sampling program was generally consistent with the NEPM (2013).

The analytical results for soil samples indicated low potential for gross contamination across the project:

- all BTEX, PAHs, pesticide and PCBs concentrations were below the laboratory LOR
- all TRH concentration levels were below the adopted site assessment criteria
- concentrations of metals were below adopted assessment criteria for all samples, except for nickel and zinc
  - nickel exceeded the environmental investigation levels (EILs) in sixteen samples collected from nine boreholes located to the east/north-east of Uarbry. Zinc exceeded EILs in two samples collected from a borehole located approximately 2.5 km north of switching station M9
- asbestos containing material was not detected in any samples.

The analytical results for the groundwater samples indicated:

- concentrations of metals were below the adopted assessment criteria for all samples, except for copper, nickel and zinc. Copper exceeded the adopted criteria in monitoring bores BH01_PR, BH06_PR (located to the east/north-east of Uarbry) and BH02_Mines (located within the Wilpinjong Coal Mine). Nickel exceeded the adopted criteria in monitoring bores located within the Wilpinjong Coal Mine (BH02_Mines), located east/north-east of Uarbry (BH04_PR, BH05_PR, BH06_PR), west of Elong Elong Energy Hub (BH14_PR) and within Moolarben Mine (BH21_W2M). Zinc exceeded the adopted criteria in monitoring bores located east/north-east of Uarbry (BH01_PR, BH05_PR, BH06_PR) and within the Wilpinjong Coal Mine (BH02_Mines)
- concentrations of inorganics were below the adopted assessment criteria for all samples except for chloride, sodium, total dissolved solids and hardness. Chloride exceeded the adopted criteria in monitoring bores BH01_PR, BH02_Mines, BH04_PR, BH05_PR and BH14_PR. Sodium exceeded the adopted criteria in monitoring bores BH02_Mines, BH04_PR, BH05_PR and BH14_PR. Total dissolved solids exceeded the adopted criteria in monitoring bores BH01_PR, BH02_Mines, BH04_PR, BH05_PR and BH14_PR. Hardness exceeded the adopted criteria in monitoring bores BH01_PR, BH02_Mines, BH04_PR, BH05_PR and BH14_PR
- the reported pH ranged from 6.09 (BH02_Mines) to 7.67 (BH01_PR) indicating generally neutral to slightly acidic conditions.

The concentrations ranges for copper and nickel were generally consistent across all the monitoring locations. The samples collected from BH02_Mines located within the Moolarben Coal Mine recorded a zinc concentration of 0.16 µg/L which was higher than concentration range for the other four monitoring locations (<0.005 µg/L to 0.014 µg/L). Slightly acidic groundwater conditions were recorded at BH02_Mines (pH 6.09).

4.10.4 *WSP Golder (2022a) Central-West Orana Renewable Energy Zone – Geotechnical Factual Report – Energy Hubs (Packages A and C)*

The objective of the geotechnical investigation was to inform the environmental impact assessment and other planning approval requirements, and the reference design.

Aggressivity testing (to inform durability design of concrete and steel structures) was completed on samples collected during the field investigation (parameters included chlorides, sulfates, pH and resistivity). The results when compared against the exposure classification to concrete and steel piles in accordance with AS 2159-2009: Piling – Design and Installation show that the soils tested are non-aggressive to moderate to both concrete and steel.

4.10.5 *WSP Golder (2023) Central-West Orana Renewable Energy Zone – Geotechnical Factual Report – Transmission Alignment (Packages B, D, E)*

The objective of the geotechnical investigation was to inform the environmental impact assessment and other planning approval requirements, and the reference design.

Aggressivity testing (to inform durability design of concrete and steel structures) was completed on samples collected during the field investigation (parameters included chlorides, sulfates, pH and resistivity). The results when compared against the exposure classification to concrete and steel piles in accordance with AS 2159-2009: Piling – Design and Installation show that the soils tested are non-aggressive to moderate to both concrete and steel.

5 Construction assessment

This chapter presents an assessment of the potential impacts that could not be avoided and are expected to occur as part of construction. Impacts that have been avoided through design are described where relevant and detailed in Chapter 2 (Strategic context) of the EIS.

Potential construction impacts associated with contamination and soils identified by the risk assessment included:

- interaction with potentially contaminated soils and groundwater as a result of sub-surface disturbance during construction and operation, including disturbance and potential migration/mobilisation of contaminants
- spontaneous combustion of HCM disturbed during construction
- liberation of asbestos fibres from naturally occurring asbestos rocks and soils
- release of potentially contaminated groundwater where construction activities such as piling could intercept groundwater and require de-watering
- de-watering, management and disposal or discharge of contaminated groundwater and managing the disposal of contaminated soils encountered during construction in areas where existing contamination is present
- contamination of soils and groundwater due to spills or leaks of fuels, oils or other hazardous substances during construction and operation
- direct contact and inhalation of contaminated soil and groundwater by site workers where construction activities result in the exposure of existing contamination.

5.1 Potential to encounter contamination

Based on the desktop assessment, with the exception of the three active, operating coal mines between Merotherie Energy Hub and New Wollar Switching Station, it was identified that the construction area is predominantly comprised of a mix of undisturbed native vegetation and cleared agricultural land with minimal areas of contamination concern identified.

Outside of the active mining leases, areas of contamination concern identified are generally limited to existing substations, transmission line infrastructure, roadways, and areas surrounding farm structures and dams. The potential to encounter contamination within these areas is generally considered low in areas with existing transmission infrastructure and medium at farm dams and structures. The existing substations which have a high potential for contamination to be present are located outside of the construction area.

Where the construction area intersects active mining operations or rehabilitation areas (Moolarben and Wilpinjong coal mines), the potential impact from ground disturbance during construction is considered medium to high.

If inadequately managed, disturbance of contaminated areas has the potential to:

- mobilise contaminants, affecting nearby soils, surface water and groundwater
- increase the migration of contaminants into surrounding areas via leaching, overland flow and/or subsurface flow (water and/or vapour) or dust, with the potential to impact on receiving environments
- increase the risk of exposure to contaminants (direct contact and/or inhalation) by site workers, visitors and the local community.

Construction works have the potential to impact on the existing mining operation areas associated with the Moolarben and Wilpinjong coal mines at the following interfaces:

1. remediation areas at Wilpinjong Coal Mine (Pit 4) where excavation activities have the potential to encounter HCM
2. underground mine UG4 mains access at Moolarben Coal Mine which runs underneath the construction area.

The construction area does not interface with any of the Ulan Coal mining operations or former rehabilitation areas.

Farm dams throughout the construction area present both erosional and contamination hazards to the surrounding environment. It is expected that impacts to farm dams would generally be avoided through continued design development where possible. If disturbance of a farm dam(s) cannot be avoided, the construction environmental management plan (CEMP) would contain appropriate measures to manage any farm dam dewatering required during the project.
A geotechnical engineer would inspect and assess the material at the base and walls of relevant dam structures and provide recommendation on the extent of removal, replacement and/or treatment (if any) to provide a suitable foundation for dam backfill activities.

Existing soil contamination could be encountered during construction work at locations not previously identified as areas of potential concern and within areas of uncontrolled fill. An unexpected contamination finds procedure (an example of which is provided in Appendix B) would need to be developed as part of the CEMP.

The risk of disturbing or encountering contaminated material during construction varies depending on the extent and type of contamination and the nature of the construction work being undertaken. Based on available information, and experience, a preliminary risk rating has been assigned to each area of contamination concern and construction activity based on the potential for the activity to cause exposure of sensitive receivers to contamination. This information is presented in Table 5-1 below.

Table 5-1 Preliminary risk ranking

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
Existing infrastructure at Transgrid Wollar Substation	Nearby pile construction	**Source:** Common contaminants of concern associated with electrical substations include PCBs and hydrocarbons. **Potential Sensitive Receivers:** If not managed appropriately, construction activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems).	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Low likelihood for groundwater contamination to be present.	Moderate Exposure pathways complete during construction (without the implementation of appropriate controls). Groundwater volumes during project construction would be negligible.	Low
Existing towers and transmission line infrastructure	Excavation activities (earthworks), vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Common contaminants of concern associated with the construction and maintenance activities surrounding towers and powerlines include pesticides, asbestos and hydrocarbons. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems).	Low potential for contaminants to be present.	Minor Exposure pathways complete during construction (without the implementation of appropriate controls).	Low

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
	Adjacent pile construction	**Source:** Common contaminants of concern associated with maintenance activity surrounding powerlines include pesticides and hydrocarbons. **Potential Sensitive Receivers:** If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems)..	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Low likelihood for groundwater contamination to be present.	Minor Exposure pathway complete during construction (without the implementation of appropriate controls). Groundwater volumes during project construction would be negligible.	Low
Farm structures	Excavation activities (earthworks), vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Common contaminants of concern associated with farm structures, include uncontrolled fillings and spills from vehicles. Contaminants of concern associated with uncontrolled fill including TRH, heavy metals, PAH, pesticides and asbestos. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems)..	Medium potential for contaminants to be present, however contamination present likely to be localised.	Minor Exposure pathway complete during construction (without the implementation of appropriate controls).	Low

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
	Pile construction	**Source:** Common contaminants of concern associated with farm structures, include uncontrolled fillings and spills from vehicles. Contaminants of concern associated with uncontrolled fill including TRH, heavy metals, PAH and pesticides. **Potential Sensitive Receivers:** If not managed appropriately, construction activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems).	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Low likelihood for groundwater contamination to be present.	Minor Exposure pathways complete during construction (without the implementation of appropriate controls). Groundwater volumes during project construction would be negligible.	Low
Farm Dams	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Common contaminants of concern associated with farm dams, include uncontrolled filling and release of potentially contaminated water. Contaminants of concern associated with uncontrolled fill including TRH, heavy metals, PAH, pesticides, and asbestos. Contaminants of concern associated with surface waters include heavy metals, E. coli (and faecal bacteria), and nutrients. **Pathway-Receivers:** If not managed appropriately, disturbance of contaminated soil/waters could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems).	Medium potential for contaminants to be present.	Moderate Exposure pathways complete if dam dewatering/backfill is required (without the implementation of appropriate controls).	Medium

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
Areas of Active Cropping/ Cleared agricultural land	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Common contaminants of concern associated with cleared agricultural land include TRH, heavy metals, pesticides and PAH. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems).	Low potential for contaminants to be present.	Minor Exposure pathways complete during construction (without the implementation of appropriate controls).	Low
	Pile construction	**Source:** Common contaminants of concern associated with cleared agricultural land include TRH, heavy metals, pesticides and PAH. **Potential Sensitive Receivers:** If not managed appropriately, construction activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems).	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Low likelihood for groundwater contamination to be present..	Minor Exposure pathways complete during construction (without the implementation of appropriate controls). Groundwater volumes during project construction would be negligible.	Low

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
Existing roadways and rail corridor	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Common contaminants of concern associated with roadways and rial corridor, include uncontrolled fillings and spills from vehicles. Contaminants of concern associated with uncontrolled fill including TRH, heavy metals, PAH, pesticides and asbestos. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems).	Low potential for contaminants to be present.	Minor Exposure pathways complete during construction (without the implementation of appropriate controls).	Low
Mining lease areas (scenario A) Areas outside active mine footprints including mining access roads	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Contaminants of concern include acid mine drainage, methane, TRH, heavy metals and PAH. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems) — ingress/accumulation of methane gases within open excavations.	Low potential for soil contaminants to be present based on contamination investigations undertaken for the project.	Moderate Exposure pathways complete during construction (without the implementation of appropriate controls).	Low

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
	Pile construction	**Source:** Contaminants of concern include acid mine drainage, methane, TRH, heavy metals and PAH. **Potential Sensitive Receivers:** If not managed appropriately, construction activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems) — potential explosive atmosphere (methane).	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Medium likelihood for groundwater contamination to be present.	Moderate Exposure pathways complete during construction (without the implementation of appropriate controls). Volumes during project construction would be negligible.	Medium

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
Mining lease areas (scenario B) Active Surface Mining, Mine Surface Water Infrastructure, Areas within 500 m of Water Treatment Plants, Tailings Piles (Moolarben and Wilpinjong coal mines)	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	**Source:** Contaminants of concern include acid mine drainage, methane, TRH, heavy metals and PAH. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems).	High potential for contaminants to be present.	Significant Exposure pathways complete during construction (without the implementation of appropriate controls).	High
	Pile construction	**Potential Sensitive Receivers:** If not managed appropriately, construction activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems).	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Medium likelihood for groundwater contamination to be present.	Moderate Exposure pathways complete during construction (without the implementation of appropriate controls). Volumes during project construction would be negligible.	Medium

Area of contamination concern (see Section 4.9)	Construction activity	Potential construction impact	Likelihood for contamination to be present	Consequence/ pathways	Preliminary risk evaluation
Mining lease areas (scenario C) Remediated Mining Landforms (Wilpinjong Coal Mine)	Excavation activities such as earthworks, vegetation clearing, vehicle movement and utilities works	**Source:** Contaminants of concern include TRH, heavy metals and HCM. **Potential Sensitive Receivers:** If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — spontaneous combustion — direct contact, ingestion, and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment (aquatic and terrestrial ecosystems).	High potential for contaminants to be present.	Significant Exposure pathways complete during construction (without the implementation of appropriate controls). Unlikely that contaminated soils would be exposed during shallow excavation (<1 m depth).	High
	Pile construction	**Potential Sensitive Receivers:** If not managed appropriately, construction activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion, and inhalation by construction workers — incidental discharge into receiving environment (aquatic and terrestrial ecosystems).	Groundwater depth observed to be variable although generally <5 mBGL across the project construction area. Medium likelihood for groundwater contamination to be present.	Moderate Exposure pathways complete during construction Volumes during project construction would be negligible.	Medium

5.2 Potential impacts to the project from existing sources of contamination

5.2.1 Naturally occurring asbestos

Based on the information reviewed, there is no known or expected naturally occurring asbestos minerals or serpentine and amphibole occurrence within the contamination study area. Therefore, no naturally occurring asbestos impacts are expected in relation to the construction of the project.

5.2.2 Soil contamination

Construction activities including excavation (earthworks), vegetation clearing, vehicle movement and utility works, would disturb the soil. This could result in the exposure of existing contaminated soils, which could lead to ecological or human health impacts, if not properly managed. The majority of the areas of contamination concern within the contamination study area were evaluated as having a low contamination risk during construction. The mine lease areas were evaluated to pose a medium to high risk during construction due to the higher potential to encounter soil contamination during excavation activities, including exposing areas of HCM in discrete locations. It is noted that the risk rankings in Table 5-1 are prior to the implementation of the recommended management measures identified in Chapter 7.

Data gaps remain regarding potential soil and groundwater contamination surrounding the Wilpinjong mining area/ structures and additional targeted investigations into these areas should be undertaken as part of continued design development and prior to construction commencing. The Moolarben Coal Mine was targeted during contamination investigations undertaken for the project, however no investigation has occurred within the Wilpinjong Coal Mine. The potential risks associated with unexpected contamination finds (including potential uncontrolled filling) have not been assessed as this would be managed in accordance with an unexpected contaminated finds procedure (refer to Appendix B).

Following the implementation of recommended management measures (see Chapter 7), it is anticipated that the identified risk to the project from encountering contaminated soil would be effectively managed through the implementation of controls as part of the CEMP and unexpected finds protocol. Furthermore, the CEMP would consider the impact of the project on the existing mine operations plans, and the presence of existing environmental management controls, and proposed and existing rehabilitation programs in place on the three mine sites.

5.2.3 Surface water and groundwater contamination

Contaminated groundwater from identified areas of contamination concern poses a low risk to the environment with regards to the construction of the project. This is because the volumes of groundwater expected to interact with project infrastructure during project construction would be negligible or are not expected to require management. Notwithstanding the above, the project needs to ensure that it does not interact with the current mine surface water and ground water management infrastructure.

Releases of stormwater and groundwater off-site into the surrounding environments would be managed through the CEMP to protect the surrounding surface and groundwater environments. A soil and water management sub-plan would also be prepared for the project and contain details of appropriate measures in the event that groundwater is encountered during construction. Stormwater overflow should be diverted around excavation to the extent practicable.

5.3 Potential impacts to the soil environment from construction activities

5.3.1 Top-down contamination sources

Storage and laydown areas would be used to store construction materials, plant and equipment and recovered waste and recycling materials. Hazardous and dangerous goods storage would include petroleum, diesel, liquefied natural gas (LPG), herbicide, pesticide and mineral oils that would be secured in purpose-built bunded and secure areas, where required.

During construction of the project, there is the potential for impacts from the improper storage management of waste, resulting in the exposure of the surrounding soil and water environments to contamination from spills and leaks from plant and equipment during standard operations or incidents.

With appropriate and standard construction controls in place as part of the CEMP, the risks from these activities would be minimised.

5.3.2 Acid sulfate soils and acid rock

Based on the information reviewed as part of the desktop assessment and summarised in Section 4.2.4, there is a low probability of encountering acid sulfate soils within the contamination study area. Should disturbance of waterlogged areas be required, a preliminary assessment in accordance with the Acid Sulfate Soil Manual (detailed in Figure 2-1) should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

5.3.3 Salinity

Development of rural land can change the movement of surface, and groundwater, resulting in a change in the way salts and other minerals interact. When the water table rises close to the surface, it carries dissolved salts that are typically locked in the soil and rock profile to the surface causing increased soil salinity.

The current hydrogeological environment is not anticipated to be altered significantly by the project. As such, no significant impact on soil salinity is anticipated from the project.

Construction within areas where evidence of salting has been mapped (refer to Figure 4-3) would be managed under a CEMP and should be carried out in accordance with the NSW Department of Primary Industries (2014) Salinity Training Handbook.

5.3.4 Soil erosion and sediment transportation

The highest potential for soil erosion would be associated with the disturbance of soils on existing slopes during construction. As soil disturbance is expected, soil erosion and the associated sediment transportation is a hazard that could occur because of the construction of the project. The soil type expected within the construction area indicates that surface soils have a moderate to high potential for dispersion due to their sodic nature. Off-site transportation of sediments and soils could transport contaminated soils (if present) to sensitive receivers which may cause the contamination of surface water bodies. It is expected that erosion and sediment control plans will be included in the CEMP. As discussed in Section 5.2.3 soil and sediment erosion control are critical especially within the vicinity of the mining leases; all three of the mines have extensive surface water monitoring programs in place as part of their ongoing EPLs with strict compliance limits, and continual testing is undertaken.

6 Operational assessment

This chapter presents an assessment of the potential impacts that are expected to occur as part of operation. These include:

- increased runoff from new impervious surfaces resulting in the mobilisation of underlying salts and migration of contaminants to aquifers
- accidental spillage of petroleum, chemicals, or other hazardous materials because of leakage or vehicle accidence, which could result in contamination of the surrounding environment
- impacts to surface water features and their associated groundwater aquifers.

6.1 Potential impacts from existing potential sources of contamination to the environment and exposure to users

The operation of the project is not expected to result in the exposure of potentially contaminated soil or groundwater to the surrounding environment and other sensitive receivers (e.g., maintenance workers or farmers). Soil disturbance activities during operation would not be part of the general maintenance activities as the infrastructure components would all be above ground.

As transmission infrastructure is partially located within the footprint of three active mine leases, an easement would be negotiated with the mine operators to facilitate worker access for operation of the project and the associated maintenance activities without the potential of tracking contamination on/off site. It is anticipated that the identified risk would be effectively managed through controls in place in the operational environmental management plan (OEMP).

The results from aggressivity testing conducted during geotechnical investigations to inform the reference design indicate that the soils tested are non-aggressive to moderate to both concrete and steel when compared against the exposure classification to concrete and steel piles in accordance with AS 2159-2009: Piling – Design and Installation.

No groundwater take is required during the operation of the project.

6.2 Potential impacts to the environment from project activities

The potential operational impacts to the environment from the project relate to:

- potential contamination of soil, surface water and/or groundwater from hydrocarbons (fuels, diesel, oils), arising from incidents involving vehicle accidents
- leaks and/or spills in the transmission line easement or at the energy hubs and switching stations.

Spill volumes from such incidents (should they occur) are likely to be minor and localised in nature. Notwithstanding, the potential for hydrocarbon fuel to migrate off-site cannot be discounted. Spill containment facilities (such as bunded containers, designated fill points, and spill kits) would be used on maintenance work sites and at the proposed energy hubs and switching station sites. Furthermore, an incident response procedures would be developed and implemented during operation to manage the contamination risk from these occurrences.

7 Recommended management and mitigation measures

7.1 Environmental management

Potential contamination impacts during construction and operation of the project (in terms of both causing contamination or creating impacts as a result of existing contamination sources) are expected to be limited, and would be further reduced with the implementation of the mitigation measures outlined below (refer to Table 7-1) and within a CEMP and a soil and water management sub-plan.

The mitigation measures would be implemented and monitored for their effectiveness during construction. A CEMP would be prepared prior to construction of the project. The CEMP would identify the measures required to be implemented at construction work sites to minimise potential impacts as a result of the project (refer to the EIS for details). These would include soil and water measures which are commonly applied and well understood (refer to further detail in Technical paper 14 – Hydrology and water quality).

Operational controls would need to be managed within an operational environmental management plan (OEMP).

7.2 Mitigation measures

Table 7-1 provide the mitigation measures which would be implemented for the project. Mitigation measures in other technical papers that are relevant to the management of contamination include:

- Technical paper 14 – Hydrology and water quality; specifically measures which address surface water quality impacts from erosion
- Technical paper 17 – Groundwater; specifically measures which address interaction with groundwater.

Table 7-1 Mitigation measures – detailed design, pre-construction, construction, and operation

ID	Impact	Identified mitigation measure	Timing	Applicable location(s)
SC1	Mobilisation of saline soils	Prior to ground disturbance, a visual inspection would be undertaken in areas identified as potentially containing saline soils will be undertaken to look for the presence of saline soils. Areas where evidence of salting has observed or recorded will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with Book 4 Dryland Salinity: Productive use of Saline Land and Water (NSW DECC 2008) to prevent impacts from salinity.	Construction	All locations

ID	Impact	Identified mitigation measure	Timing	Applicable location(s)
SC2	Impacts due to spontaneous combustion	Disturbance of areas of active (and previously active) surface mining, underground mine access and process routes will be avoided where possible. Where this cannot be avoided, testing of the material(s) will be undertaken to confirm if High Carbon Material would be disturbed and/or exposed, and appropriate safeguards implemented to ensure the risk of spontaneous combustion is adequately controlled (in accordance with the Industry and Investment NSW, 2011 "*MDG Spontaneous Combustion Management Guideline*").	Detailed design, pre-construction and construction	Wilpinjong Coal Mine
SC3	Contamination exposure to human health and/or the environment	Disturbance to areas of medium to high risk of contamination will be avoided or minimised where practicable during construction. Management of contamination and any resulting remediation would be carried out in accordance with the relevant legislation, standards and guidelines, including but not limited to the National Environment Protection (Assessment of Contamination) Measure 1999, as amended 2013, and all relevant guidelines made or approved under the *Contaminated Land Management Act 1997* and the *Protection of the Environment Operations Act 1997*.	Detailed design and pre-construction	Areas of medium to high contamination risk
SC4	Contamination exposure to human health and/or the environment	Prior to construction, activities within the Wilpinjong Coal Mine lease areas subject to disturbance will be tested to confirm the presence/absence of contaminants of concern identified in this Technical paper.	Detailed design and pre-construction	Wilpinjong Coal Mine site
SC5	Contamination exposure to human health and/or the environment	Additional intrusive investigations will be undertaken to confirm the presence/absence of the contaminants of concern prior to commencing ground disturbance within 50 metres of farm structures or farm dams (if applicable).	Detailed design and pre-construction	All locations
SC6	Impacts due to spontaneous combustion	Remediation areas disturbed during construction of the project will be capped in accordance with the Peabody Energy Wilpinjong Capping of Tailings Storage Facilities TD5 Procedure (WI-MIN-PRO-0119).	Construction	Wilpinjong Coal Mine site
SC7	Contamination impact to human health and/or the environment	An unexpected finds protocol will be developed and implemented to manage the discovery of previously unidentified contaminated material (including the discovery of high carbon material within mining lease areas outside of areas indicated by mine operators where this occurs).	Construction	All locations

ID	Impact	Identified mitigation measure	Timing	Applicable location(s)
SC8	Soil and/or water pollution	Construction materials, spoil and waste will be stored/ managed in accordance with applicable EPA requirements to minimise the potential for the project to result in the contamination of soil, groundwater, and/or surface water quality.	Construction	All locations
SC9	Soil and/or water pollution	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards, and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on site plans.	Construction Operation	All locations
SC10	Soil and/or water pollution	Incident response procedures will be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities. Environmental spill kits will be provided at strategic, accessible locations, and staff will be trained in spill response procedures (as a minimum spill kits will be located at the energy hubs and New Wollar switching station).	Operation	All

8 References

Acid Sulfate Soils Management Advisory Committee 1998, Acid Sulfate Soil Manual.

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.

Australian Energy Market Operator Services Limited (AEMO) (2023), Draft 2023 Infrastructure Investment Objectives Report – May 2023. Accessed from: https://aemoservices.com.au/-/media/services/files/publications/iio-report/2023/231604-2023-iio-report-final.pdf?la=en&hash=950511E55FFB9BA69261CECDE4AE6CAB.

Australian Government 2018, National Water Quality Management Strategy.

Connell Wagner (NSW) Pty Ltd. 1999, Ulan Coal Mine – Extension of No. 3 Underground Mine – Environmental Impact Statement. December 1992.

CSIRO 2016, Australian Soil Classification.

Department of Environment and Conservation, 2006. *Assessing Vibration: A Technical Guideline.*

Department of Land and Water Conservation 1997, Acid Sulfate Soils risk mapping.

DPE, 2022, *eSPADE: NSW Soil and Land Information,* Accessed via *https://www.environment.nsw.gov.au/eSpade2WebApp#*.

DPI. 2016. *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources: Background document*. Department of Primary Industries.

EnergyCo (2023), NSW Network Infrastructure Strategy, NSW, Available at https://www.energyco.nsw.gov.au/sites/default/files/2023-05/network-infrastructure-strategy.pdf.

Geological Survey of New South Wales 1983, 1:250,000 Dubbo Region Geological Map.

Glencore, November 2017 Ulan Coal Mines Pty Ltd Mining Operations Plan 2017 to 2024.

HEPA 2018, PFAS National Environmental Management Plan.

ICOMOS, 2013. *The Australian International Council on Monuments and Sites, Charter for Places of Cultural Significance* (also known as the Burra Charter, Australian).

Landcom 2004, Managing Urban Stormwater: Soils and Construction Volume 1, the 'Blue Book'.

National Water Quality Management Strategy (NWQMS) (Australian Government, 2018).

National Health and Medical Research Council (NHMRC) 2011, Australian Drinking Water Guidelines.

NEPC, National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013.

NSW Department of Land and Water Conservation 2002, Site Investigations for Urban Salinity.

NSW Department of Planning and Environment (DPE) 2018, *Remediation of Land SEPP State Environmental Planning Policy (SEPP),* viewed 30 August 2022, <https://www.planning.nsw.gov.au/Policy-and-Legislation/Under-review-and-new-Policy-and-Legislation/Remediation-of-Land-SEPP>.

NSW Environment Protection Authority (EPA) 2015, Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997, viewed 30 August 2022.

NSW EPA 2017, Guidelines for the NSW Site Auditor Scheme (3rd edition).

NSW EPA 2020, Location of former gasworks sites, viewed 30 August 2022, <https://www.epa.nsw.gov.au/your-environment/contaminated-land/other-contamination-issues/former-gasworks-sites/remediating-former-gasworks-sites>.

NSW EPA 2020, Search the contaminated land record, viewed 30 August 2022, <https://apps.epa.nsw.gov.au/prclmapp/searchregister.aspx>.

NSW EPA 2020, list of notified sites, viewed 30 August 2022, <https://www.epa.nsw.gov.au/your-environment/contaminated-land/notified-and-regulated-contaminated-land/contaminated-sites-list>.

NSW Office of Environment and Heritage 2011, Guidelines for Consultants Reporting on Contaminated Sites.

OEH, 2013a. *NSW Landuse 2013*. NSW Office of Environment and Heritage, Sydney.

OPEC Systems 2020, Defence Update Nationwide Unexploded Ordnance (UXO) Map, viewed 30 August 2022, <https://opecsystems.com/article/defence-update-nationwide-unexploded-ordnance-uxo-map>.

SafeWork NSW 2014, Managing Asbestos in or on Soil.

Stewart J.R. and Alder J.D. 1995, New South Wales Petroleum Potential, New South Wales Department of Mineral Resources Sydney, Eds 1995.

YANCOAL, September 2020 *Moolarben Coal Mining Operations Plan.*

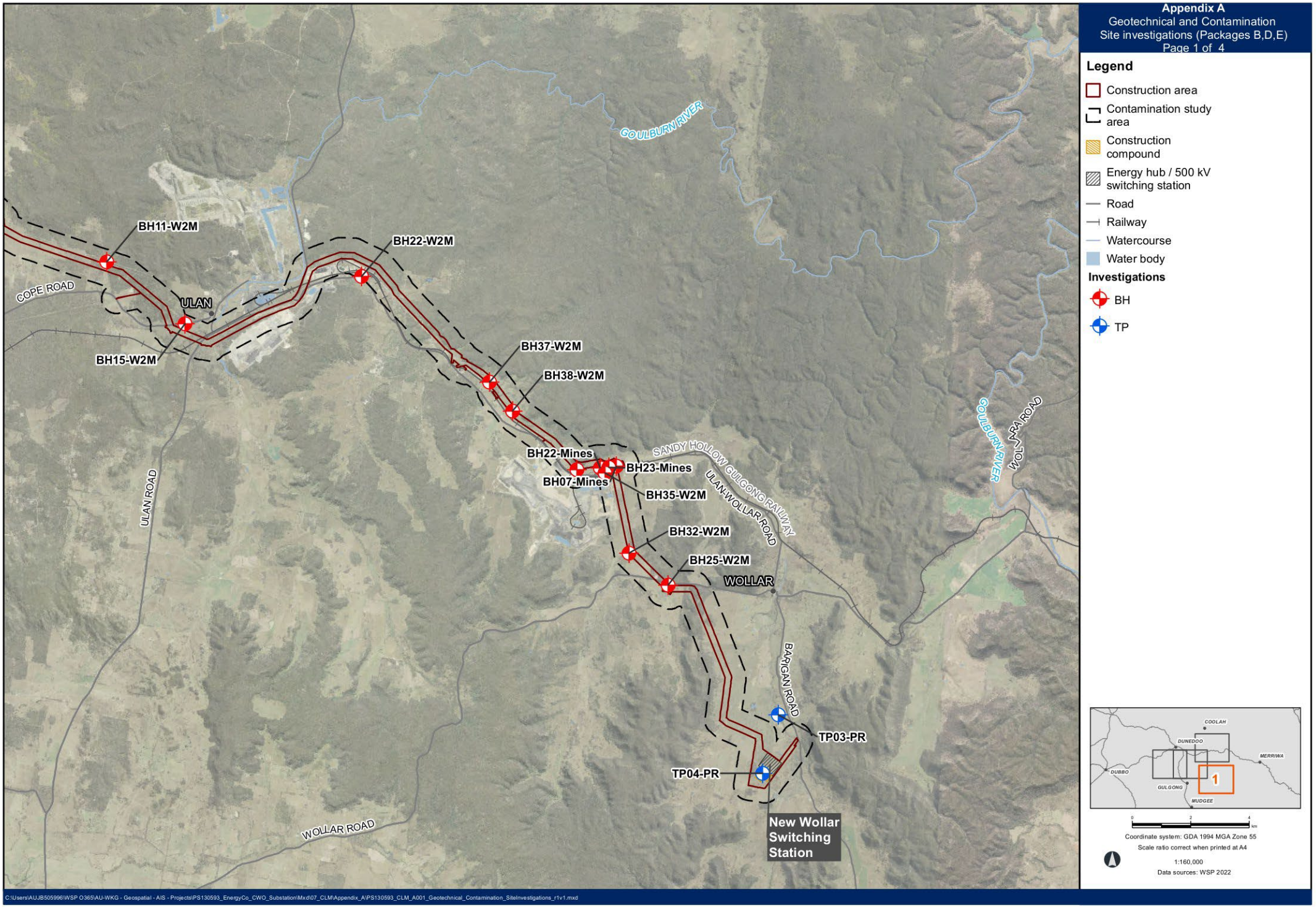
YANCOAL – Moolarben Coal. 2022, Original Rehabilitation Management Plan – Moolarben Coal Complex, August 2022.

WA Department of Health, 2009, Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia.

Wilpinjong Coal Mine. Peabody 2022, Wilpinjong Coal Mine Rehabilitation Management Plan, July 2022.

Appendix A

Factual investigations map


Appendix A
Geotechnical and Contamination
Site investigations (Packages B,D,E)
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Legend
Construction area
Contamination study area
Construction compound
Energy hub / 500 kV switching station
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Watercourse
Water body
Investigations
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TP
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BH11-W2M
BH22-W2M
COPE ROAD
ULAN
BH15-W2M
BH37-W2M
BH38-W2M
BH22-Mines
BH23-Mines
BH07-Mines
SANDY HOLLOW GULGONG RAILWAY
ULAN-WOLLAR ROAD
BH35-W2M
BH32-W2M
BH25-W2M
WOLLAR
ULAN ROAD
GOULBURN RIVER
WOLLARA ROAD
BARIGAN ROAD
TP03-PR
TP04-PR
New Wollar Switching Station
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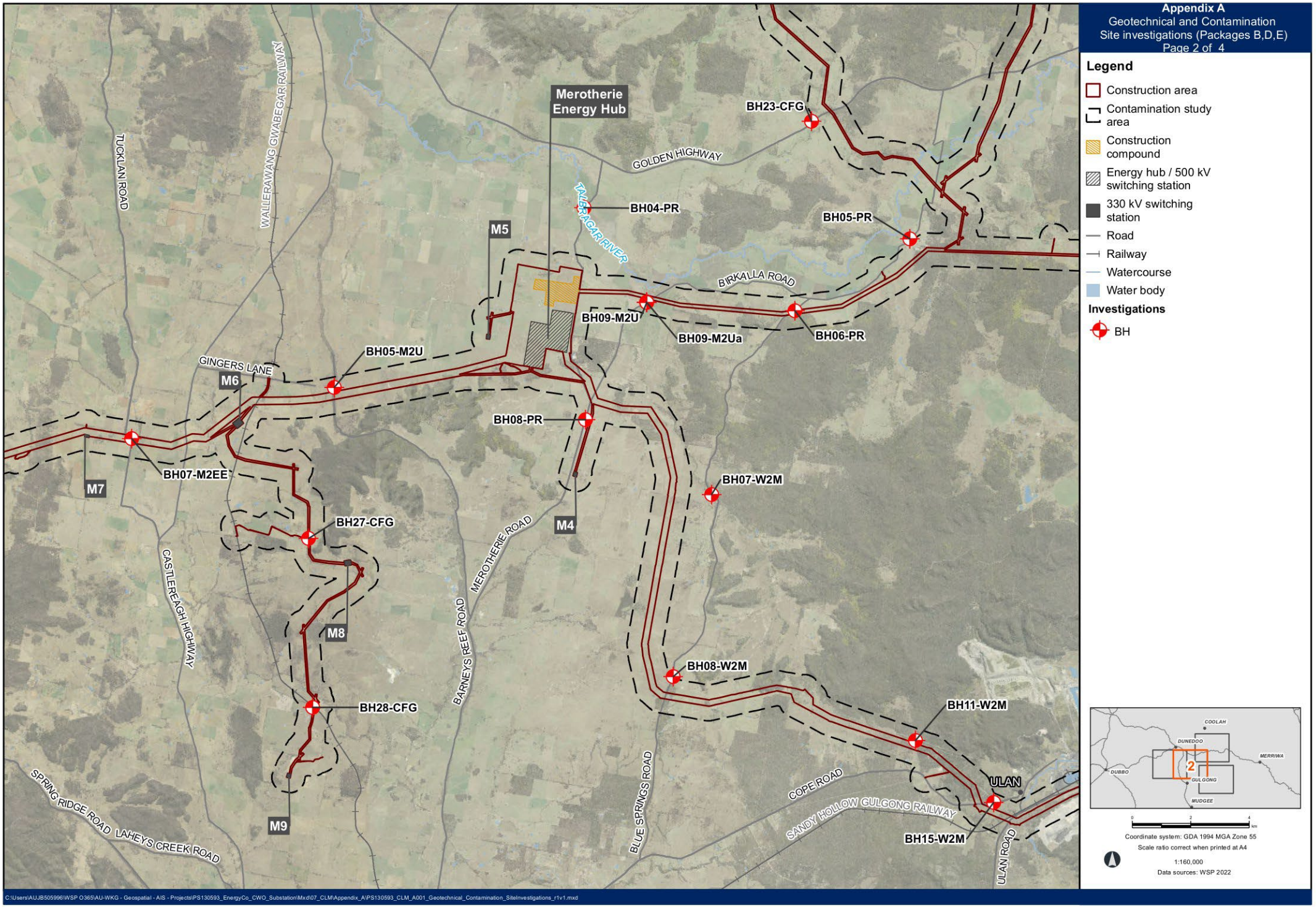
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M5
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BH06-PR
TUCKLAN ROAD
WALLERAWANG GWABEGAR RAILWAY
GINGERS LANE
M6
BH05-M2U
BH08-PR
BH07-M2EE
M7
BH07-W2M
M4
BH27-CFG
CASTLEREAGH HIGHWAY
MEROTHERIE ROAD
BARNEYS REEF ROAD
M8
BH08-W2M
BH11-W2M
BH28-CFG
BLUE SPRINGS ROAD
COPE ROAD
ULAN
SANDY HOLLOW GULGONG RAILWAY
SPRING RIDGE ROAD
LAHEYS CREEK ROAD
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BH15-W2M
ULAN ROAD
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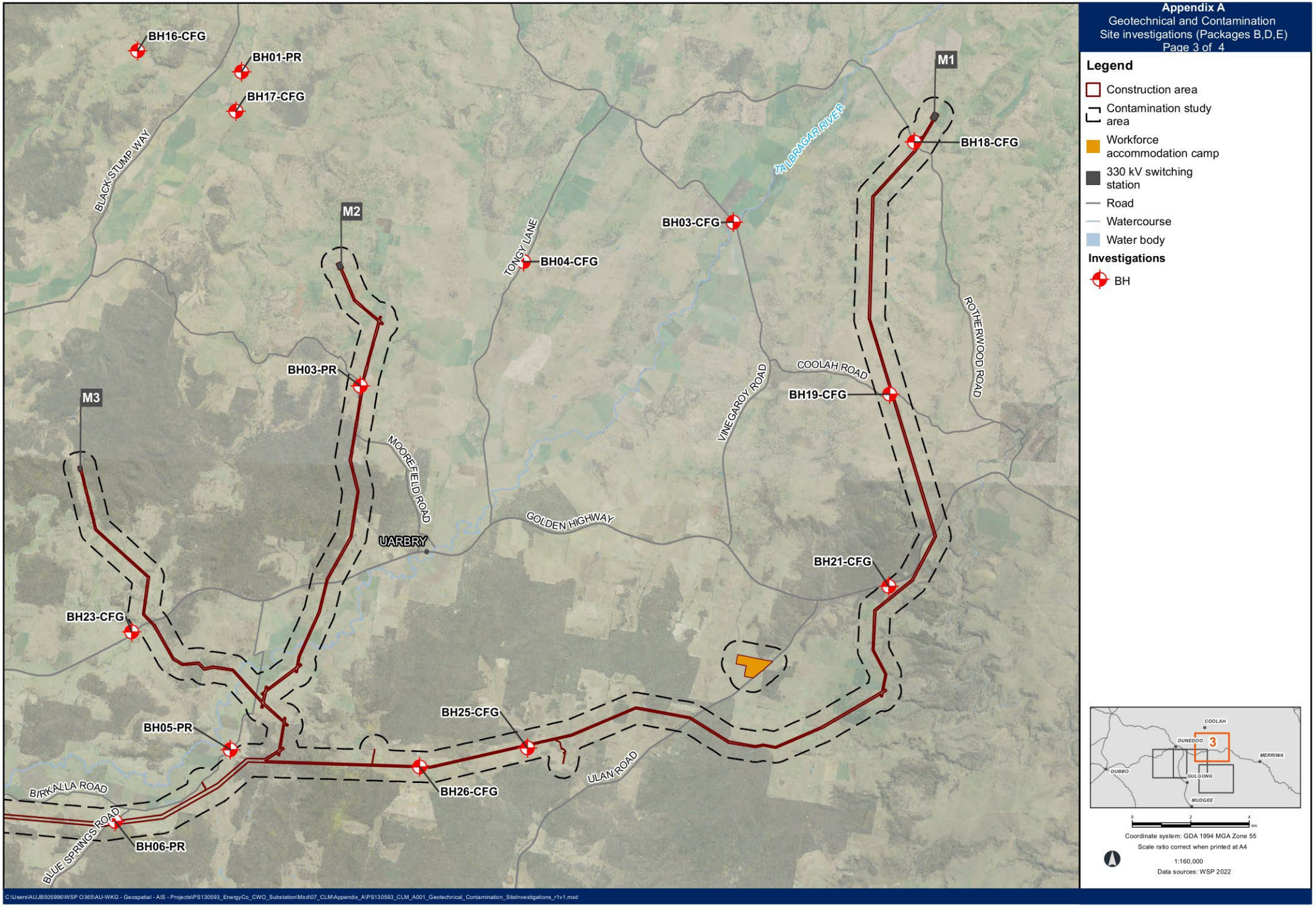
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BH01-PR
BH17-CFG
BLACK STUMP WAY
M2
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BH04-CFG
BH03-CFG
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M1
BH18-CFG
BH03-PR
M3
MOOREFIELD ROAD
VINEGAROY ROAD
COOLAH ROAD
BH19-CFG
ROTHERWOOD ROAD
GOLDEN HIGHWAY
UARBRY
BH21-CFG
BH23-CFG
BH25-CFG
BH05-PR
ULAN ROAD
BH26-CFG
BIRKALLA ROAD
BLUE SPRINGS ROAD
BH06-PR
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Watercourse
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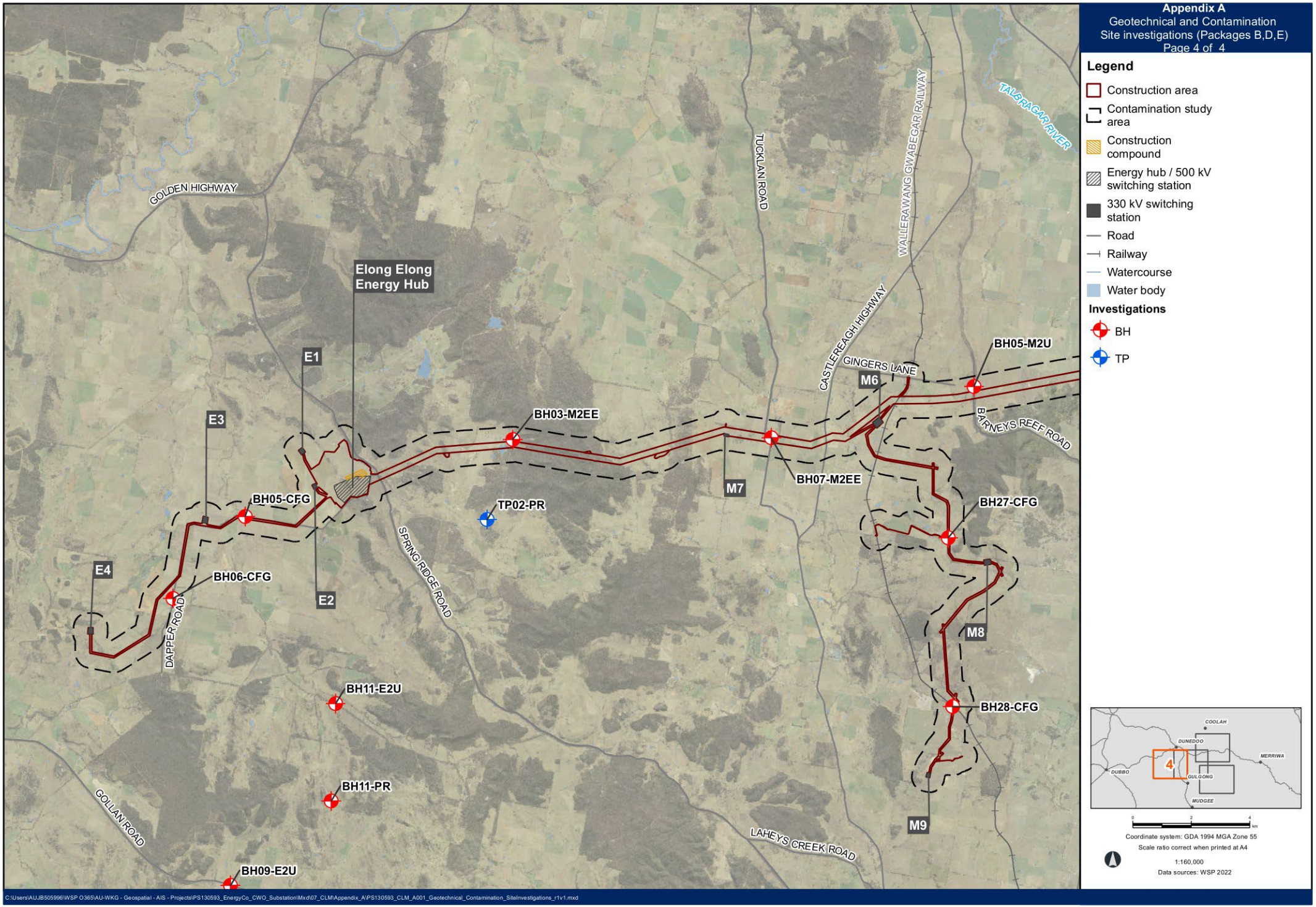
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BH05-CFG
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BH09-E2U
BH27-CFG
BH28-CFG
TP02-PR
GOLDEN HIGHWAY
TUCKLAN ROAD
WALLERAWANG GWABEGAR RAILWAY
TALBRAGAR RIVER
CASTLEREAGH HIGHWAY
GINGERS LANE
BARNEYS REEF ROAD
SPRING RIDGE ROAD
DAPPER ROAD
GOLLAN ROAD
LAHEYS CREEK ROAD
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Appendix B

Unexpected finds protocol

The following document details protocols regarding what must be done if potentially contaminated or hazardous materials are unexpectedly encountered during construction activities.

B1.1 What is an unexpected find and where could it be?

An unexpected find is likely to comprise of any buried material which is not a typical soil material (i.e., fill, soil, rock) or waters which are suspected of being contaminated or Potential Asbestos Containing Materials are encountered during development works. There could be many kinds of unexpected materials that could be encountered during excavation works including (but not limited to):

- buried wastes
- buried containers/drums
- discoloured and odorous soils and groundwater/seepage
- underground tanks
- munitions/unexploded ordnance (UXO)
- asbestos (the management of unexpected asbestos finds is presented as a separate protocol).

These unexpected finds are likely to be associated with poor waste disposal or construction activities.

B1.2 Where is there a risk of encountering an unexpected find?

The higher risk activities for encountering unexpected finds during construction activities are considered to be excavation works.

Higher risk areas for encountering unexpected finds during construction activities are considered to be:

- areas within and immediately adjacent to current or historical refuelling facilities, mechanical and industrial operations, and historical airport operations.

B1.3 What to do if an unexpected find is encountered?

Cease any further excavation or ground disturbance, in the area of the find(s).

The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be temporarily halted; and

The site supervisor and the Principal will be informed of the find(s).

Do not remove or unnecessarily disturb the area of the find(s).

Ensure that the area of the find(s) is adequately marked as a no-go area for machinery or further disturbance and that the potential for accidental impact is avoided.

Note the location and nature of the finds, and report the find to:

- Site Supervisor
- Environmental Consultant.

Where feasible, ensure that any excavation remains open so that the finds can be recorded and verified. Excavation may be backfilled if this is necessary to comply with work safety requirements. An excavation that remains open should only be left unattended if it is safe and adequate protective fencing is installed around it.

Following consultation with the *environmental consultant*, and, where advised, any other relevant stakeholder groups, the significance of the finds should be assessed, and an appropriate management strategy followed. Depending on project resources and the nature of the find(s), this process may require input from external consultants.

Development works in the area of the find(s) may re-commence, if and when outlined by the management strategy, developed in consultation with, and approved by the relevant environmental advisor.

For munitions and UXO, a project representative will need to contact the local police to organise attendance and disposal of munitions/UXO by Defence personnel.

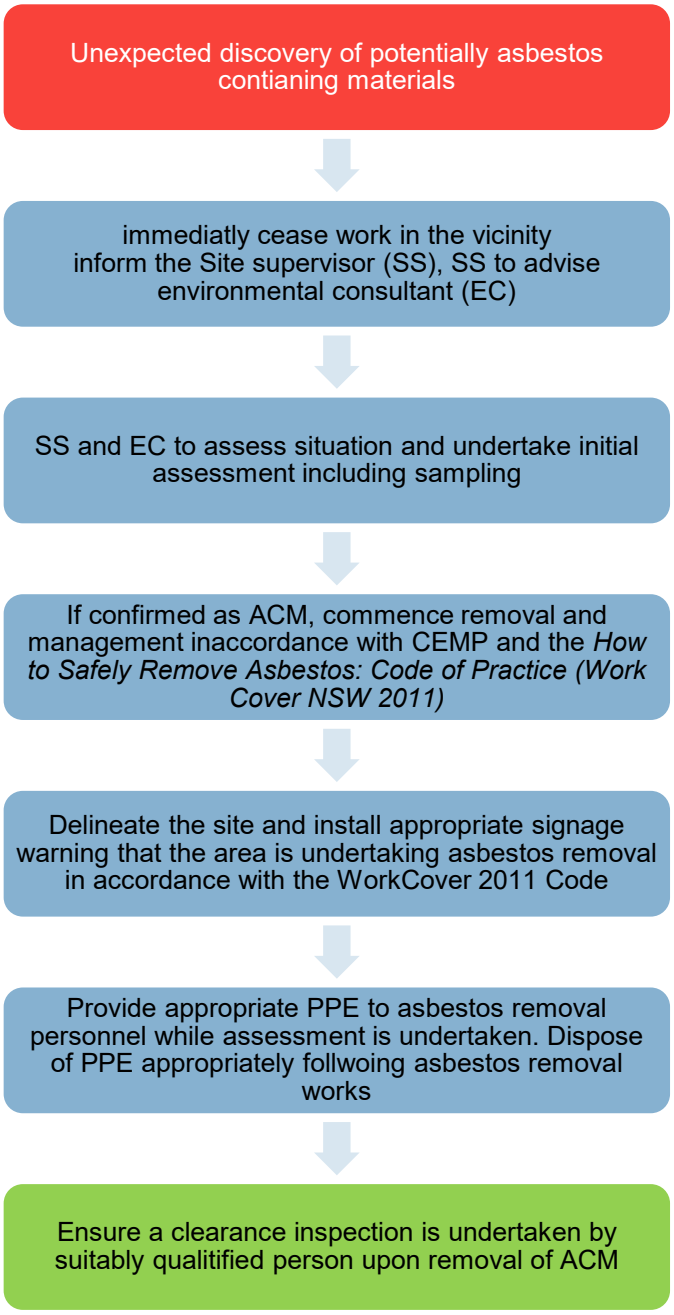
A flow chart demonstrating the requirements for managing unexpected finds is provided below.

B1.4 Legislative, standards and codes of practise

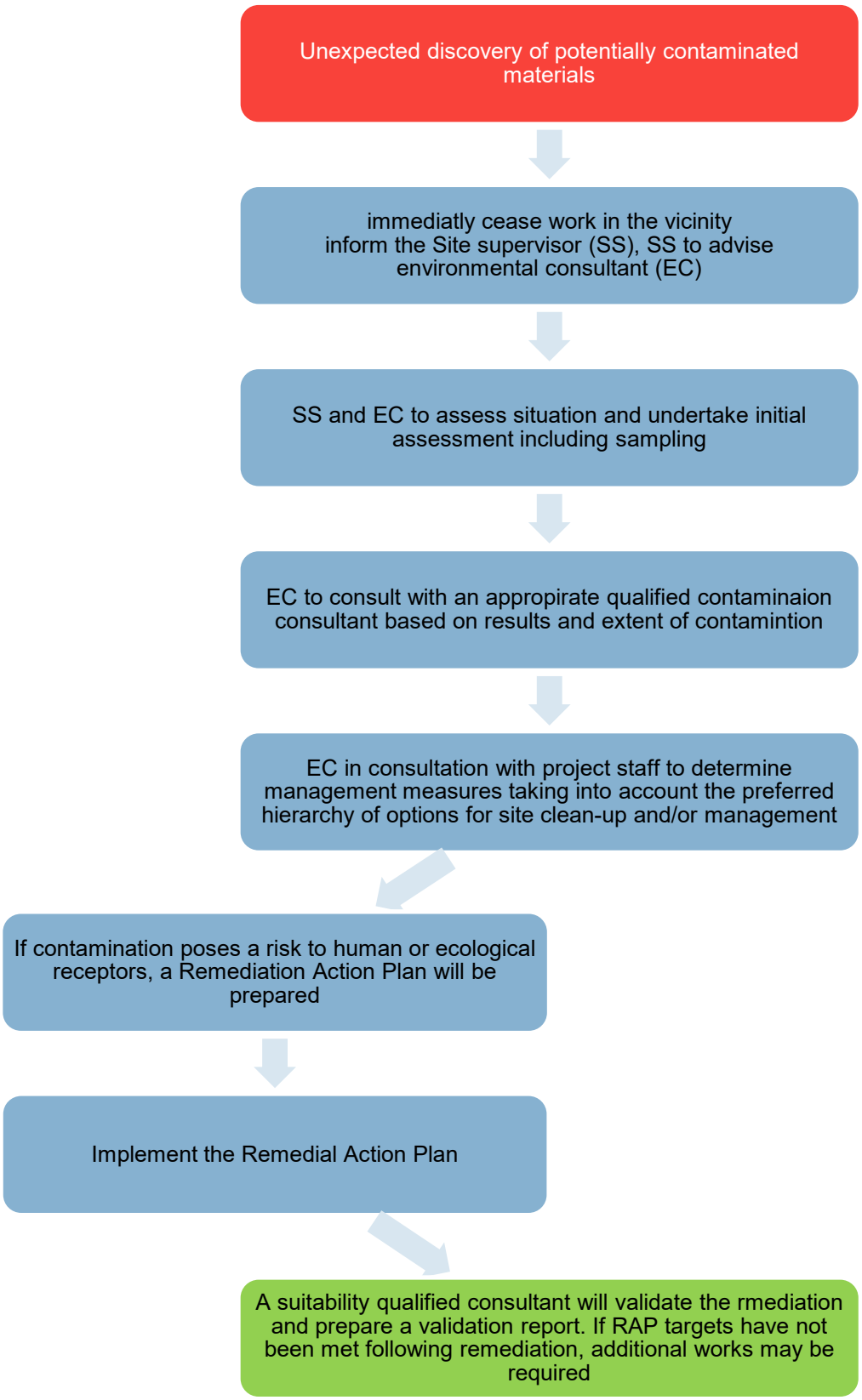
These protocols have been developed to ensure adherence to relevant legislative, standards and codes of practices.

- Occupational Health and Safety Act 2000 and associated regulations
- Contaminated Land Management Act 1997.

B1.5 Potential asbestos containing materials



B1.6 Potential contamination



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