Meering West Wind Farm

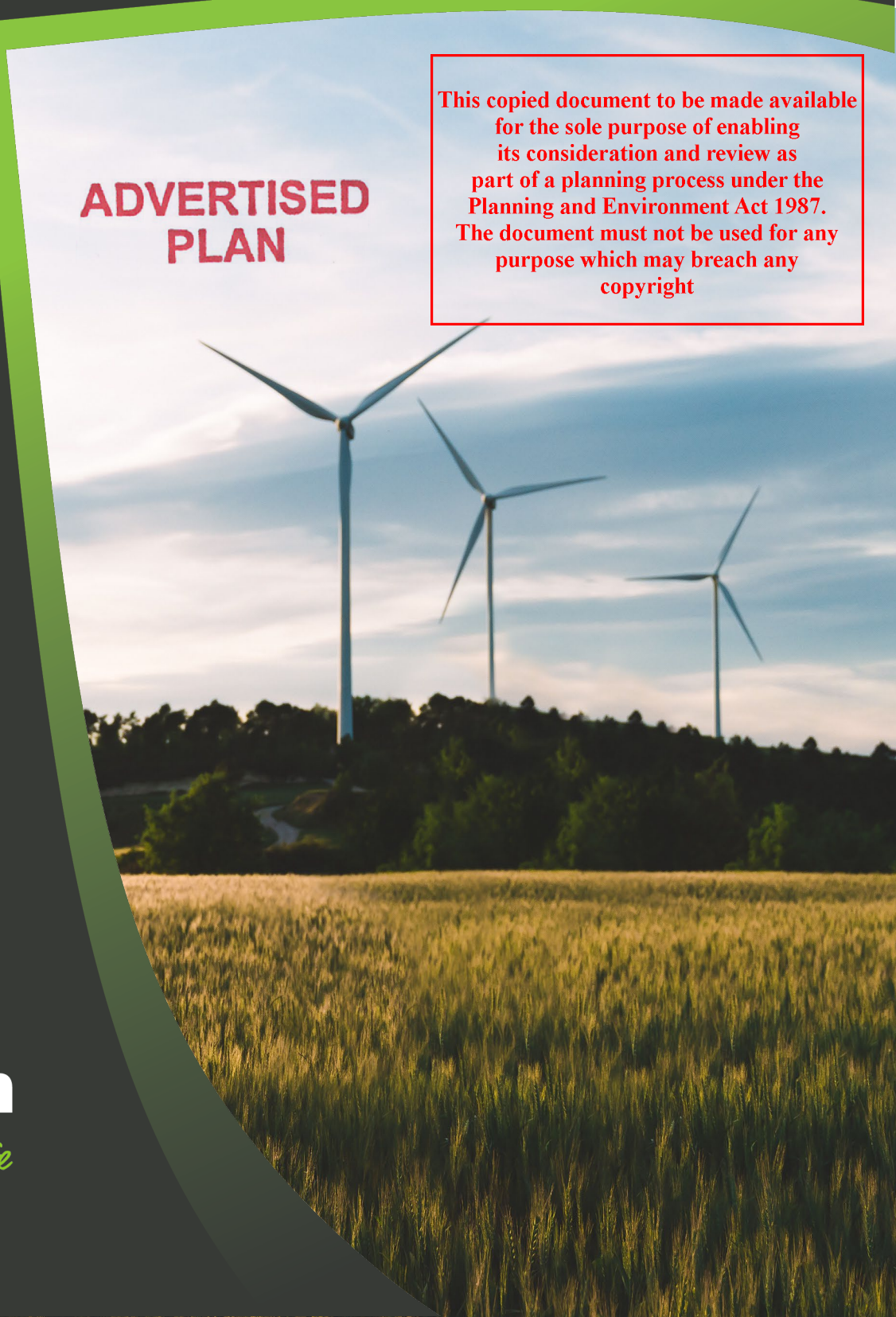
Surface and Groundwater Assessment

Meering West Wind Farm Pty Ltd as trustee for the Meering West Wind Farm Trust

Reference: P527201

Revision: FINAL

2025-11-20



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Document control		aurecon				
Report title		Surface and Groundwater Assessment				
Document code			**Project number**		P527201	
File path		**https://aurecongroup.sharepoint.com/:w:/r/sites/527201/5_WorkingFiles/Water/Report/Final/P527201%20Meering%20West%20Wind%20Farm%20Surface%20Groundwater%20Assessment%20FINAL.docx?d=w0db499cbe3844e0ca74bcb1021418855&csf=1&web=1&e=zP3jwl**				
Client		Meering West Wind Farm Pty Ltd as trustee for the Meering West Wind Farm Trust				
Client contact			**Client reference**		-	
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
A	26/05/2025	Draft for Client Review	EM/ZR	LL	LL	JB
B	05/06/2025	For submission with Planning Report	EM/ZR	LL	LL	JB
C	25/06/2025	For submission with Planning Report	EM/ZR	LL	LL	JB
FINAL	20/11/2025	Applicant Entity Update		LL	LL	
Current revision		**FINAL**				

Approval			
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Executive Summary

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Meering West Wind Farm Pty Ltd as trustee for the Meering West Wind Farm Trust to facilitate the environmental and planning assessments and approvals for the Meering West Wind Farm Project (the Project), located near Meering West in Northern Victoria. This Project is located 25 km south east of Kerang in northern Victoria and encompasses around 20,000 hectares of farmland within the Loddon and Gannawarra Local Government Areas. The Meering West Wind Farm aims to become one of Australia's largest onshore wind and energy storage developments, contributing to Victoria's transition towards renewable energy.

A surface water and groundwater assessment was completed to support the approval of Meering West Wind Farm development. This assessment comprised desktop review of the surface water and groundwater characteristics of the Project Area to identify the potential impacts on the final location of the wind farm and the proposed work. An impact assessment was completed using the information acquired from the desktop assessment to identify potential impacts and mitigation measures associated with the Project construction and operation.

The Project Area is situated within the North Central Catchment Area, and within the catchment areas of both the Avoca River and Loddon River. The Catchment Area contains two internationally recognised Ramsar Wetlands (approximately 13km to the north of the Project Area) and several terminal lakes. Multiple unnamed ephemeral drains which flow across the Project Area have the potential to carry sediment and contaminants to these sensitive areas. The low rainfall and sandy soils mean much of the rainfall is infiltrated to the groundwater rather than generating runoff and flowing towards the rivers.

The depth to groundwater is relatively deep, with the watertable below 20 metres below ground level so the risk of intersecting the watertable during construction is low, with the exception of the north east corner. Groundwater salinity is also high and consequently groundwater use is limited.

There are 20 existing bores located across the Project Area (for investigation purposes) and these could be encountered during construction. Works should be avoided near these bores, however if encountered, they may need to be decommissioned in accordance with the Minimum Construction Requirements for Water Bores in Australia. Potential impacts to surface and groundwater are generally considered to be low and key impact mitigation measures include a Construction Environmental Management Plan (CEMP) to manage drainage on site.

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Glossary

Acronym	Definition
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
Aurecon	Aurecon Australasia Pty Ltd.
BESS	Battery Energy Storage System
bgl	Below Ground Level
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
DEECA	Department of Energy, Environment and Climate Action
EES	Environmental Effects Statement
EP Act	*Environment Protection Act 2017*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERS	Environment Reference Standards
GDE	Groundwater Dependent Ecosystem
GED	General Environmental Duty
ha	hectares
km	kilometres
kV	Kilovolt
m	Metres
mg/L	Milligrams per Litre
mm	Millimetres
MNES	Matter of National Environmental Significance
MW	Megawatts
MWh	Megawatt hours
NWQMS	National Water Quality Management Strategy
SWL	Standing Water Level
TDS	Total Dissolved Solids
VNI West	Victoria to New South Wales Interconnector West
°C	Degrees Celcius

1 Introduction

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Meering West Wind Farm Pty Ltd as trustee for the Meering West Wind Farm Trust ('the Proponent') to undertake a Surface Water and Groundwater Assessment to inform the development of a wind farm and associated infrastructure located near Meering West in Northern Victoria, called the Meering West Wind Farm (herein referred to as 'the Project').

1.1. Purpose and Scope

The purpose of this report is to assess the existing surface water and groundwater conditions within the Project Area to support the planning approval of Meering West Wind Farm development. Matters required to be considered under the Gannawarra and Loddon Planning Schemes and the Planning Guidelines for Development of Wind Energy Facilities are identified and addressed in this report. A desktop review of the surface water and groundwater characteristics of the Project Area is required to determine if there were any matters that would impact on the final location of the wind farm and if a potential impact is expected as a result of the proposed work and recommend mitigation measures.

A desktop review was completed of publicly available information in relation to the relevant legislation and guidelines, hydrology and hydrogeology of the confirmed project boundary (hereafter referred to as the 'Project Area'). Information collated during this review has been used to prepare this surface water and groundwater assessment.

The scope of the surface and groundwater water assessment includes:

- Review current legislative requirements and guidelines.
- A desktop review of existing surface water and groundwater conditions in the Project Area.
- Assessment of potential impacts to surface water including:
  - Drainage
  - Flooding
  - Sensitive Water Environments.
- A high-level mitigation measures to address any identified impacts.
- Determination of conclusions and recommendations for further work.

1.1 The Project

The Project is located in regional Victoria, 25 kilometres (km) south east of Kerang (Figure 3-1). The Project proposes the construction of up to 164 wind turbines which is estimated to have a total generation capacity of 1,500 Megawatts (MW).

The Project works include the construction of a permanent core and ancillary infrastructure including:

- 164 wind turbines.
- An operation and maintenance building, including a car park and an office.
- Internal access tracks.
- 1000 MW / Megawatt hours (MWh) Battery Energy Storage System (BESS).
- A terminal station and substations.
- Permanent meteorological monitoring mast.
- Internal access tracks.
- Internal feeder transmission lines.
- Utility installations.

The Project will also include temporary ancillary infrastructure including:

- A construction office and compounds, including site offices, car parking, storage and amenities.
- Concrete batching plant
- Hard stands, laydown areas and temporary structural supports.

2 Legislative Requirements and Guidelines

Table 2-1 summarises the current legislative requirements and guidelines relevant to the Project.

Table 2-1 Legislative requirements

Relevant Legislation and Guidance	
Relevant Commonwealth Legislation and Guidance	
National Water Quality Management Strategy (NWQMS)	The 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 provides a framework for the development and implementation of management plans for catchment, aquifer, coastal waters and other water bodies, by community and government. The NWQMS includes a number of guidelines covering water quality benchmarks, groundwater management, diffuse and point sources, sewerage systems, effluent management, and water recycling. The guidelines relevant to the Project include: ■ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) ■ Australian Drinking Water Guidelines (2011, updated 2024) ■ Australian Guidelines for Water Quality Monitoring and Reporting (2000) ■ Guidelines for groundwater quality protection in Australia (2013).
Relevant State Legislation and Guidance	
Planning and Environment Act 1987	Victoria's statutory land use planning system operates through Planning Schemes, which are subordinate legislation under the *Planning and Environment Act 1987*. Planning Schemes set out policies and provisions for the use, development and protection of land. Planning Schemes set out the state-wide principles, policies and strategies for how land is used and developed. The Planning Policy Framework recognises the impacts of natural hazard hazards, including flooding, and sets strategies for development to be located away from flood areas.
Environment Protection Act 2017 (EP Act)	The EP Act creates the legislative framework to protect the environment and came into effect on 1 July 2021. The Environment Protection Authority (EPA) Victoria has implemented a broad range of statutory instruments and policies, subordinate legislation and tools under the EP Act. This includes the Environmental Reference Standard, which sets environmental values for water, land and air, and mechanisms for regulation of the discharges to these elements of the environment. The EP Act aims to prevent and minimise the risks of harm to human health and the environment from pollution and waste, by setting environmental objectives and establishing programs to meet them. The EP Act establishes the powers, duties and functions of the EPA Victoria. These include the administration of the EP Act and any regulations and orders made pursuant to it, issuing works approvals, licences, permits, pollution abatement notices and implementing National Environment Protection Measures. Furthermore, under the General Environmental Duty (GED) all organisations have a responsibility to reduce risk to human health and the environment. It states that you must manage your activities to reduce the risk of harm: ■ to human health and the environment. ■ from pollution or waste.
Environment Reference Standards	Environment Reference Standards (ERS) are an important component of the regulatory framework established by the *Environment Protection Act 2017*. They serve as specific benchmarks or criteria used to assess environmental quality and performance concerning various environmental factors. The standards aim to protect the environment and human health by setting out acceptable limits for various pollutants and environmental impacts. ERS focus on different environmental media, such as air, water, and soil, and include parameters such as concentration levels of pollutants or contaminants, indicators and environmental quality objectives that need to be achieved or maintained.

Relevant Legislation and Guidance	
	Compliance with these standards is monitored, and entities that exceed the set levels may face penalties or be required to take corrective actions.
Water Act 1989	The *Water Act 1989* provides the legal framework for water management and use across Victoria, including the issuing and allocation of water entitlements and the provision of water services by state-owned water corporations and catchment management authorities. Under the *Water Act 1989*, the designated waterways, regional drainage and floodplain management authority for the Project Area is the North Central Catchment Management Authority (CMA). The North Central CMA is one of ten floodplain management authorities which operate across Victoria and manages the land and water resources in the south west region. The CMA is the caretaker of river health and carries out works to protect and enhance the quality of water and condition of rivers.
Planning Guidelines for Development of Wind Energy Facilities	The Planning Guidelines for Development of Wind Energy Facilities (2023) provides a framework aimed at promoting the sustainable and effective deployment of wind energy projects while balancing environmental, social, and economic considerations. During construction, the Environmental Management Plan must include procedures to manage stormwater runoff, minimising earthworks and implementing measures to protect drainage lines and waterways.
Catchment and Land Protection Act 1994	The *Catchment and Land Protection Act 1994* is a key legislative framework in Victoria, Australia, aimed at promoting sustainable management of land and water resources. It establishes Catchment Management Authorities to oversee resource conservation, addresses issues of land degradation such as salinity and erosion, and includes provisions for managing invasive species. The Act encourages community involvement in decision-making and integrates with other environmental legislation to ensure comprehensive natural resource management, aiming to protect Victoria's natural assets for current and future generations.

3 Project Area

The Project is situated in Northern Victoria, approximately 25 km south-west of Kerang and encompasses approximately 20,000 hectares (ha) (Figure 3-1). The landscape is predominantly characterised by agricultural land, featuring largely flat to gently undulating dryland cropping. The Project Area is privately owned, agricultural land which has minimal vegetation and is intersected by multiple drainage lines.

Victoria to New South Wales Interconnector West (VNI West) is a proposed new high capacity 500 Kilovolt (kV) transmission line between Victoria and New South Wales. The exact location of the VNI West has not been finalised however it is expected VNI West will run through the Project Area. It is proposed to connect the Meering West Wind Farm directly to VNI West.

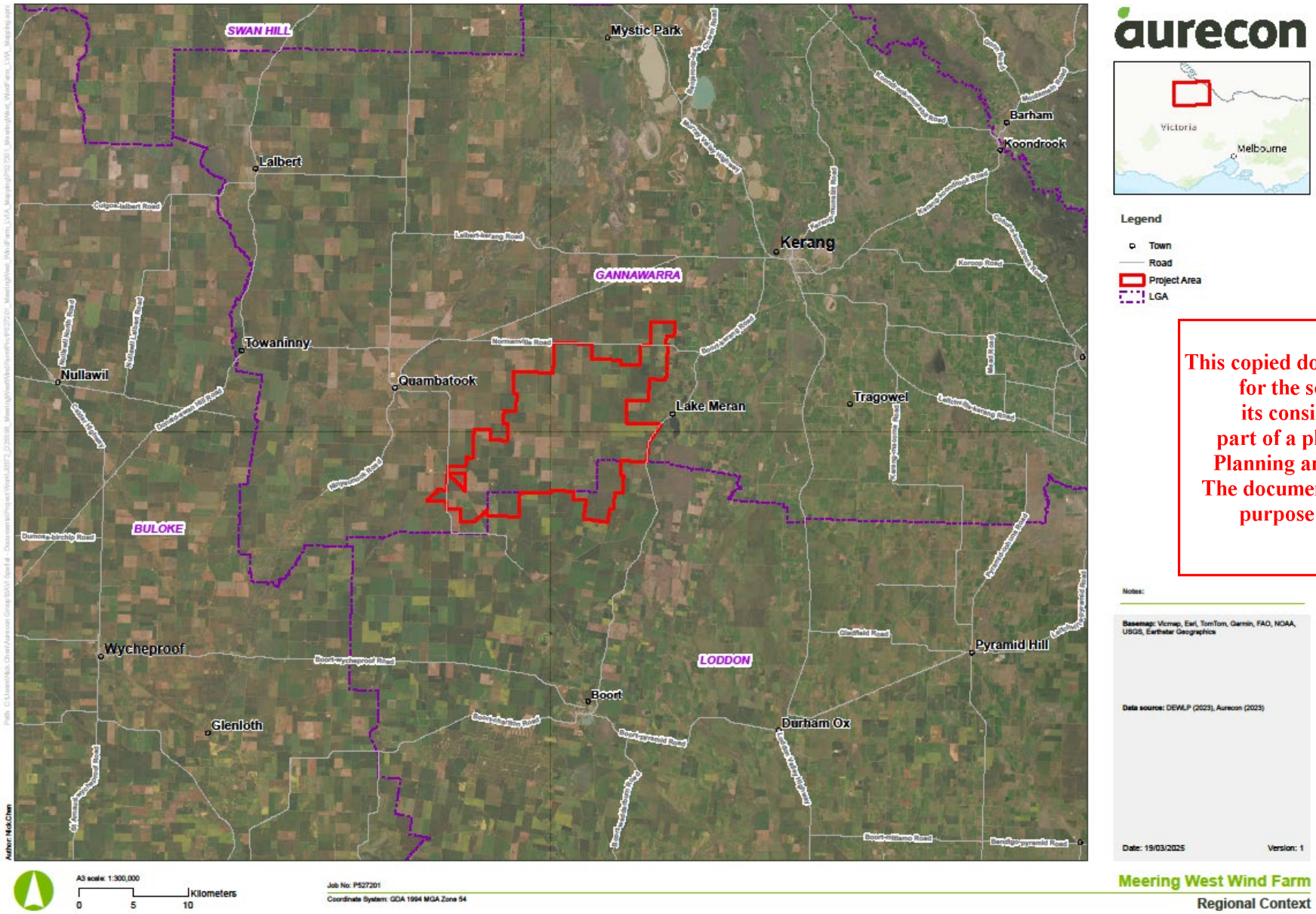


Figure 3-1 Aerial Image showing location of Project Area

3.1 Climate and Rainfall

The Project Area has a mild mediterranean climate, experiencing mild wet winters and hot dry summers, with an average annual maximum temperature of 23 degrees Celsius (°C) (Bureau of Meteorology, 2025). The area experiences winter dominant rainfall and evaporation at its highest over the summer months.

The long-term rainfall and temperature data for the closest weather station (Kerang (Meran Downs) - 080024, located 6.1 km to the north) indicates that an average of 373 millimetres (mm) of rain falls each year at this site.

Rainfall at the Project Area corresponds to a season between May and October, with the monthly rainfall ranging between 27 and 33 mm during these months (Bureau of Meteorology, 2025). January to March are the months with the lowest rainfall values.

Rainfall values may be inversely proportional to temperature values (Figure 3-2).

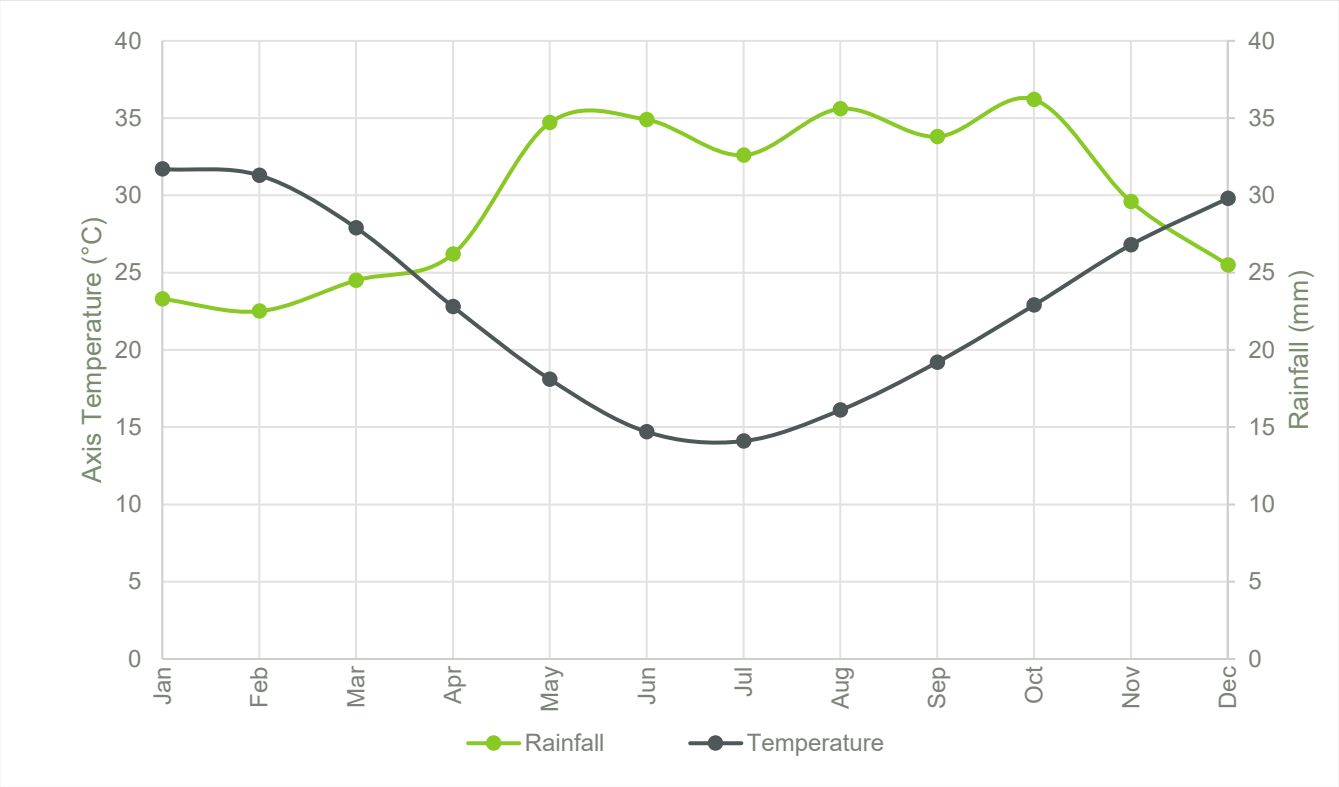


Figure 3-2 Average monthly rainfall and temperature

3.2 Site Topography

The topography of the Project Area is relatively flat with a gentle slope to the north east. Elevations range from 130 m above Australian height datum (AHD) in the south western corner to 80 m AHD at the north eastern boundary. The south western boundary of the site has a slightly steeper slope, as shown in Figure 3-3. Due to the gradient of the Project Area, overland and stormwater is likely to flow in a north-westerly direction towards the flood plain of the Avoca River and north-easterly towards the Loddon River, including Lake Meran and ultimately the Kerang Wetlands.

3.3 Soils

Soil texture affects the movement and retention of water. The ease with which water can move through the soil profile depends on the porosity of the soil. The porosity is larger in coarse-textured soils (sands) than in

fine-textured soils (clays). As a result, water and dissolved nutrients can move faster through coarse-textured soils than fine-textured soils; conversely, fine-textured soils will tend to generate more surface runoff.

Soils across the Project Area (Figure 3-4) are likely to be predominantly sodosols which are mainly red with carbonates in the subsoil. Patches of cracking clay vertosols exist to the western area of the site. These soils are predominant on the Loddon floodplain and generally have a low salinity. Heavy textured calcarosols exist to the southern portion of the site and consist of mostly red brown and carbonaceous soils.

There is a low to extremely low probability of acid sulfate soil occurrence across the majority of the Site (Figure 3-5). There are discrete pockets of a high probability of occurrence in the north east beyond the Project Area, towards Great Spectacle Lake and associated water bodies (State Government of Victoria, 2025).

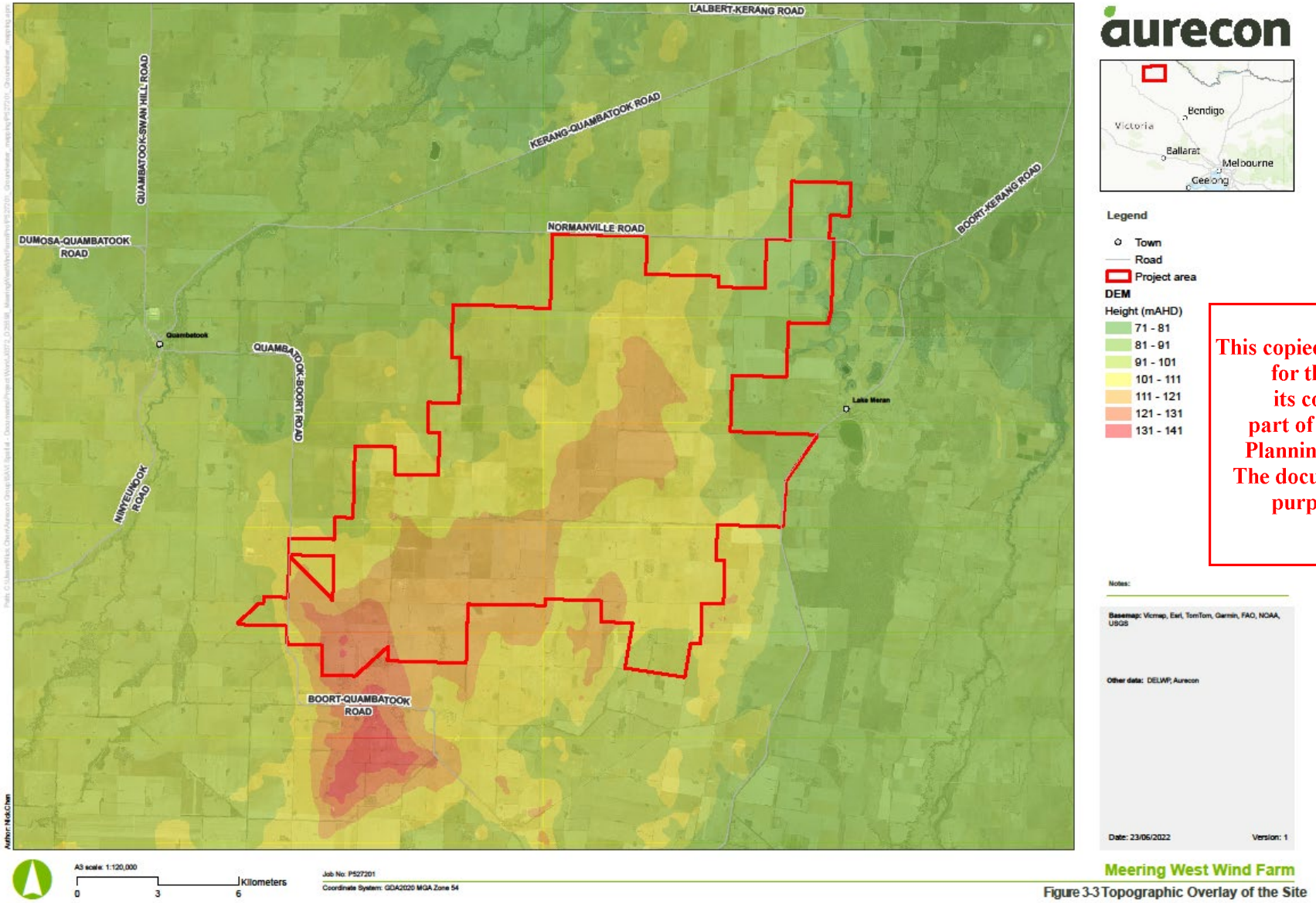


Figure 3-3 Project Area Topography surrounding the Meering West Wind Farm Project Area

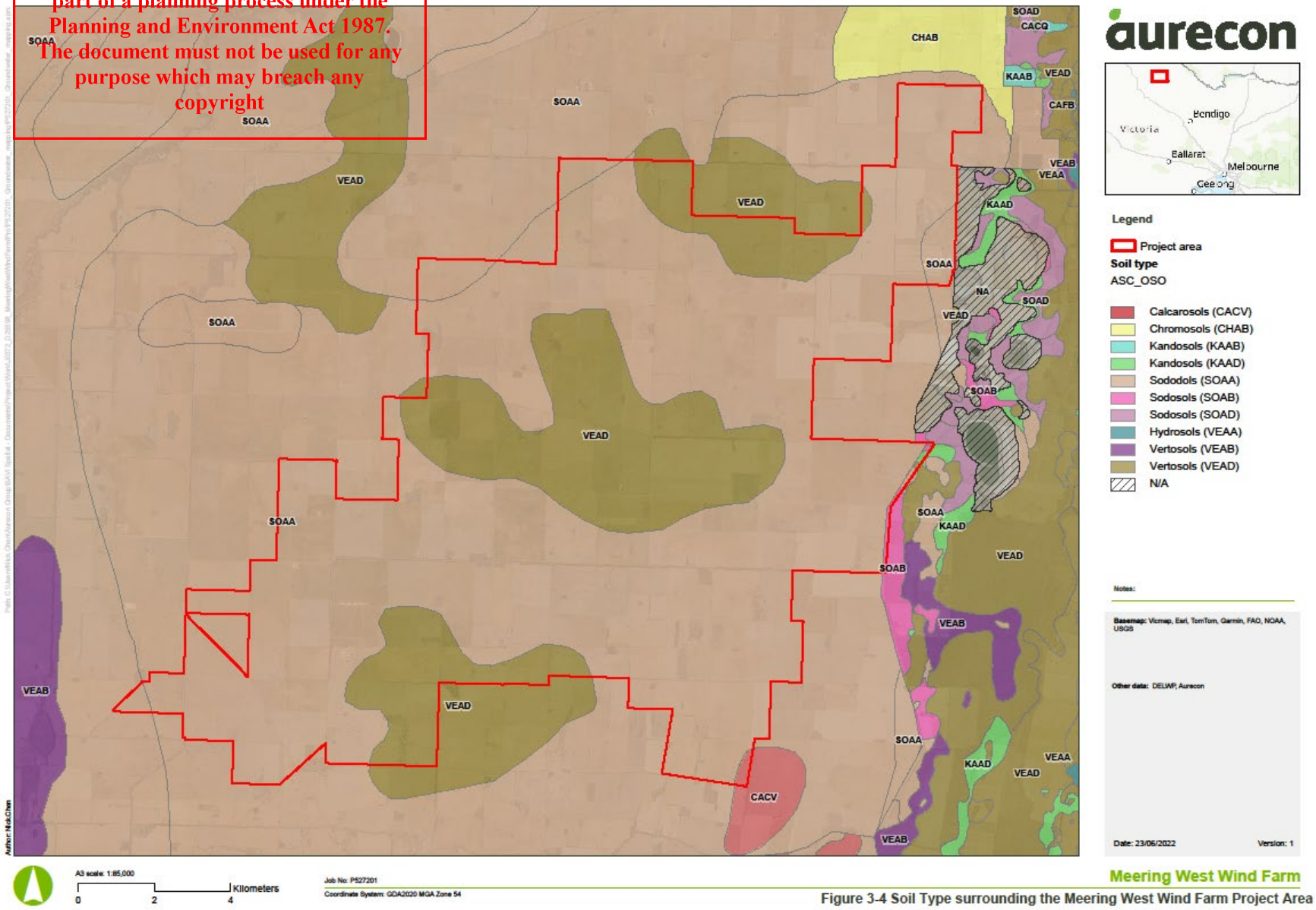


Figure 3-4 Soil Type surrounding the Meering West Wind Farm Project Area

Figure 3-4 Soil Type surrounding the Meering West Wind Farm Project Area

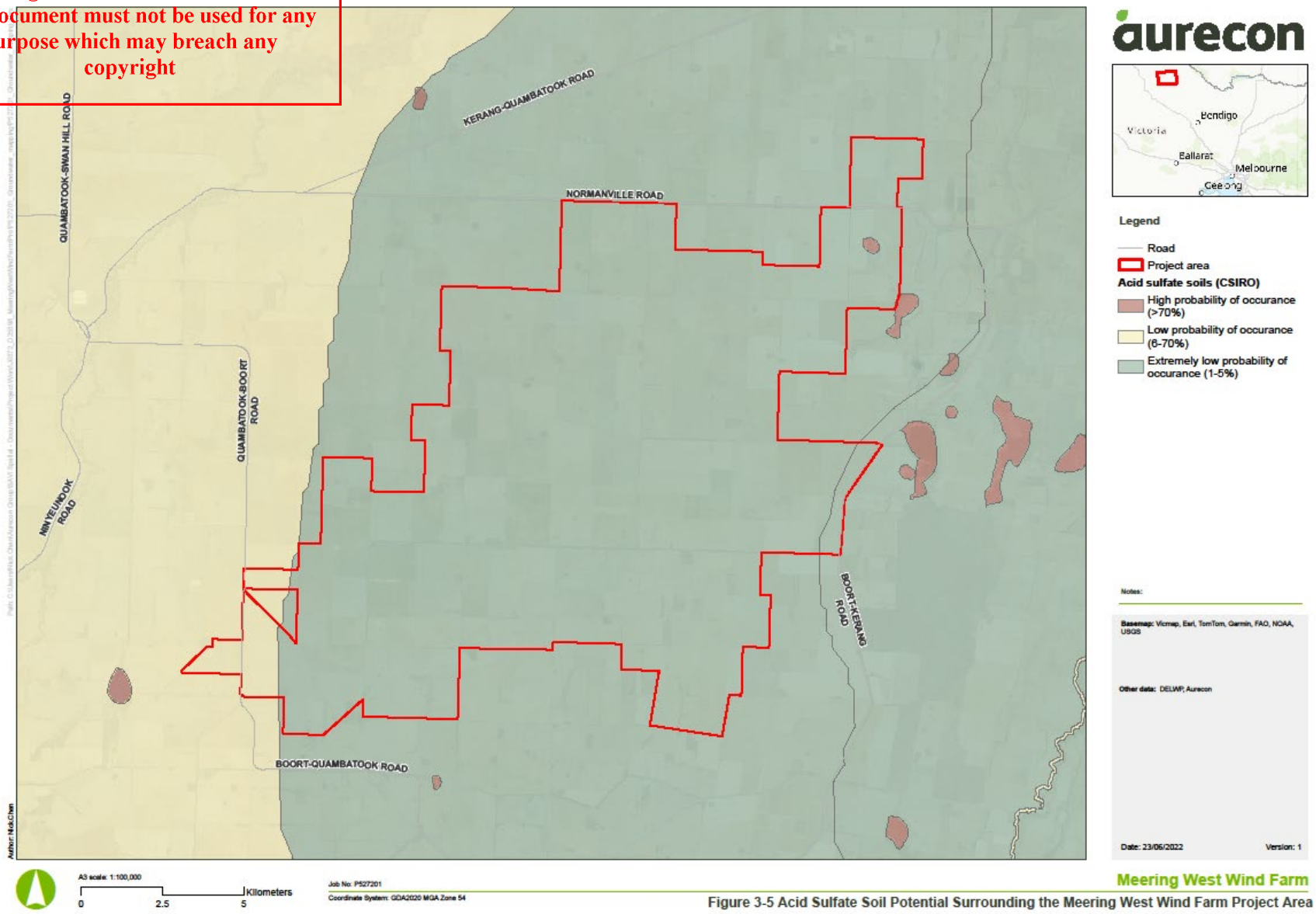


Figure 3-5 Acid Sulfate Soil Potential Surrounding the Meering West Wind Farm Project Area

Figure 3-5 Acid Sulfate Soil Potential Surrounding the Meering West Wind Farm Project Area

4 Surface Water Conditions

4.1 Regional Hydrology

The Project Area is in the North Central Catchment Management Authority (CMA), which is drained by several waterways including Avoca River, Loddon River and Campaspe Rivers that generally flow north towards the Murray River. Figure 4-1 shows the Avoca River is located 5 km to the west and the Loddon River is located 8 km to east.

The Project Area is situated in the catchment areas of the Avoca and Loddon Rivers which form part of the Murray Darling Basin, an area highly valued for recreation, tourism, fishing and amenity values. The Loddon River is located approximately 8 km to the east of the Project Area and flows towards the north. The River has headwaters in the Great Dividing Range, flowing in a northerly direction for approximately 300 km before terminating at Swan Hill, discharging into the River Murray (State Government of Victoria, 2021).

The Avoca River is located approximately 5 km west of the Project Area. The River originates from the Central Highlands near Amphitheatre and flows north for 270 km towards the Murray River.

Key management documents for the Project Area include:

- North Central Regional Catchment Strategy 2021-2027 (State Government of Victoria, 2021).
- Local Management Plan Lake Meran (Goulburn Murray Water, 2018).
- North Central Regional Floodplain Management Strategy 2018 – 2028 (State Government of Victoria, 2021).

4.2 Local Hydrology

The site is located outside the flood plains for the Avoca and Loddon Rivers. These rivers are relatively low flowing and have experienced dry periods in recent years due to low rainfall and water abstraction. The low rainfall and sandy soils mean much of the rainfall is infiltrated to the groundwater rather than generating runoff and flowing towards the rivers.

The Loddon River is located approximately 8 km to the east of the Project Area and flows towards the north. The River has headwaters in the Great Dividing Range, flowing in a northerly direction for approximately 300 km before terminating at Swan Hill, discharging into the River Murray (State Government of Victoria, 2021).

The Avoca River is located approximately 5 km west of the Project Area. The River originates from the Central Highlands near Amphitheatre and flows north for 270 km towards the Murray River.

Multiple un-named drainage lines flow through the Project Area, including two larger channels which are likely to be ephemeral, only flowing during rainfall events (Figure 4-1). One channel drains the northern half of the site, starting on the eastern boundary and roughly following the northern boundary of the site to ultimately connect to the Avoca River via multiple tributaries and channels. Another channel flows along the south western boundary of the site to meet other drainage lines and flow towards the Avoca.

Lake Meran is located 1 km to the north east in the Loddon River floodplain and is supported by natural flooding events that flow into the lake (Goulburn Murray Water, 2018). Most of the inflow into the lake is supported either by natural flooding of the Loddon River or by allocated water inflow.

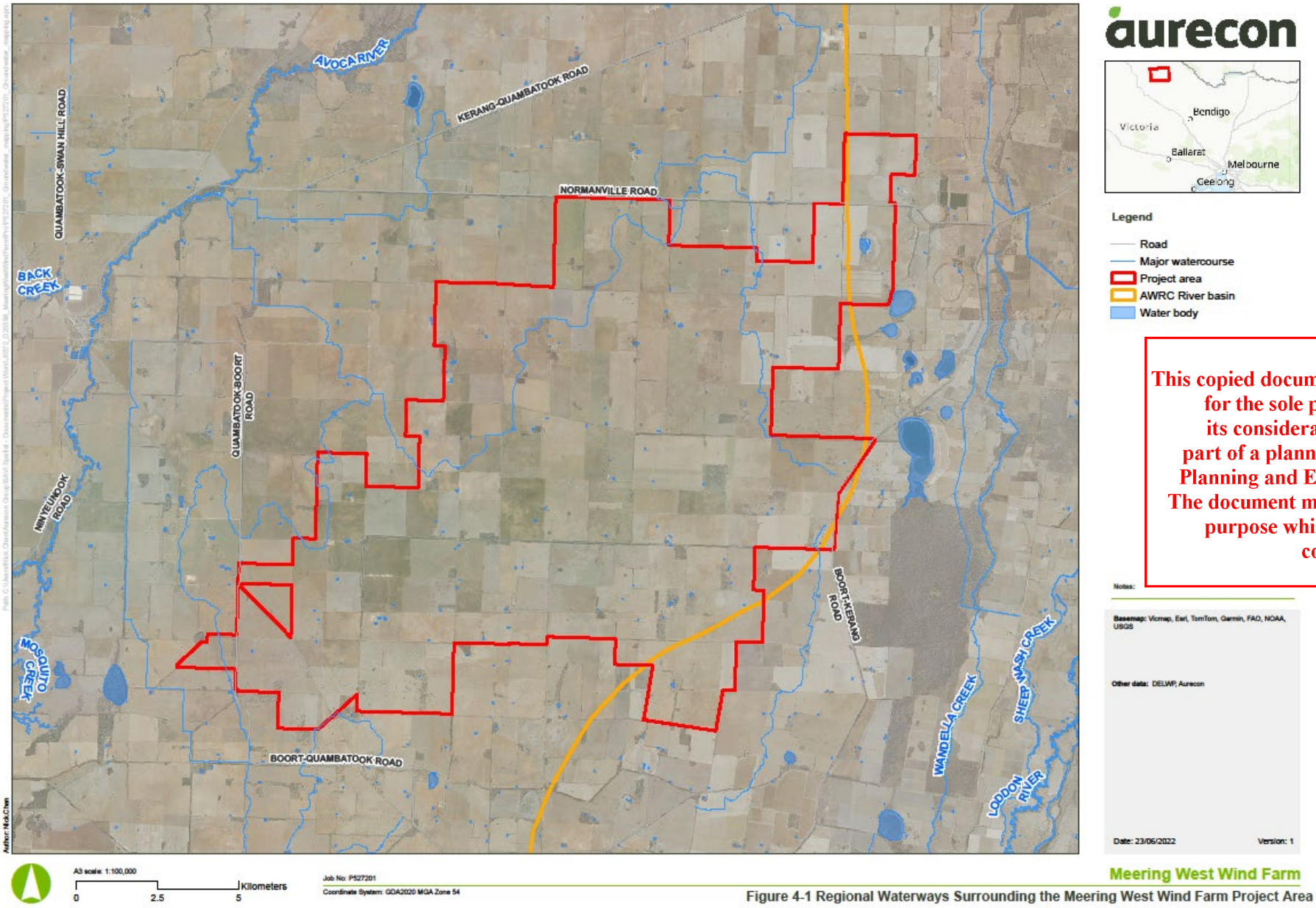


Figure 4-1 Regional Waterways Surrounding the Meering West Wind Farm Project Area

Figure 4-1 Regional waterways surrounding the Meering West Wind Farm Project Area

4.3 Flood Risk

The North Central Regional Floodplain Management Strategy (State Government of Victoria, 2021) sets out an assessment of the flood risk within the North Central Catchment Area, using a rapid appraisal of flood risk methodology developed by the Department of Energy, Environment and Climate Action (DEECA). The Project Area is located within an area of moderate flood risk, with areas of the greatest risk being in the lower catchment areas within rural land uses (Figure 4-2).

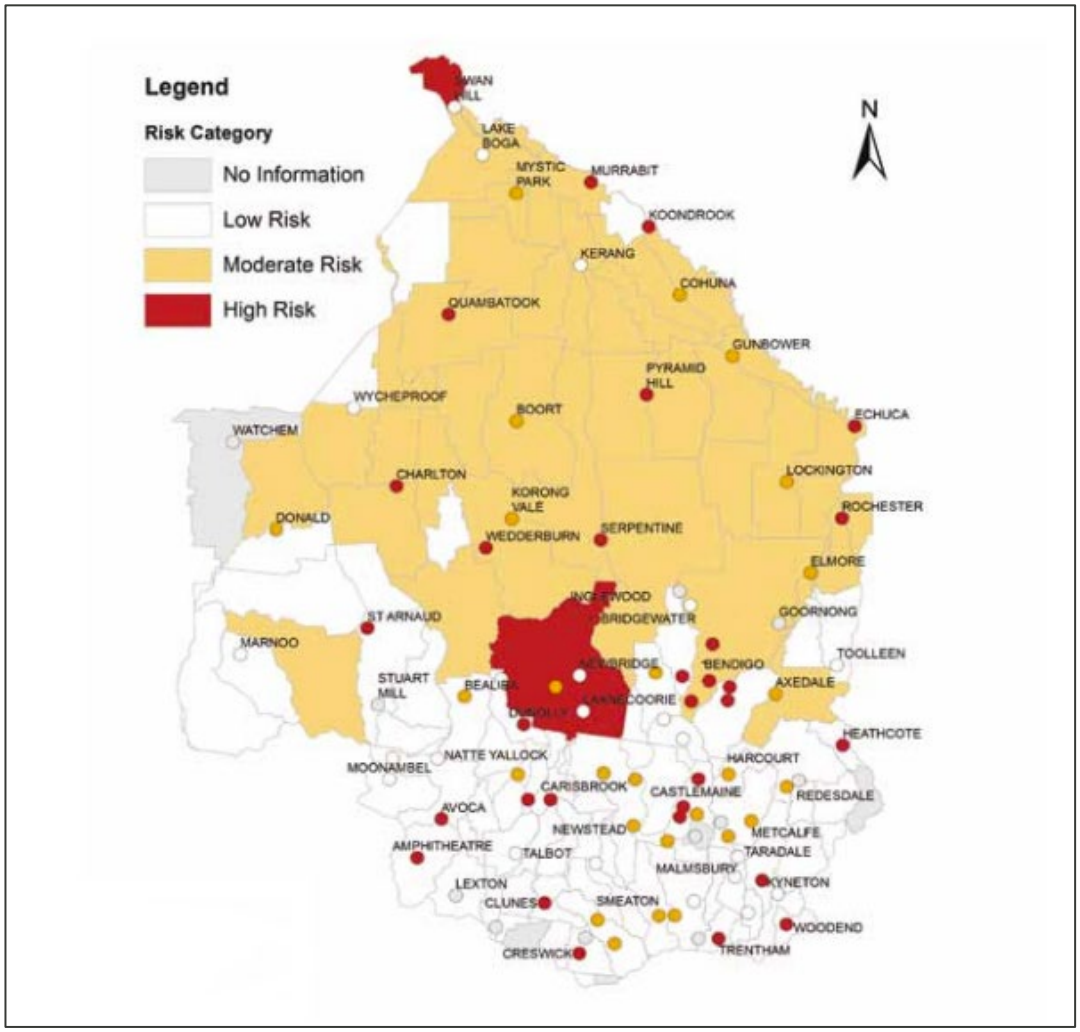


Figure 4-2 Regional Flood Risk Profile of the North Central Catchment Management Area (State Government of Victoria, 2021)

The Project is situated on the Avoca and Loddon catchments, however, given the Project Area is located outside the floodplain, there is no existing flood modelling in the Project Area. As shown in Figure 4-3, the majority of the Project Area is located outside of the 1% Annual Exceedance Probability (AEP) flood extent (State Government of Victoria, 2021). This suggests that the proposed location of the wind farm and associated infrastructure is unlikely to encroach into the 1% AEP flood extent, however due consideration should be given to the design of the south-wester corner and eastern boundaries of the Project Area.

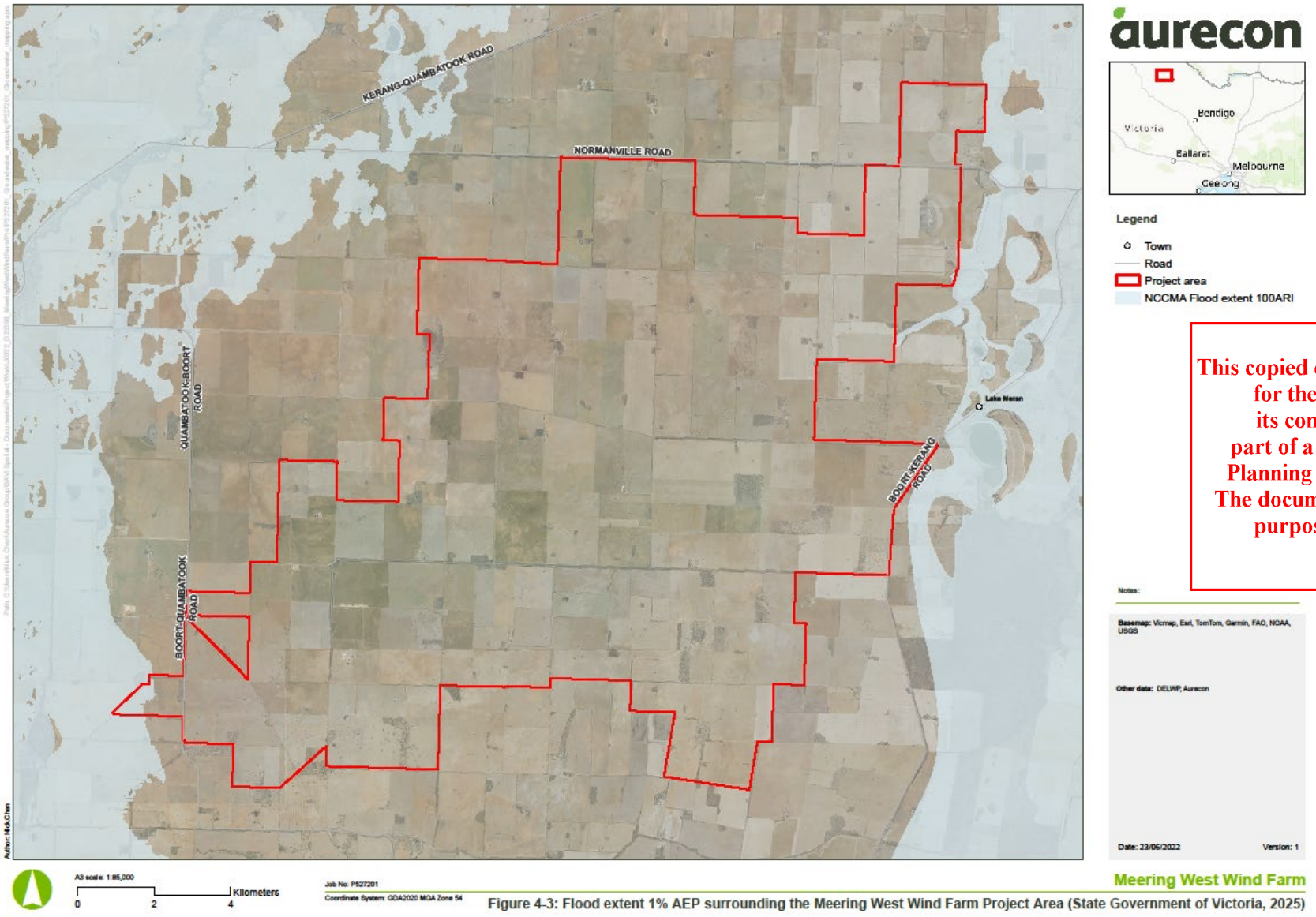


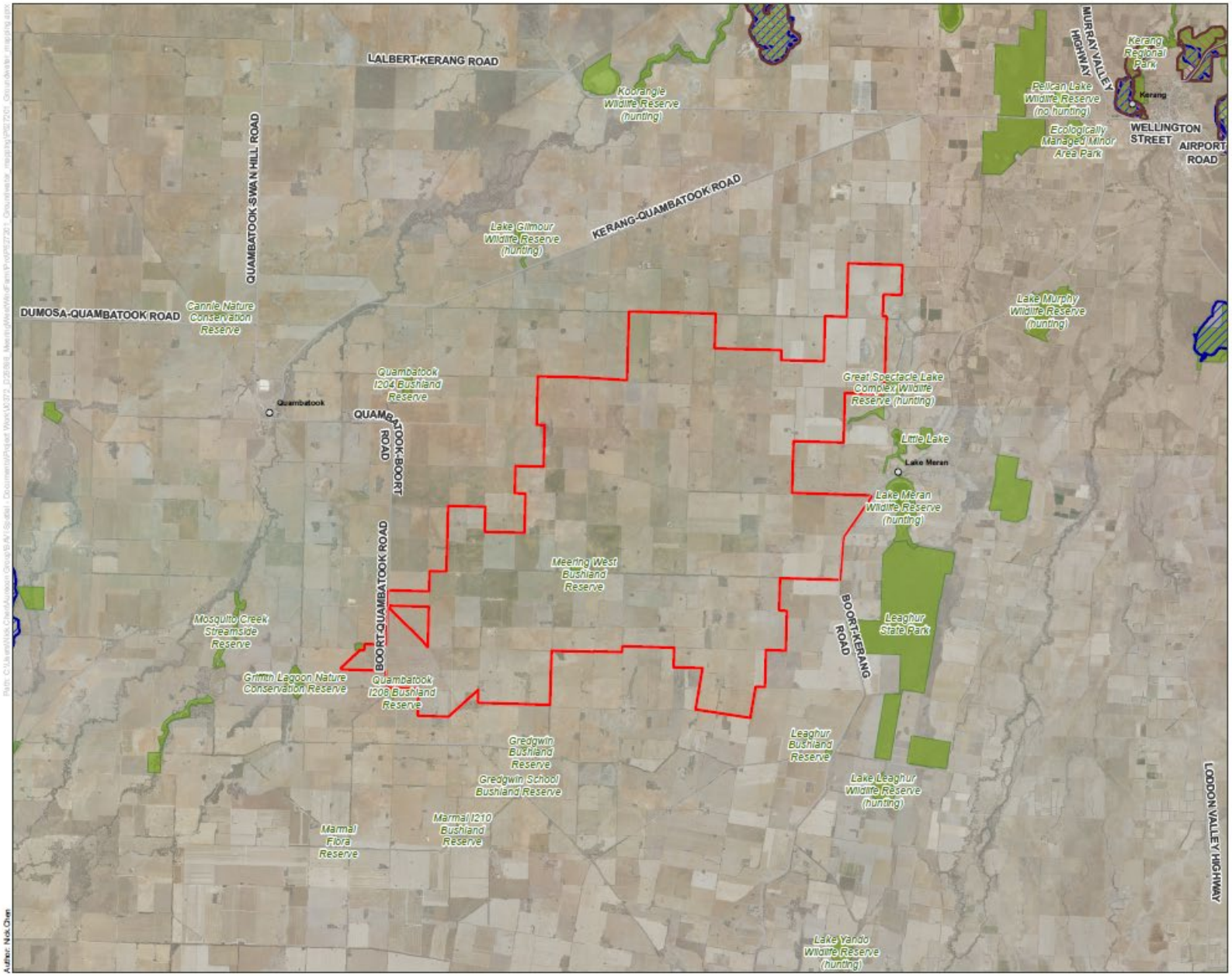
Figure 4-3 Flood extent 1% AEP surrounding the Meering West Wind Farm Project Area (State Government of Victoria, 2025)

4.4 Sensitive Receiving Environments

The Kerang Wetlands are located approximately 13 km north of the Project Area (Figure 4-4) and are Ramsar listed (State Government of Victoria, 2021). Ramsar wetlands encompass a network of vital ecological sites that play a critical role in maintaining biodiversity. These wetlands are internationally recognised for their unique ecosystems, which support a diverse array of flora and fauna, including several threatened and endemic species. A potential impact pathway could be contamination of groundwater or surface water that flows downstream to the Kerang Wetlands.

Other sensitive receivers include the numerous parks and reserve and in particular the Leaghur State Park located 1.5 km to the east of the Project Area and the Wandella Nature Conservation Reserve, located approximately 5 km north east of the Project Area. These areas further contribute to the region's biodiversity and ecological health, offering habitat for various species and serving as critical spaces for conservation efforts.

Lake Meran is situated 2 km to the north east of the Area. This lake has been rehabilitated to support colonial nesting birds, migratory water birds and Murray River turtle populations as well as providing recreational benefits (Goulburn Murray Water, 2018). Outside flood events, the majority of flow into the lake is for environmental flows in line with the recommendations of the North Central Catchment Management Authority's Meran Lakes Complex Environmental Water Management Plan 2016 (EWMP) (Goulburn Murray Water, 2018)



Legend

- Town
- Road
- Project area
- Ramsar wetland
- Important wetland
- Park and Reserve

Notes:

Basemap: Vicmap, Esri, TomTom, Garmin, FAO, NOAA, USGS

Other data: DELWP, Aurecon

Date: 23/06/2022 Version: 1

A3 scale: 1:150,000

0 3.75 7.5 Kilometers

Job No: P527201

Coordinate System: GDA2020 MGA Zone 54

Meering West Wind Farm

Figure 4-4 Sensitive receiving environments surrounding the Meering West Wind Farm Project Area

Figure 4-4 Sensitive receiving environments surrounding the Meering West Wind Farm Project Area

5 Groundwater Conditions

5.1 Regional Geology and Hydrogeology

The Project Area is located in northern part of Loddon River basin, where the surficial geology comprises the Quaternary Shepparton Formation near the Loddon and Avoca Rivers and the wind-blown sands of the Tertiary Parilla Sand Formation between the rivers (Figure 5-1).

The geology beneath the Project Area is the Tertiary Parilla Sand Formation which comprises coarse, clayey sands that are typically pale brown to rusty red-brown in colour (Visualising Victoria's Groundwater, 2025). The Parilla Sand aquifer is recharged by infiltration from direct rainfall and groundwater flows to the Murray River.

The Shepparton Formation is located to the east and west of the Project Area and contains sands mixed with clay and silt and is typically confined to the floodplains. The Shepparton Formation aquifer is recharged by infiltration from direct rainfall and flood events. Alluvial sediments also overlie the Shepparton Formation in some parts of the floodplains of the Loddon and Avoca Rivers.

The Renmark Group underlying the Parilla and Shepparton Formation aquifers and comprises sandstone, mudstone and siltstone.

The Leaghur Fault lies to the east of the site alongside the Loddon River floodplain. The Faultline runs in a north-south direction marking the western limit of the Riverine Plain and is a part of a larger system of faults in the region (Figure 5-1) (Visualising Victoria's Groundwater, 2025).

Figure 5-2 shows that the depth to groundwater within the Project Area is reasonably deep (30-50 metres below ground level [m bgl]), however the groundwater is shallower in the north eastern corner of the site. Approximately 1 km to the east of the Project Area, the groundwater is within 5 m of the surface.

Groundwater salinity is saline (up to 35,000 mg/L of total dissolved solids [TDS]) in the Parilla Sand aquifer (Visualising Victoria's Groundwater, 2025). The salinity of the Shepparton Formation aquifer is variable, ranging from fresh to brackish to saline in some regions. The groundwater is brackish to the south west of the site (in the Avoca River catchment) and small pockets of fresh groundwater are found in the Shepparton Formation aquifer to the east of the site in the Loddon River catchment (Figure 5-3).

Given the poor quality of the groundwater, it is typically not extracted for use and there are no Groundwater Management Areas in this region. Generally the quality of groundwater in the Avoca and Loddon River valleys improve towards the south in Central Victoria.

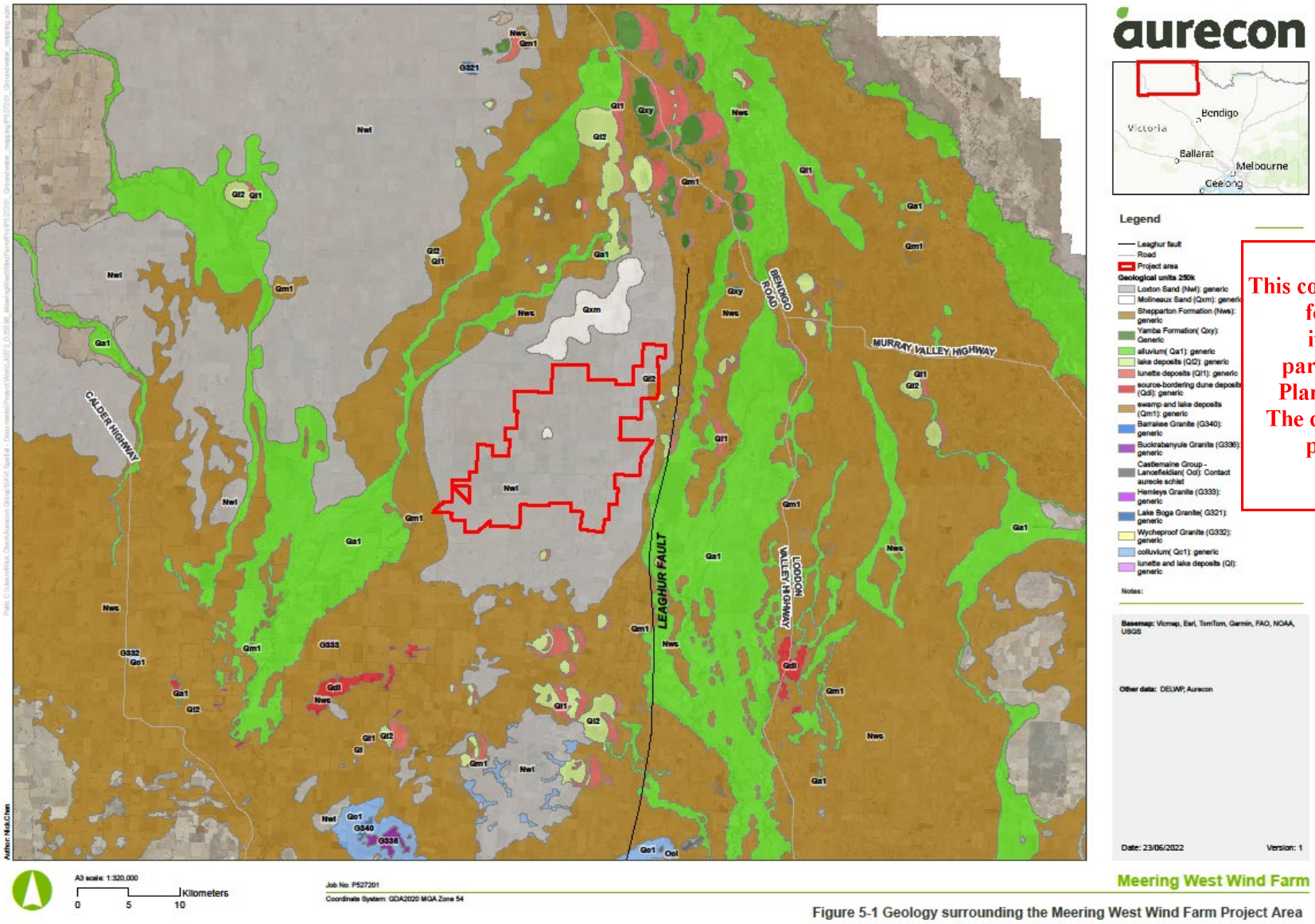


Figure 5-1 Geology surrounding the Meering West Wind Farm Project Area

Figure 5-1 Geology surrounding the Meering West Wind Farm Project Area

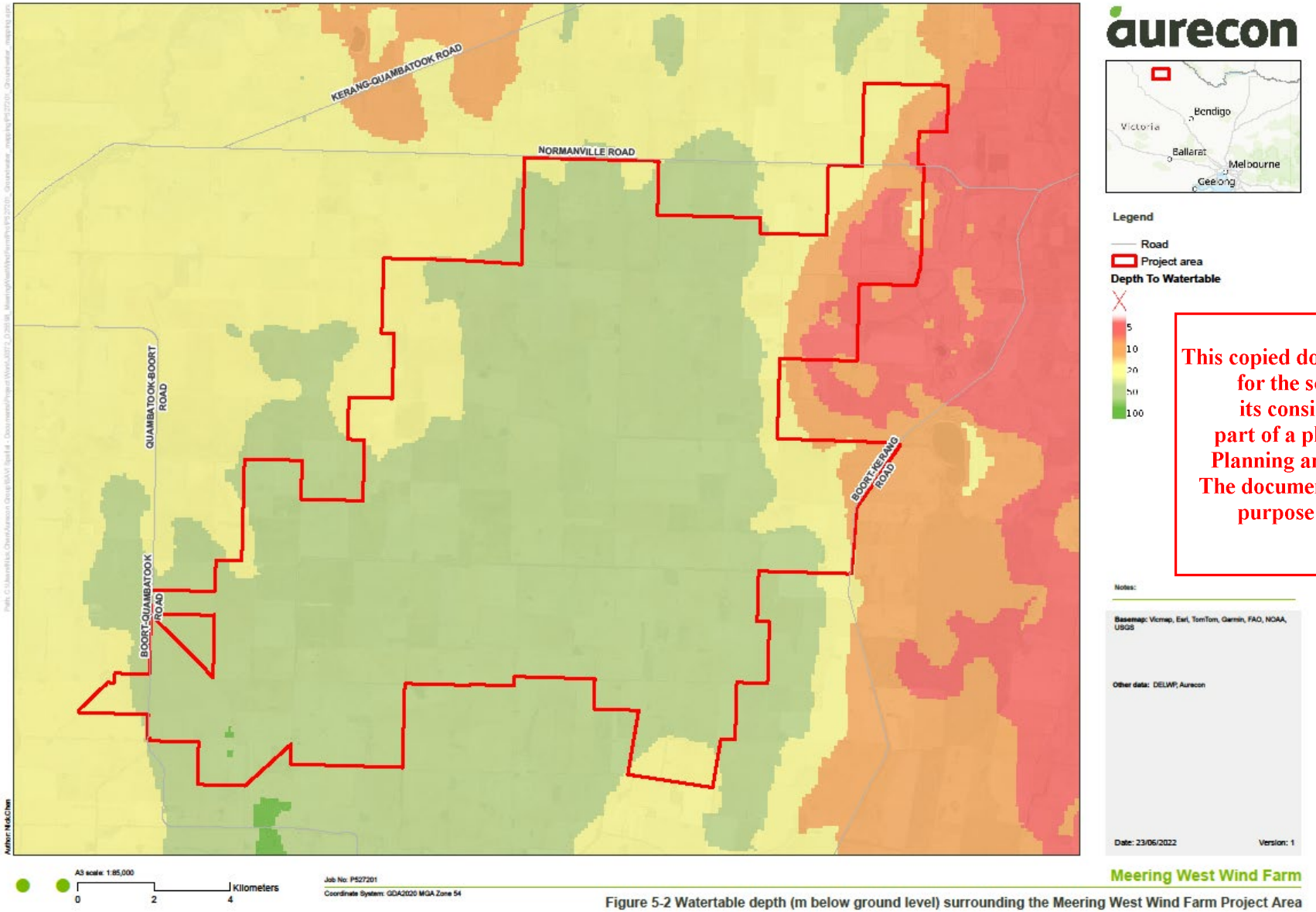


Figure 5-2 Watertable depth (m below ground level) surrounding the Meering West Wind Farm Project Area

Figure 5-2: Watertable depth (m bgl) surrounding the Meering West Wind Farm Project Area

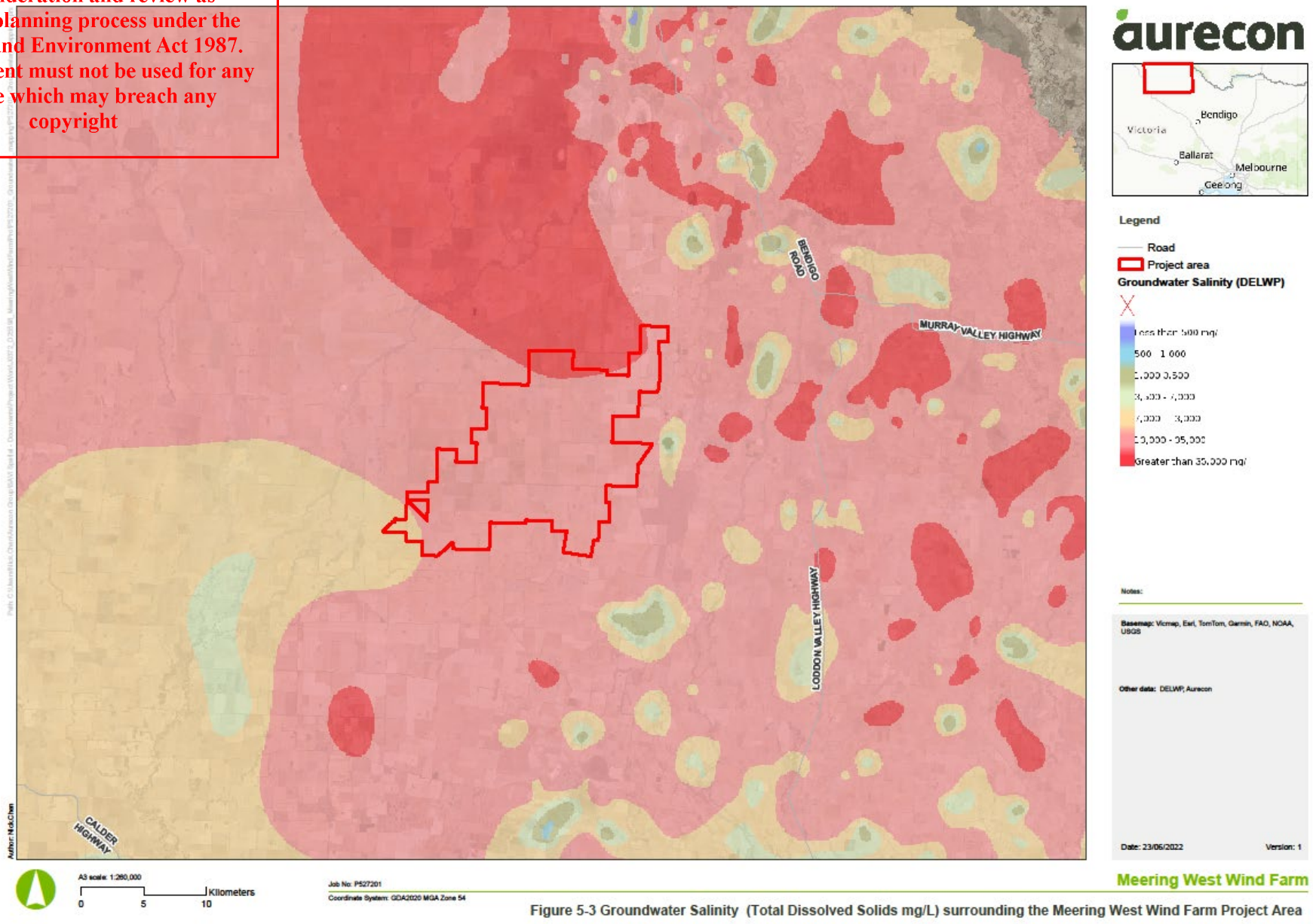


Figure 5-3 Groundwater Salinity (Total Dissolved Solids mg/L) surrounding the Meering West Wind Farm Project Area

Figure 5-3: Groundwater Salinity (Total Dissolved Solids mg/L) surrounding the Meering West Wind Farm Project Area

5.2 Local Hydrogeology

There are 32 observation bores within 1 km of the site (See Figure 5-4). Of these bores, 12 are located within the Project Area and 20 are located outside of the Project Area. All bores are registered for observation and investigation purposes (Visualising Victoria's Groundwater, 2025).

All 12 of the bores located within the Project Area intersect the Parilla Sand or Renmark Group aquifer. Bores screening the Parilla Sand aquifer are up to 70 m deep and bores screened in the Renmark Group aquifer are typically 100 – 154 m deep.

Four bores are currently monitored as part of the Victorian Statewide Monitoring Program:

- Bores 52363 and 52364 are located on the northern boundary of the site. Bore 52363 monitors the Renmark Group aquifer and Bore 52364 monitors the Parilla Sands aquifer. The water levels are similar in both aquifers, with water levels around 22.5 - 23.5 m bgl in February 2025.
- Bores 85932 and 85933 are located to the east of the site and Bore 85932 monitors the Renmark Group aquifer and 85933 monitors the Parilla Sands aquifer. Water levels are shallower in this area and are about 10 m bgl.

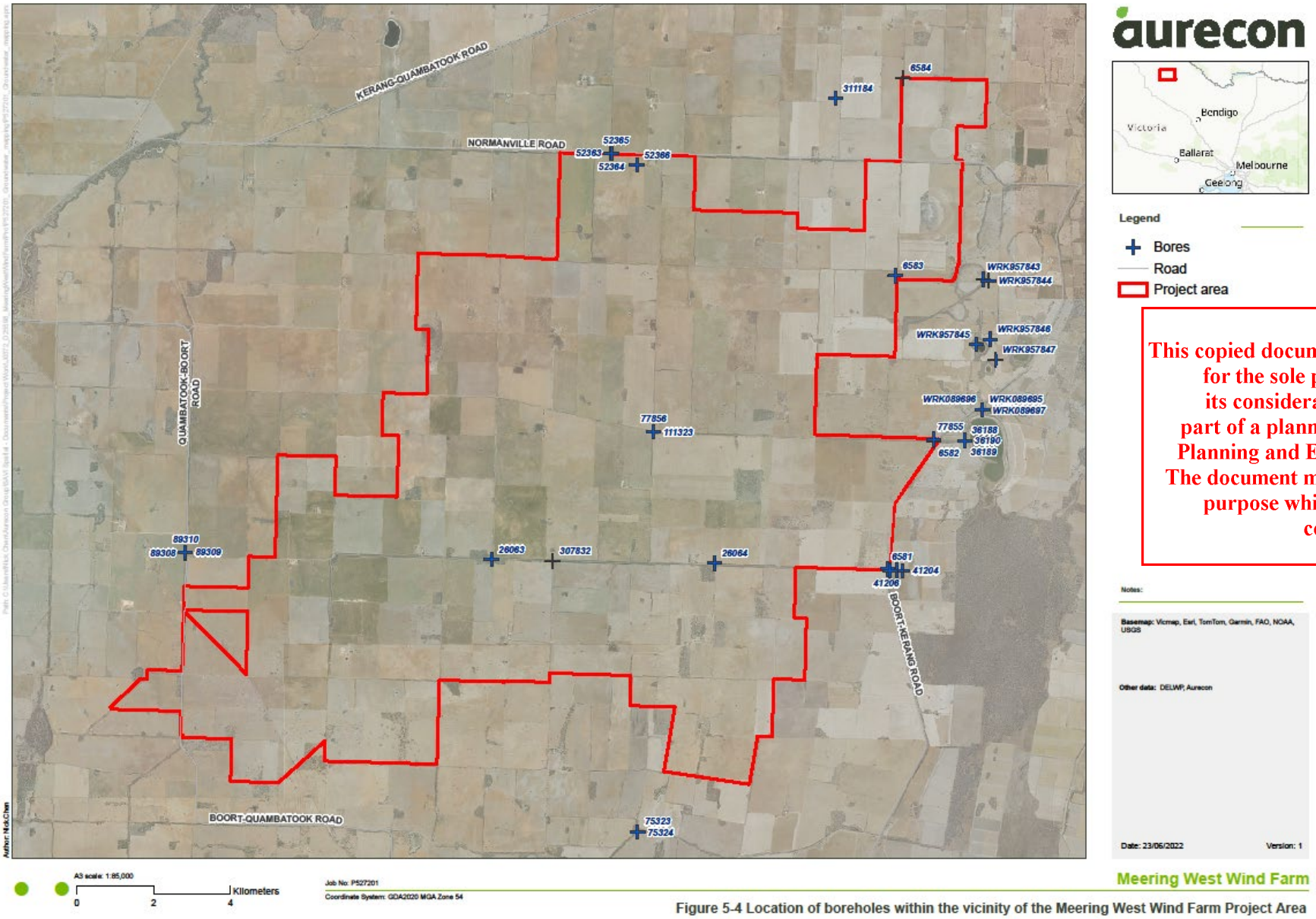
Groundwater levels are expected to range between 20 and 50 m bgl across the majority of the site. However groundwater levels are shallower in the north eastern corner of the site, where Bore 6583 records a depth to watertable around 7 m bgl.

Three bores located to the east of the project intercept the Shepparton Aquifer and are typically shallower, with average water level within 5 m bgl. All other bores outside Project Area are located within the Parilla Sand Aquifer and have deeper water levels ranging between 8 and 30 m bgl.

Details of the bores within the Project Area are displayed in Table 5-1 below. These bores are all located roads and may be encountered during project works. If encountered, these bores will need to be decommissioned in accordance with the Minimum Construction Requirements for Water Bores in Australia (National Uniform Drillers Licencing Committee, 1997), prior to construction commencement.

Table 5-1: Boreholes located within the Project Area (Visualising Victoria's Groundwater, 2025)

Bore ID	Easting	Northing	Year drilled	Bore depth (m bgl)	Aquifer
6581	750721	6022927	1976	19.3	Parilla Sand
6583	750921	6030577	1976	11.0	Parilla Sand
26063	740421	6023177	1989	30.0	Parilla Sand
26064	746221	6023077	1989	37.0	Parilla Sand
52363	743525	6033760	1987	154.8	Renmark Group
52364	743534	6033759	1988	70.0	Parilla Sand
52365	743543	6033763	1988	12.5	Parilla Sand
52366	744204	6033458	1968	39.6	No Data
77855	751916	6026309	1986	112.0	Renmark Group
77856	744629	6026511	1987	134.0	Renmark Group
111323	744629	6026502	1992	50.0	Parilla Sand
307832	742009	6023134	1981	132.0	No Data



Legend

- Bores
- Road
- Project area

Notes:

Basemap: Vicmap, Esri, TomTom, Garmin, FAO, NOAA, USGS

Other data: DELWP, Aurecon

Date: 23/06/2022 Version: 1

Meering West Wind Farm

Figure 5-4 Location of boreholes within the vicinity of the Meering West Wind Farm Project Area

Figure 5-4: Boreholes surrounding the Meering West Wind Farm Project Area

5.3 Groundwater Dependent Ecosystems

Groundwater-dependent ecosystems (GDEs) are natural environments that rely on groundwater for their health, survival, and functionality. The ecosystems reliant on groundwater within 1 km of the Project Area include wetlands, rivers and lakes. These areas play a crucial role in maintaining biodiversity and supporting various plant and animal communities. Figure 5-5 shows the locations of all GDEs within and around the Project Area and classifies locations as having a low, moderate or high potential for Groundwater interaction.

There are multiple GDEs outside of the Project Area and one GDE within the Project Area. The GDE within the Project Area is associated with a shallow marsh wetland located in the north eastern corner of the site and has a moderate potential for groundwater interaction (Bureau of Meteorology, 2019). The depth to watertable is shallower in the area.

The Leaghur State Park, located approximately 1 km east of the Project Area, is also a potential GDE. Lake Meran is located adjacent to the Leaghur State Park, which is largely supported by natural flooding and environmental allocation. Lake Meran and the connecting lakes to the north, Great Spectacle Lake, Little Spectacle Lake, Round Lake, Tobacco Lake and Little Lake are classified as having a moderate potential for GDE interaction (Bureau of Meteorology, 2019). Additionally, there are two sites to the south of the Project Area that have a low potential for groundwater interaction.

The Loddon River, which is located approximately 7 km to the east of the Project Area and the Avoca River to the west of the Project area, as well as the wetlands within those floodplains, have a low potential for groundwater interaction. During extended dry periods, the baseflows of the Avoca River and Loddon River and their tributaries are likely to be reduced due to a reduction in the groundwater table (North Central CMA , 2015).

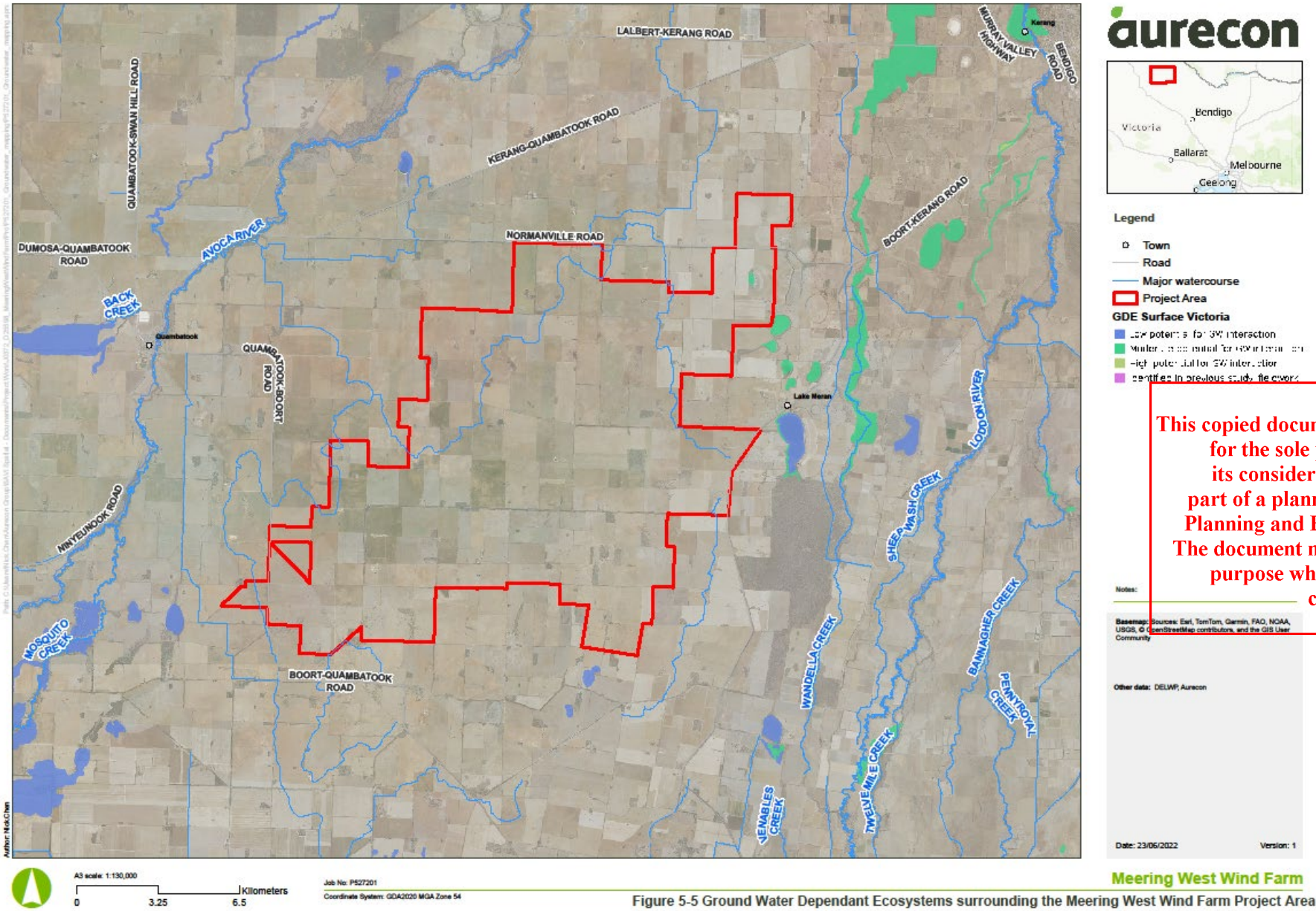


Figure 5-5 Ground Water Dependant Ecosystems surrounding the Meering West Wind Farm Project Area

Figure 5-5 Ground Water Dependant Ecosystems surrounding the Meering West Wind Farm Project Area

6 Impact Assessment

An impact assessment has been completed describing the potential impacts to drainage, flood, groundwater and sensitive receiving environments. All potential impacts are considered to be low and key impact mitigation measure is the development of CEMP to manage soils, waste and drainage on site during construction and through operation.

Impacts and mitigation measures are outlined in the following sections.

6.1 Drainage

Table 6-1 Drainage impacts associated with the Project

Impact code	Phase	Impact description	Mitigation measures	Residual Risk
D01	Construction	Stockpiles have the potential to obstruct localised overland flows and are susceptible to mobilisation of sediments which may be transported to drainage lines. Although the Project Area has a relatively flat terrain, overland flow is likely to prevail to flow to the Loddon and Avoca River flood plains which include the Kerang Wetland Reserve.	Water bodies and drainage areas within the Project Area should be identified prior to construction activities and appropriate sediment/erosion controls should be implemented. Stockpiles should be located within a designated area away from waterways, drainage points and sensitive receiving environments. This location should protect stockpiles from prevailing winds. The stockpiles should be contoured to minimise erosion during high rainfall events and stormwater diverted away from stockpiles using a drain or earth bank. A CEMP would be required to mitigate any risk regarding stockpiles. Minimising the number of stockpiles and the area / duration that the stockpiles are exposed would reduce risk. Locating stockpiles away from drainage lines and where they will be least susceptible to wind erosion. The Project should implement the guidance and mitigations outlined in EPA Victoria Publication 1895 - Managing Stockpiles.	**Low**
D02	Construction	Construction material, waste, hazardous substances or sedimentation generated through the construction of the operational and maintenance facility, Battery Energy Storage System (BESS), concrete batch plants, substations, footings and hardstand areas. Waste and sediment has the potential to be transported to drainage lines, impacting natural or existing drainage regimes by impeding drainage and reduction of environmental values such as visual amenity and aquatic ecosystem health.	Construction waste and material should be properly managed on site and minimised through planning and efficient use of materials. The Project must implement waste management protocols, designate appropriate waste storage areas and ensure that these are well maintained and monitored. On-site refuelling, service or maintenance should be carried out away from areas where runoff or wastewater may enter the stormwater system or surface waterbodies. All equipment washdown activities should be carried out within a pre-determined and bunded washdown area. This will reduce the risk of waste and hazardous materials ending up in the minor drainage line that runs through the Project Area. A CEMP should be prepared to outline storage of materials and waste.	**Low**
D03	Construction / Operation	Changes to the topography as a result of grading or levelling has the potential to create changes to local flow paths. It may also cause areas for water to pool	Changes to topography should be minimised as a result of construction and earthworks within the Project Area. A stormwater management plan to mitigate any impacts to overland flow paths will be required to support the planning application.	**Low**

Impact code	Phase	Impact description	Mitigation measures	Residual Risk
		and create localised waterlogging issues.	The design of the site drainage infrastructure should accommodate overland flow paths.	
D04	Operation	An increase of impermeable surface area due to construction of concrete foundations, hardstand areas, access tracks and footings could increase surface runoff and increase the risk of local flooding / drainage impacts.	The design should consider stabilisation of the concentrated flow pathways off the impermeable hardstand to prevent erosion. Opportunities to intercept and retard peak stormwater flows should be investigated such as beneficial water reuse (vegetation planting / site amenities). As part of the CEMP, a stormwater management plan to mitigate any short-term / localised impacts as a result of increased runoff, will be prepared to support the planning application.	**Low**

6.2 Flooding

Table 6-2 Flooding impacts associated with the Project

Impact code	Phase	Impact description	Mitigation measures	Residual risk rating
F01	Construction	The increase of impermeable surfaces for the construction of the BESS, access roads, hardstands and the operational and maintenance facility have the potential to increase runoff which may increase flood risks around the site.	The Project should consider the management of stormwater as part of the EMP, to mitigate localised and short term impacts to stormwater runoff.	**Low**
F02	Operation	Construction of any Project infrastructure either within or immediately adjacent to waterways or ephemeral waterbodies increases the potential of the infrastructure being flooded during or following high rainfall events. Building within depressions across the site may result in the displacement or diversion of storm water flows. This may result in an increase in localised flooding in the immediate vicinity of the newly constructed infrastructure.	Avoid locating Project infrastructure adjacent to waterways or within depressions across the site to avoid increasing flood levels or diverting flood flows. Design of the site drainage infrastructure should accommodate overland flow paths to prevent any increase in flood levels against the newly constructed infrastructure. A stormwater management plan to mitigate any short-term / localised impacts as a result of increased runoff, will be required to support the planning application.	**Low**
F04	Operation	The Project has the potential to affect flooding of the region on the proposed Infrastructure.	The Project Area does not sit within the 1% AEP flood event layer for the Loddon or Avoca River.	**Low**

6.3 Groundwater

Table 6-3 Groundwater impacts associated with the Project

Impact code	Phase	Impact description	Mitigation measures	Residual risk rating
G01	Construction	The Project will require some excavation works and there is the potential that excavations may intercept shallow groundwater potentially present in the north east corner of the Project Area, for example around potential GDEs. If excavations result in groundwater interactions, there is potential for groundwater intrusion into works area.	Groundwater within the majority of the Project Area is deep, likely to range between 20 and 50 m bgl and therefore unlikely to be encountered during construction. However in the north east corner of the Project Area, the groundwater is shallow and within 10 m of the surface. If dewatering is required, an impact assessment should be completed to assess potential impacts on GDEs.	**Low**
G02	Construction	Dewatering activities, if required, will need to consider disposal of saline groundwater.	Groundwater within the Project Area deep, likely to range between 20 and 50 m bgl and therefore unlikely to be encountered during construction. However groundwater is shallower in the north east corner of the Project Area. If groundwater is encountered and dewatering is necessary, the Project should consider the disposal of saline groundwater. Depending on the volume of groundwater, disposal could occur via infiltration pits or reinjection into the groundwater.	**Low**
G03	Construction/Operation	The increase of impermeable surfaces for the construction of the BESS, access roads, hardstands and the operational and maintenance facility have the potential to increase runoff which may cause groundwater saturation in areas of shallow groundwater.	As the groundwater depth will likely be more than 20 m bgl, any runoff increases are unlikely to cause groundwater saturation. However, if shallow groundwater is identified during geotechnical site investigations, stormwater management and erosion control practices should be implemented during construction to stabilise soils and reduce runoff potential. The use of vegetated swales, detention basins, permeable pavements and infiltration trenches may be considered during design to reduce runoff and promote infiltration during heavy rainfall events.	**Low**

6.4 Sensitive Receiving Environments and Water Quality

Table 6-4 Water Quality impacts associated with the Project

Impact code	Phase	Impact description	Mitigation measures	Residual risk rating
WQ01	Construction	A key potential impact from construction work is an increase in sediment runoff from disturbed construction areas and exposed soil. Construction activities will result in soil disturbance with disturbed areas being more vulnerable to erosion and the generation of sediment during rainfall events. Any increase in sediment loads has the potential to impact on receiving waterways.	Implement appropriate sediment and erosion control measures to minimise the amounts of sediment entering the waterways. This should be done both throughout the construction period (where more rigorous sediment controls will need to be implemented due to high soil disturbances associated with excavation works) and operational period. During construction, divert clean stormwater away from the parts of the site where the soil will be disturbed, to not contaminate clean stormwater Prevent dust generation by applying dust suppression methods, to avoid increase in dust and soils entering waterways. In general, these measures can be achieved through compliance with all industry standard guidelines relating to construction, sediment and erosion control.	**Low**
WQ02	Construction / Operation	There is the potential for spillage of chemicals such as oils, fuels, and sprays associated with construction activities. Spills or leaks of liquids have the potential to impact water quality and aquatic biota in waterways and wetland within the Project Area and downstream. Spills and leaks can also collect on constructed hard surfaces, and wash into waterways with stormwater runoff.	Implement appropriate spill control and bunding measures to control and contain spills, minimise the amount of fuels and chemicals stored on site and implement contingency plans to handle spills and document in CEMP.	**Low**
WQ03	Construction/ Operation	An increase in the proportion of impervious surfaces in the Project Area could result in higher flow peaks and shorter flow durations during rainfall events. This can in turn result in an increase in pollutant and sediment transport to waterways, and can also create in-stream scour, generating	The Project should consider site planning and design to reduce the areas of impervious surfaces and to promote the infiltration of stormwater during rainfall events to reduce peak flows. Stormwater management and erosion control practices should be implemented during construction to stabilise soils and reduce runoff potential. The Project should consider the maintenance of riparian vegetation during operation, which will enhance natural infiltration of overland flow increased by impervious surfaces.	**Low**

Impact code	Phase	Impact description	Mitigation measures	Residual risk rating
		additional sediment loads in receiving waterways.		
WQ04	Operation	Clearing of vegetation from the site could lead to increased erosion and sediment runoff. Loss of riparian or site vegetation can lead to a loss of natural nutrient buffer/filter capacity. This can result in greater concentrations of sediment and nutrients entering waterways in surface runoff.	Avoid any instream or riparian works that could cause direct damage to waterways, including loss of riparian or instream vegetation, or construction or installation of instream barriers.	**Low**

7 Conclusions and Recommendations

The potential impacts to surface water and groundwater associated with the development of the Meering West Wind Farm development at the Project Area are manageable with the right mitigation measures.

7.1 Surface Water

The Project Area is situated in the catchment areas of both the Avoca River as well as the Loddon River which flow to the north towards the Murray River. The low rainfall and sandy soils mean much of the rainfall is infiltrated to the groundwater rather than generating runoff and flowing towards the rivers.

Surface water has the potential to be impacted by the Project due to sedimentation, increased flow rates due to an increase in impermeable surfaces and changes in topography. Multiple unnamed ephemeral drains which flow across the Project Area have the potential to carry sediment and contaminants to the surrounding surface water and potential CMA approvals may be required to conduct works on the waterway.

The broader Loddon catchment contains an internationally recognised Ramsar Wetland and several terminal lakes which provide habitats for water dependent bird and animal species. These are located approximately 13 km north of the Project Area.

Lake Meran is situated 2 km to the north east of the Project Area and is largely supported by natural flooding and environmental allocation due to limited water availability.

Without appropriate measures, surface water has the potential to be impacted by the Project due to sedimentation, increased flow rates due to an increase in impermeable surfaces and changes in topography.

Multiple unnamed ephemeral drains which flow across the Project Area have the potential to carry sediment and contaminants to the surrounding surface water and potential CMA approvals may be required to conduct works on the waterway.

7.2 Groundwater

The geology beneath the Project Area is comprised of the Parilla Sand Formation and the Renmark Group. The Shepparton Formation outcrops to the east and west of the site and is the main aquifer in the floodplain of the Avoca and Loddon Rivers.

The depth to groundwater is relatively deep, with the watertable below 20 m bgl so the risk of intersecting the watertable during construction is low, except in the north east corner of the site where groundwater is within 7 m of the surface. Groundwater salinity is also high and consequently groundwater use is limited.

There are 20 existing bores located across the site and these could be encountered during construction. Works should be avoided near these bores, however if encountered, they may need to be decommissioned in accordance with the Minimum Construction Requirements for Water Bores in Australia.

7.3 Potential Impacts and Recommendations to Mitigate Impacts

Potential impacts to surface and groundwater are generally considered to be low and key impact mitigation measures can be incorporated into a CEMP to manage drainage on site.

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Appendix A – Borehole Data

Borehole data within a 1 km of the Project Area collected from Visualising Victoria's Groundwater (VVG) 2025.

Data in bold represents boreholes consistently monitored as a part of the Victorian State Water Measurement Information System (WMIS).

Bore ID	Easting	Northing	Year Constructed	Constructed depth	Average Standing Water Level (m AHD)	Aquifer
6581	750722	6022927	1976	19.3	13.6	Parilla Sand
6582	751922	6026277	1976	14.6	7.9	Parilla Sand
6583	750922	6030577	1976	11.0	7.5	Parilla Sand
6584	751122	6035727	1976	21.0	17.0	Parilla Sand
26063	740422	6023177	1989	30.0	14.9	Parilla Sand
26064	746222	6023077	1989	37.0	33.4	Parilla Sand
36188	752722	6026277	1990	2.5	0.9	Shepparton
36189	752722	6026277	1990	9.0	3.5	Shepparton
36190	752722	6026277	1990	9.0	4.0	Shepparton
41204	751112	6022880	1971	50.0	Not recorded	Parilla Sand
41205	750953	6022888	1971	15.2	Not recorded	Parilla Sand
41206	750790	6022887	1971	40.0	Not recorded	Parilla Sand
52363	743526	6033761	1987	154.8	28.5	Renmark Group
52364	743534	6033759	1988	70.0	28.4	Parilla Sand
52365	743544	6033763	1988	12.5	11.6	Parilla Sand
52366	744205	6033458	1968	39.6	Not recorded	No Data
75323	744222	6016077	1991	120.0	22.7	Renmark Group
75324	744222	6016077	1991	41.5	23.9	Parilla Sand
77855	751916	6026310	1986	112.0	7.4	Renmark Group
77856	744629	6026511	1987	134.0	39.6	Renmark Group
89308	732461	6023351	1988	173.0	28.6	Renmark Group
89309	732462	6023359	1988	92.0	29.9	Parilla Sand
89310	732462	6023363	1988	27.0	28.0	Parilla Sand
111323	744630	6026502	1992	50.0	41.4	Parilla Sand
307832	742010	6023134	1981	132.0	Not recorded	No Data
311184	749371	6035199	1981	130.0	Not recorded	No Data
WRK089695	753186	6027081	2015	9.0	Not recorded	No Data
WRK089696	753186	6027081	2015	9.0	Not recorded	No Data
WRK089697	753186	6027081	2015	9.0	Not recorded	No Data
WRK957843	753208	6030479	2008	7.0	Not recorded	No Data
WRK957844	753344	6030445	2006	7.0	Not recorded	No Data
WRK957845	753022	6028783	2005	8.5	3.3	No Data
WRK957846	753388	6028915	2007	8.5	3.9	No Data
WRK957847	753525	6028382	2008	7.0	3.4	No Data

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