Marri Wind Farm

Preliminary Water Resources Impact Assessment

Alinta Energy

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Document control record

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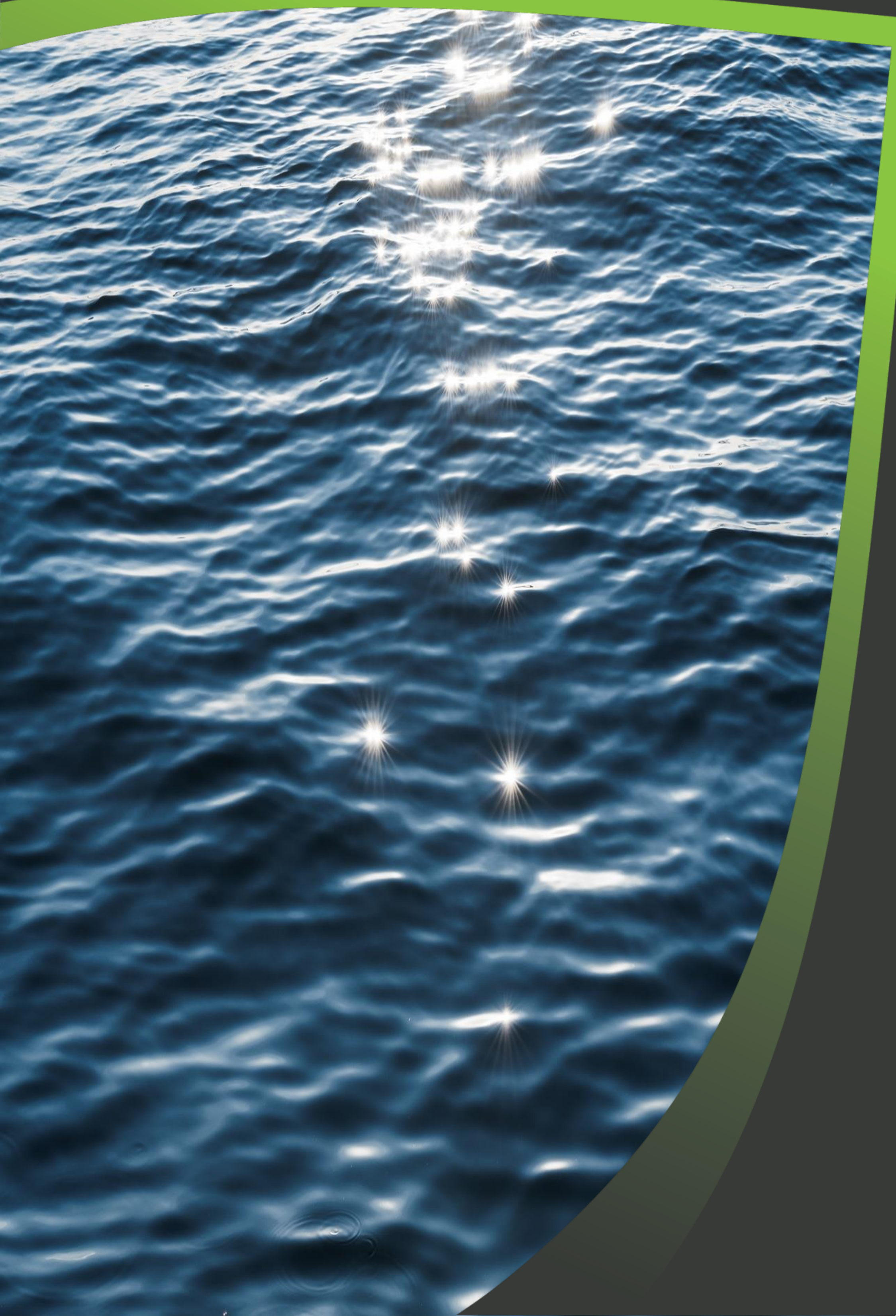


1 Introduction

1.1 Project summary

Alinta Energy is seeking approval to develop the Marri Wind Farm (the project), located approximately 20 kilometres (km) south of the township of Dandaragan, within the Shire of Dandaragan (refer to Figure 1-1). The project includes the construction of up to 82 wind turbines (WTGs), with a generation capacity of up to 550 MW, and also incorporates a Battery Energy Storage System (BESS) with a capacity of up to 6,600 MWh, along with associated infrastructure. The project is situated within a designated Development Envelope (DE) of approximately 12,550 hectares (ha), encompassing freehold land and road reserves.

The location was selected due to its predominantly cleared landscape, historical use for agriculture, and low population density. These agricultural areas have been extensively cleared over time, minimising the potential for significant impacts on native vegetation.

The project is intended to contribute to Western Australia's clean energy transition and emissions reduction targets. These objectives are aligned with the priorities outlined by the Western Australian Government, supporting the shift towards a sustainable and low-carbon energy future.

1.1. Objective of this report

The objective of this Preliminary Water Resources Impact Assessment (WRIA) is to evaluate the potential water-related considerations associated with the proposed project. Specifically, this report aims to:

- Characterise the existing surface water and groundwater conditions within the project area
- Assess the potential water demand throughout the project's lifecycle, including construction, operation, and decommissioning phases and identify feasible water supply options to meet the project's needs.
- Assess the potential impacts of the project on the surface water and groundwater environment throughout the project lifecycle
- Propose management and mitigation measures to minimise potential adverse effects on the surface water and groundwater environment in accordance with relevant regulatory requirements.

1.2 Scope of study

This WRIA addresses the potential water-related aspects of the project across all phases of development, including construction, operation, and decommissioning. The scope of the study includes:

- Characterisation of the existing environment, including climate, surface water, groundwater, hydrology, soils, and identification of sensitive receptors and water-dependent ecosystems within the project area.
- Estimation of the project's water demand for each phase of development, considering key assumptions regarding construction, operation and decommissioning activities.
- Identification and evaluation of potential water supply sources, including a preliminary assessment of supply feasibility and constraints and recommend a water supply strategy.

- Qualitative assessment of the potential impacts of the project on local and regional surface water and groundwater resources, including potential changes to surface water flows, groundwater levels, surface and groundwater quality, and the availability of water for other users.
- Identification of management and mitigation measures to avoid, minimise, or offset potential impacts on surface water and groundwater resources, in accordance with regulatory and policy frameworks.
- Provision of recommendations to guide future investigations, water management planning, and environmental approval processes.

1.3 Assumptions, limitations and exclusions

Preparation of this document has relied on the following assumptions, limitations, and exclusions:

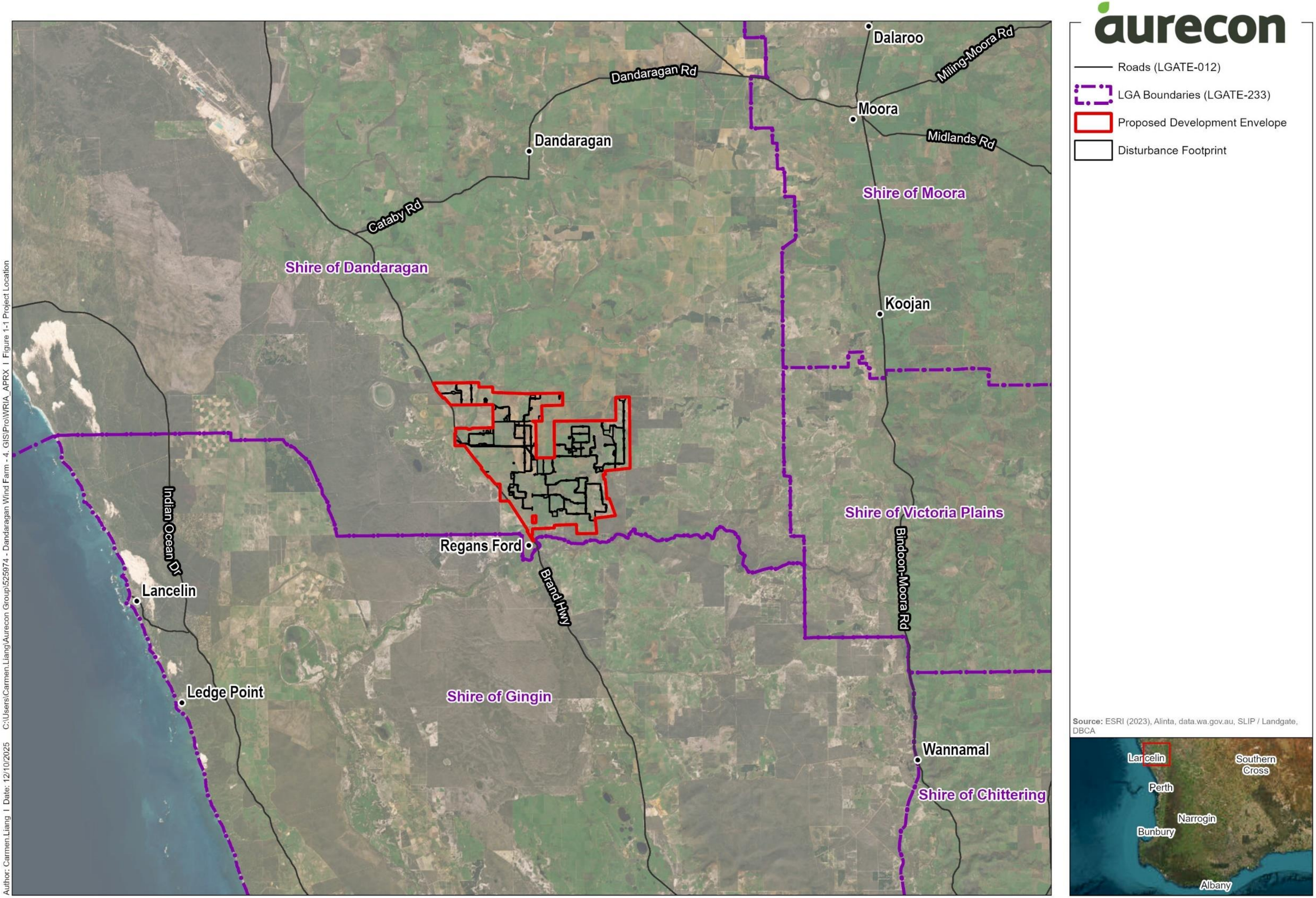
- The assessment is based on the project design communicated to Aurecon as at 23/09/2025, including the proposed number and locations of WTGs, infrastructure layout, and associated project components. Any changes to the project design after this date may affect the findings of this report.
- Flood impacts are addressed separately in the flood risk assessment.
- The assessment of existing soil, groundwater and surface water contamination is not part of this assessment.
- No site visits or field investigations were conducted to support this preliminary assessment. The study is based on desktop analysis and publicly available datasets.
- No consultations with landholders, water users, Traditional Owners (TOs), or other stakeholders were undertaken at this stage. Further engagement may be required as the project progresses.
- Water demand estimates are preliminary and based on typical construction and operational assumptions for projects of this nature. These figures may be refined as project planning advances.

These assumptions and limitations should be considered when interpreting the findings and recommendations of this report.

1.3.1 Information gaps

No surface water or groundwater features were inspected or monitored. No publicly available water quality data was available for Caren Caren Brook. As such various information gaps exist, these include:

- Surface water gauging for Caren Caren Brook
- Water quality data for Moore River at the project area and Caren Caren Brook
- Groundwater quality data
- Groundwater levels
- Actual groundwater allocations available for purchase within the project are



Marri Wind Farm Water Resource Impact Assessment

Figure 1-1 : Project location

Version: 1
Job No.: 525974
Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:405,000

2 Project description

The project involves the construction, operation, and eventual decommissioning of the Marri Wind Farm, a renewable energy generation facility located within the Shire of Dandaragan, Western Australia. The project is situated predominantly on previously cleared agricultural land and aims to support the transition to clean energy in Western Australia.

2.1 Key Components

The project includes the following physical and operational elements:

- Wind Farm Infrastructure:
  - Installation of up to 82 WTGs, each with a hub height of 275 m, located within a defined Development Envelope (DE) of 12,550 ha.
  - Construction of turbine foundations and hardstands.
  - Development of internal and external access roads and service corridors.
  - Electrical connections, substations, and grid connection infrastructure.
  - Control room, operational and maintenance facilities, and permanent meteorological masts.
  - BESS with a storage capacity of up to 6,600 MWh.
  - Communication towers.
  - Temporary laydown areas, construction compounds, site offices, workshops, and utilities for the duration of construction.
- Transmission Infrastructure:
  - Construction of a 330 kV overhead transmission line to connect the wind farm to the existing Western Power network via an approximately 15 km transmission line spur.
  - Associated power poles, hardstands, and overhead power reticulation throughout the wind farm project area.
- Water Supply and Management:
  - Water required for construction, operation and decommissioning.
  - Water transfer and storage systems across the project area, as required.
  - Surface water management infrastructure to manage onsite drainage.
- Other Supporting Infrastructure:
  - Concrete batching plant(s) with a maximum output capacity of 240 m^3/hr (construction phase only).
  - Fuel storage facilities.
  - Fencing and firebreaks installed along the proposed Development Envelope.

2.2 Project Phases

The project will be implemented in the following phases:

- Construction phase:
  - Estimated duration of 36 months.
  - Includes earthmoving, site preparation, installation of project infrastructure, and temporary construction facilities.
  - Use of plant and equipment, resulting in Scope 1 greenhouse gas emissions of approximately 12,500 tCO_2e over the construction period.
  - Land clearing of up to 6.3 ha of native vegetation.
- Operational phase:
  - The operational life of the project is anticipated to be +35 years.
  - The project will supply renewable energy to the Western Power network, supporting the decarbonisation of the State's energy grid.
  - Scope 3 emissions associated with turbine manufacturing, transport, and maintenance are acknowledged but will be offset by the renewable energy generation.
- Decommissioning phase:
  - Occurs at the end of the operational life or lease term.
  - Options include full decommissioning or potential repowering with upgraded turbine models.
  - Decommissioning activities will include the removal of turbines, BESS units, ancillary infrastructure, and rehabilitation of disturbed areas, in consultation with stakeholders and landowners.

2.3 Environmental Considerations

The project has been designed to minimise environmental impacts by:

- Locating the majority of infrastructure on previously cleared agricultural land.
- Limiting native vegetation clearance to a maximum of 6.3 ha, with the final footprint expected to be refined during detailed design.
- Layout has been adjusted to avoid direct disturbance of mapped geomorphic wetlands or where mapped geomorphic wetlands comprise areas of cropping land the layout has avoided the identifiable wetland features
- The proposed cable corridor crossing of Caren Caren Brook between WP73 and WP23 will be undertaken via directional drilling below the invert of the creek to avoid disturbance of the waterway and riparian vegetation

3 Legislation and policy

3.1 Relevant legislation and regulation

Table 3-1 summarises the applicable Commonwealth and State legislation and regulation deemed relevant for the WRIA.

Table 3-1 Relevant Commonwealth and State legislation

Authority	Legislation	Approval required	Activity / impact
Department of Water and Environmental Regulation (DWER)	*Environmental Protection Act 1986* (EP Act)	The EP Act is the principal environmental legislation governing environmental protection and impact assessment in Western Australia. Part IV Division 1, administered by DWER for the EPA, assesses proposals with potential significant environmental impact. Proposals are referred to the EPA under Part IV if they could significantly impact environmental factors as defined by the EPA.	Construction, operation and decommissioning of the Wind Farm and supporting infrastructure
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	*Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)	The EPBC Act is the Commonwealth legislation, administered by DCCEEW, that provides a legal framework to protect Matters of National Environmental Significance (MNES). MNES include world heritage properties, national heritage places, international wetlands, threatened species and ecological communities, migratory species, Commonwealth marine areas, water resources related to coal seam gas and large coal mining activities, the Great Barrier Reef Marine Park, and nuclear actions. Controlled Actions, defined in Section 67, are those likely to significantly impact MNES and require approval under the EPBC Act.	Construction, operation and decommissioning of the Wind Farm and supporting infrastructure
DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)	The project is located within a Proclaimed Groundwater Area under RIWI Act. If groundwater abstraction is required, a Section 5C licence (water abstraction permit) may be necessary. It is understood that water for the project will be sourced from existing farm dams and/or bores. Therefore, a Section 26D licence is unlikely to be required, but a Section 5C licence will be necessary—either a new licence or an amendment to an existing one. Water for concrete would be the responsibility of the concrete supplier. The project is also located within a Proclaimed Surface Water Area under the RIWI Act. If any works are required off-tenure, potential impacts may need to be assessed through the Bed and Banks permit process, which could involve a new section 11, 17 or 21A permit to interfere with bed and banks, or an amendment to an existing one.	Construction of a bore and dewatering Interference with, or taking water from a watercourse

3.2 Relevant policies and guidelines

Table 3-2 provides a summary of the relevant policies and guidelines considered in this assessment.

Table 3-2 Relevant policies and guidelines

Authority	Document	Relevance to this assessment
Environmental Protection Authority (EPA)	Environmental Factor Guideline – Inland Waters	This guideline provides guidance on what information is required by the EPA regarding water hydrology and water quality impacts for an Environmental Impact Assessment (EIA) in Western Australia. It highlights the need to understand, avoid, minimise, and manage any impacts from all phases of the project lifecycle supported by detailed baseline data, impact modelling, and adaptive management in conformity with EPA expectations.
EPA	Statement of environmental principles, factors, objectives and aims of EIA	This EPA Statement offers general guidance relevant to what should be included in an Environmental Impact Assessment for projects in Western Australia; and how it will be assessed by the EPA. It outlines broad environmental principles and objectives to be considered during assessment and encourages a structured approach to evaluating potential impacts throughout a project's lifecycle, including implementation of mitigation hierarchy; consideration of cumulative, off-site and long-term effects; and incorporation of rehabilitation and adaptive management measures to meet the State's environmental protection objectives.
Department of Water (DoW) (merged with D. Environmental Regulation in 2017 to become DWER)	Gingin Groundwater Allocation Plan	Provides allocation limits, licensing requirements and management approach for groundwater abstraction within the Gingin groundwater area. Relevant to confirm whether the project area intersects with the plan boundary and to ensure that any potential groundwater abstraction for construction or operation would align with allocation limits and licensing conditions.
DoW	Gingin Surface Water Allocation plan	Sets out management objectives, allocation limits and licensing requirements for surface water resources in the Gingin area. Relevant to this assessment to identify whether surface water features in or near the project area fall under the plan, and to guide consideration of potential impacts to surface water availability.
DoW	Lower Moore River – River Action Plan	Outlines management actions for riparian condition, water quality and habitat values along the Lower Moore River. Relevant as the project lies within the Moore River catchment and the plan provides context for identifying and mitigating potential downstream impacts to riverine environments.
DoW	Moore River Floodplain Management Study	Identifies flood risk areas and provides guidance for land use planning and development within the Moore River floodplain. Relevant to ensure the project considers potential flood risk and incorporates appropriate avoidance and management measures for infrastructure siting.

Authority	Document	Relevance to this assessment
DWER	Gingin groundwater allocation plan	Defines allocation limits, groundwater-dependent ecosystem protections and management objectives for the Gingin groundwater system. Relevant because the project area occurs within proximity to this groundwater system; ensures that the assessment of potential drawdown or water use aligns with the plan's sustainable management framework.
DWER	Water Quality Protection Note 6: Vegetation buffers to sensitive water resources	This document offers essential strategic principles and practical recommendations on retaining, maintaining or re-establishing vegetated buffer zones between land use activities and sensitive water resources. The objective is to protect water quality and ecosystem health by managing runoff, reducing erosion, and mitigating contamination risks through appropriately designed and maintained vegetation buffers.
DWER	Water Quality Protection Note 30: Groundwater monitoring bores	The document provides detailed recommendations on the siting, construction, and maintenance of groundwater monitoring bores designed to measure groundwater levels and quality, should monitoring bores need to be constructed for this project.
DWER	Water Quality Protection Note 13: Dewatering of soils at construction sites	The document provides general guidance on managing the environmental risks associated with short-term dewatering activities during the construction phase of a project. It outlines potential impacts on surface water and groundwater and sets out preferred options and quality criteria for disposing of extracted groundwater.
DWER	Water Quality Protection Note 68: Mechanical equipment wash down	The document provides general guidance on managing the risks of water contamination from mechanical equipment wash down activities, which is relevant primarily to the construction phase of the project where equipment cleaning may occur. It highlights potential risks to surface water and groundwater from contaminants and provides guidance on location constraints for wash down facilities.
DWER	Water Quality Protection Note 65: Toxic and hazardous substances	The document offers guidance on the storage, handling, and management of toxic and hazardous substances (THS) to protect surface water and groundwater quality.
DWER	Water Quality Protection Note 18: Information the Department of Water requires to assess a proposed development or activity	This document specifies the information requirements of the Department of Water for assessing proposed developments or activities near sensitive water resources to ensure protection of surface water and groundwater quality. The note outlines a comprehensive list of data that proponents must provide, including technical and environmental data, project activity details, water use and management, contaminant handling and mitigation, stormwater and drainage management, and monitoring and contingency.
DWER	Water Quality Protection Note 10: Contaminated spills - emergency response plan	The document provides comprehensive guidance on preparing and implementing an Emergency Response Plan (ERP) to manage and mitigate contaminant spills that could impact surface water and groundwater quality.

Authority	Document	Relevance to this assessment
DWER	Water Quality Protection Note 3: Using water quality protection notes	The document provides Water Quality Protection Notes (WQPNs) which are the Western Australian Department of Water's recommendations for best practice guidance to minimise contamination risks to surface water and groundwater, supporting sustainable water resource management.
DWER	Water Quality Protection Note 14: Statutory approvals	The document outlines the key statutory approvals and relevant Western Australian legislation that developers must consider ensuring protection of surface water and groundwater.
Barnett et al (2012, as revised)	Australian Groundwater Modelling Guidelines	The objective of the guidelines is to promote a consistent and sound approach to the development of groundwater flow and solute transport models in Australia. By following the guidelines, a comprehensive and defensible surface water and groundwater assessment can be produced.

4 Methodology

4.1 Assessment approach

The WRIA was undertaken in accordance with the EPA Inland Water Environmental Factor Guideline and included the following tasks:

- Desktop review of documents and data including:
  - Review of project description and design information (Section 2)
  - Legislation, policy and guidelines (Section 3)
  - Review of publicly available data (Section 4.3)
- Description of the climate, topography, land use, soils, surface water environments, geology, soils, hydrogeology and sensitive surface water and groundwater receptors, based on the desktop review (Section 5).
- Water demand and supply assessment. This includes an estimate of water demands during construction, operation, decommissioning/rehabilitation. This assessment provides a preliminary understanding of the availability and reliability of water sources and associated constraints for use (Section 6).
- Qualitative assessment of impacts to surface water quality, surface water quantity, geomorphology and groundwater during construction (Section 7), operation (Section 8) and decommissioning (Section 9). The residual risk of each impact was assessed based on the criteria listed in Section 4.2 with consideration to the proposed management or mitigation measures.
- Description of management or mitigation measures to eliminate or reduce the identified potential impacts.

4.2 Criteria adopted

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

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

This scale is displayed in a risk assessment matrix in Table 4-1 below.

Table 4-1 Qualitative risk assessment

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

4.3 Data sources

Table 4-2 lists the data sources used for analysis in this report.

Table 4-2 Data sources

Data	Source
Aerial Imagery	▪ Esri Geoscience Australia Topographic Basemap
Topography and land use	▪ Cadastre (Polygon) (LGATE-217) ▪ Reserves (LGATE-227) ▪ Generalised agricultural land use of Western Australia (DPIRD-003) ▪ Pastoral Stations (DPLH-083)
Climate data (daily rainfall, potential evapotranspiration)	▪ BoM Climate data online

Data	Source
Geology	▪ 1:500 000 State interpreted bedrock geology (DMIRS-016) ▪ 1:500 000 State linear structures layer (DMIRS-015) ▪ Linear structures 1:100 000 (DMIRS-053)
Soils and landforms	▪ Acid Sulfate Soil Risk Map 50K (DWER-049) ▪ Interim Biogeographical Regionalisation for Australia (IBRA) Regions (v7) ▪ Soil Landscape Mapping – Best Available (DPIRD-027) ▪ Soil Landscape Mapping – Rangelands (DPIRD-063) ▪ 2 metre contours (DPIRD-072)
Groundwater Bores	▪ Australian Groundwater Explorer (BoM) ▪ The Australian Groundwater Explorer provides access to a wide range of groundwater data, including around 900 000 bore locations, bore logs, groundwater levels, salinity, hydrochemistry, 3D groundwater models, groundwater management areas and landscape characteristics. ▪ Bore locations within the groundwater study zone have been taken from this source. ▪ Baseline bore assessments (undertaken during the fieldworks)
Watercourses and water bodies	▪ EPA Environmental Factor Guideline – Inland Waters 2018 ▪ Wild Rivers (DWER-087) ▪ Groundwater Salinity Statewide (DWER-026) ▪ Hydrographic Catchments - Basins (DWER-027) ▪ Hydrographic Catchments - Catchments (DWER-028) ▪ Hydrographic Catchments - Divisions (DWER-029) ▪ Hydrographic Catchments – Sub-catchments (DWER-030) ▪ Hydrography, Linear Hierarchy (DWER-031) ▪ Public Drinking Water Source Areas (DWER-033) ▪ RIWI Act, Groundwater Areas (DWER-034) ▪ RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037) ▪ Waterways Conservation Act Management Areas (DWER-072) ▪ WRIMS – Groundwater Subareas and Areas (DWER-083, DWER-085) ▪ WRIMS – Groundwater Resources (DWER-084) ▪ WRIMS – Surface Water Subareas and Areas (DWER-080, DWER-082) ▪ WRIMS – Surface Water Resources (DWER-081)
Wetlands	▪ Directory of Important Wetlands in Australia - Western Australia (DBCA-045) ▪ Ramsar Sites (DBCA-010)
Floodplain	▪ FPM Floodplain Area (DWER-020)

Data	Source
Flora and Vegetation (including GDEs)	▪ Groundwater Dependent Ecosystems Atlas (BoM) ▪ Threatened and Priority Flora (DBCA-036) ▪ Threatened Ecological Communities (DBCA-038) ▪ Directory of Important Wetlands in Australia - Western Australia (DBCA-045) ▪ Groundwater Dependent Ecosystem (GDE) Atlas (BOM, 2025)
Subterranean Fauna	▪ EPA Environmental Factor Guideline – Subterranean Fauna 2016 ▪ Regolith of WA – 500 metre grid (DMIRS-017) ▪ Groundwater Dependent Ecosystem (GDE) Atlas (BOM, 2025)

5 Existing environment

5.1 Climate

The project is situated in a region characterised by a warm Mediterranean-style climate, consistent with the broader Dandaragan Plateau and Perth subregions. The Dandaragan Plateau IBRA (Interim Biogeographic Regionalisation for Australia) subregion receives an average annual rainfall of approximately 700 mm (Desmond, 2001), while rainfall across the Perth IBRA subregion ranges between 600 and 1000 mm annually (Mitchell, Williams, & Desmond, 2002).

To characterise the local climate conditions, data was sourced from the Bureau of Meteorology's Gingin Aero station (station no. 009178; Latitude: 31.46°S, Longitude: 115.86°E), located around 55.8 km south of the project area (BOM, 2025). At the Gingin Aero station, the highest mean maximum monthly temperatures (around 33.3°C) occur in January and February, while the lowest are observed in July at approximately 18.4°C. Minimum monthly temperatures typically reach their lowest in July and August (averaging 6.6°C), and peak in February at around 17.1°C. The station's mean annual rainfall is 633.8 mm, with the highest monthly averages recorded in the winter months: July (126.3 mm), June (109.4 mm), and August (108.2 mm) (Figure 5-1).

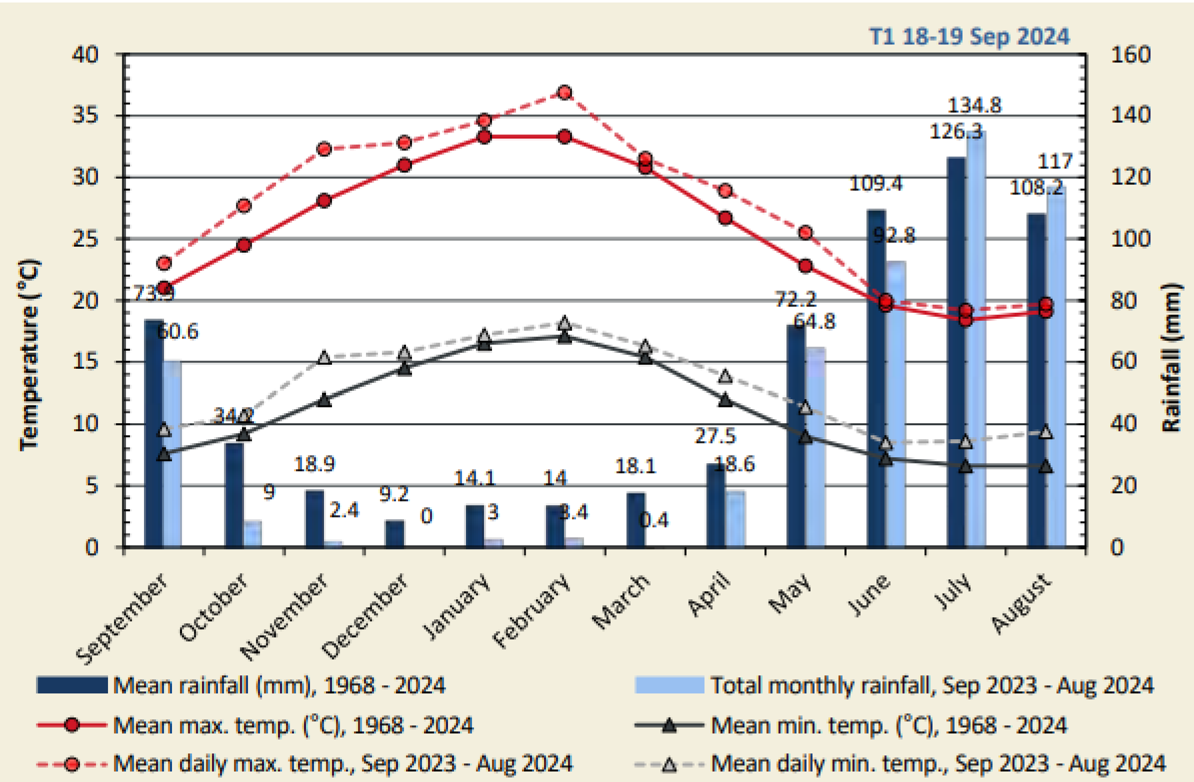


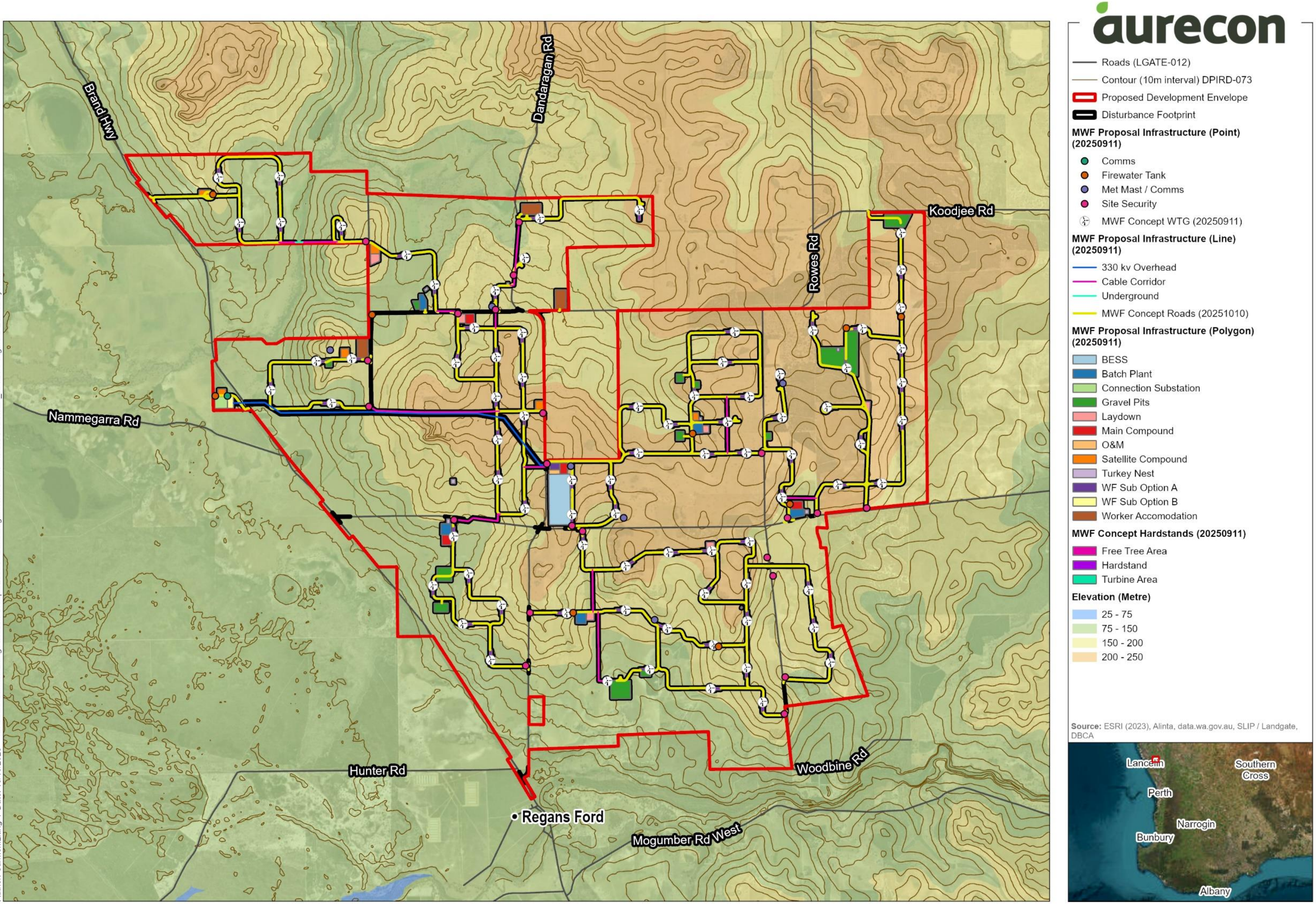
Figure 5-1 Annual climate and weather data for Gingin Aero (no. 009178) and mean monthly data for the 12 months preceding the survey

Source: (BOM, 2025)

5.2 Topography and land use

The local topography is shown in Figure 5-2. The elevation in the eastern half of the proposed Development Envelope is highest in the north and gradually declines towards Moore River in the south and south-west. In the western half of the proposed Development Envelope, the highest point is in the centre at approximately 230m. The elevation declines towards Caren Caren Brook in the north-west, and towards Brand Highway in the west and south-west. The highest point within the proposed Development Envelope is 240m in the north-eastern corner. The lowest point is approximately 100m, along Brand Highway (part of the western boundary) and the southern boundary, which sits just north of Moore River.

The land use within and around the project has primarily been used as dry land agriculture and therefore has a reduced conservation value due to prior land disturbance associated with agricultural land use. Other land uses include residential and recreation. Yandin Wind Farm is located directly north of the proposed Development Envelope, an existing wind farm comprising of 51 WTGs (Alinta Energy, 2025). Cataby Mineral Sands Project is also located less than 1 km to the northwest side of the project area.



Author: Carmen.Liang | Date: 13/10/2025 C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 5-2 Land Systems

Marri Wind Farm Water Resource Impact Assessment

Figure 5-2 : Topography

Version: 1

Job No.: 525974

Coordinate System: GDA2020 MGA Zone 50

A4 Scale: 1:100,000

5.3 Surface water

5.3.1 Catchment and watercourses

The project sits within two catchment boundaries, Minyulo-Caren Caren Catchment and the Moore River Catchment. Both are located within the proclaimed surface water area of the Moore-Hill Rivers Basin (DWER, 2020). A large proportion of the basin has been cleared, and the predominant land use is non-irrigated cropping. There are no major dams located within the basin area, and as such there is heavy reliance on groundwater (DWER, 2025). Receiving waterways for the project area include Caren Caren Brook and Moore River. Nearby water bodies include Namming Lake, Lake Guraga and local farm dams.

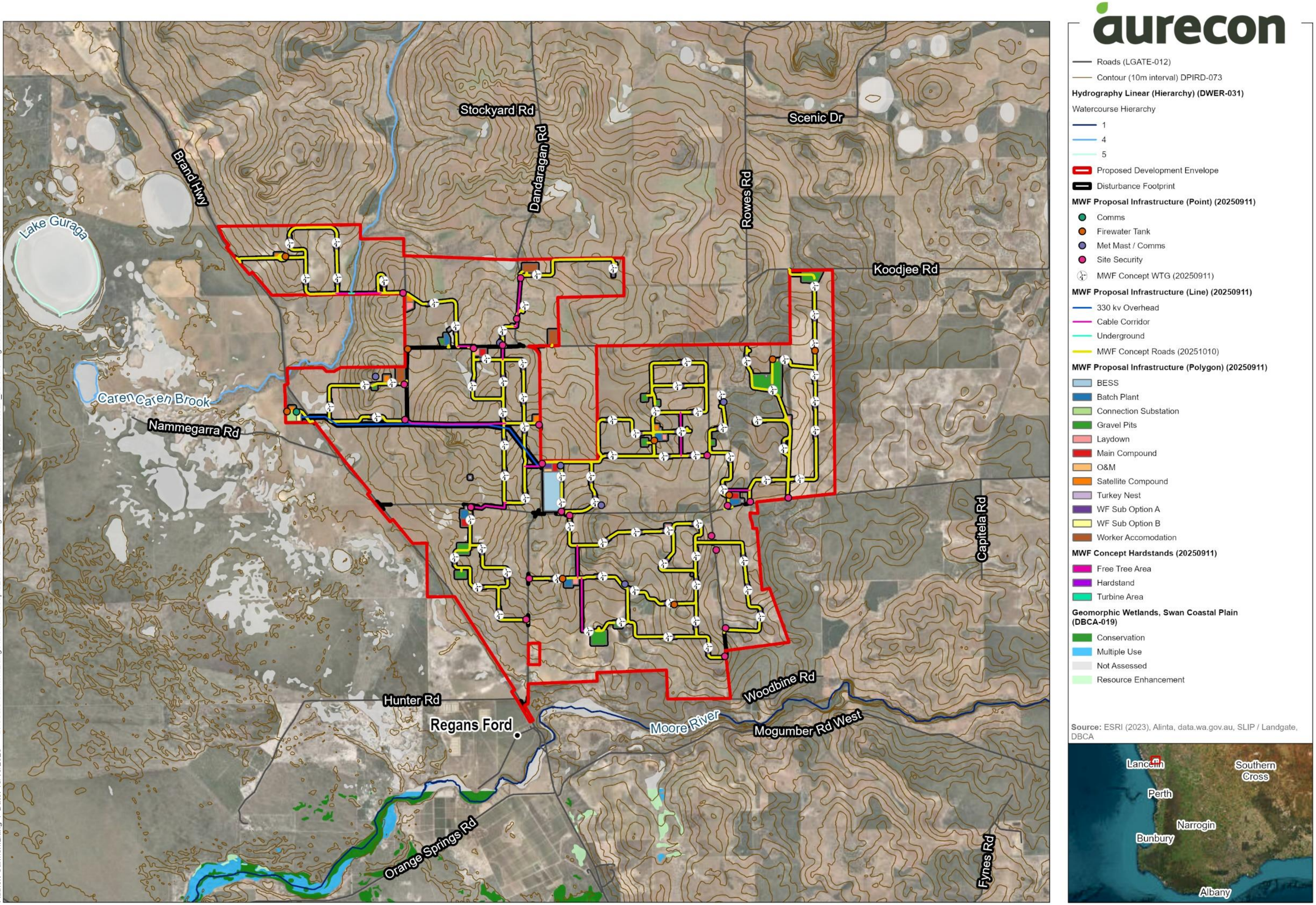
The Moore River is classified as a level 1 Mainstream (Government of Western Australia, 2021). It is located directly south of the project and would collect flows from the southern and eastern sections of the project area. Flows in the Moore River are seasonal, characterised by significant flows during winter rainfall periods and very low flows during the summer months, fed by groundwater only (DWER, 2025).

Caren Caren Brook intersects the project area in the north-west corner. It is classified as a level 4 stream, indicating that it is a Significant Stream (Government of Western Australia, 2021). Condition assessments of rivers sites in south-eastern Western Australia have been conducted as part of the Healthy Rivers Program. However, the condition of Caren Caren Brook has not yet been assessed (DWER, 2025). Caren Caren Brook is lined with riparian vegetation and feeds into Namming Lake. Information on the flow regime of Caren Caren Brook is not available, however, considering rivers in the region are seasonal, it is likely that Caren Caren Brook is also seasonal.

Namming Lake receives flows from Caren Caren Brook and is situated to the west of the proposed Development Envelope. There is no publicly available information about the origin, physical attributes and water quality of Namming Lake. However, there is information that indicates the Namming Lake is fed by the Perth-Superficial Swan Aquifer and has an allocation limit of 10,500 ML/year, a salinity range of 0-3000 mg/L TDS and a declining water level trend (DoW, 2014).

Lake Guraga is located directly north of Namming Lake and receives inflow from the Caren Caren Brook system. Lake Guraga is a macroscale round lake that is inundated on a near-permanent basis and is characterised as a “seasonal saline marsh” and “permanent saline/brackish lake” (Department of Environment and Conservation, 2009). It is designated as a wetland of national importance under criteria 1, 2, 3, 4 and 6 of the Directory of Important Wetlands in Australia (Department of Environment and Conservation, 2009).

Surface water features are presented in Figure 5-3.



C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 5-3 Surface Water Features

Author: Carmen.Liang | Date: 13/10/2025

Marri Wind Farm Water Resource Impact Assessment

Figure 5-3 : Surface Water Features

Version: 1
Job No.: 525974

Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:130,000

5.3.2 Flow and water regime

There is an active stream gauging station near the Moore River, known as Quinns Ford (station number 617001). This is approximately 1 km south of the proposed Development Envelope (DWER, 2025). Figure 5-4 shows the flow duration curve for the watercourse. The graph indicates that there is always some baseflow in the Moore River which would mean it can be classified as a perennial river. This baseflow is fed by groundwater, as indicated by the Western Australian Department of Water (2014). Flows are relatively low at most times, with flows being under 1 m^3/s 70% of the time and under 10 m^3/s 95% of the time. The seasonality of the flows is shown in Figure 5-5. As observed, the river flows at the beginning of winter in June and remain high in July and August, before decreasing in flow rate in September and remaining low for the remainder of the year.

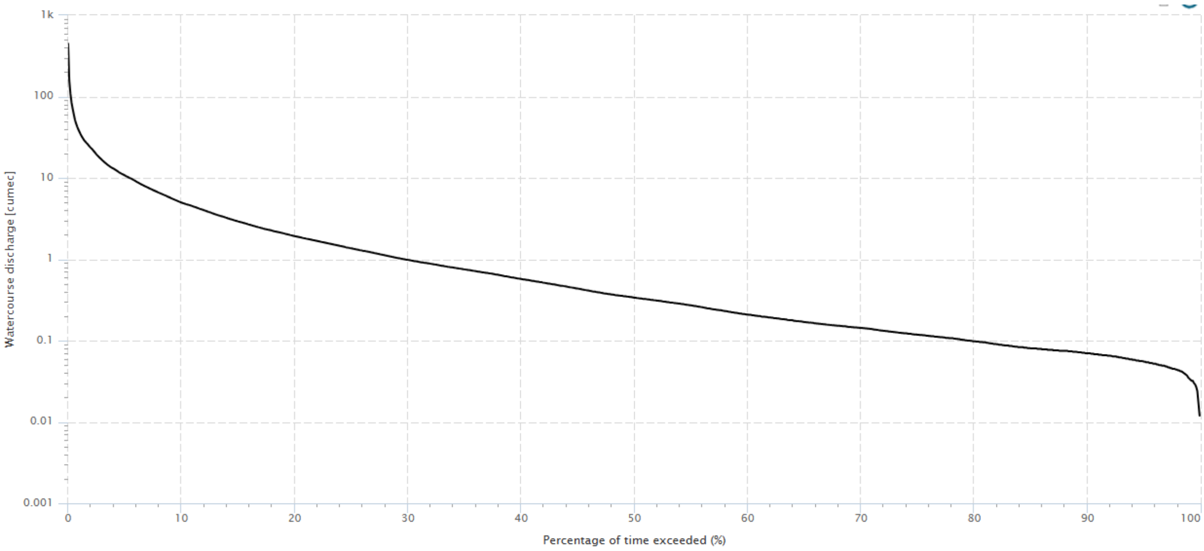


Figure 5-4 Flow duration curve for Moore River-Quinns Ford (station number 617001) (DWER, 2025)

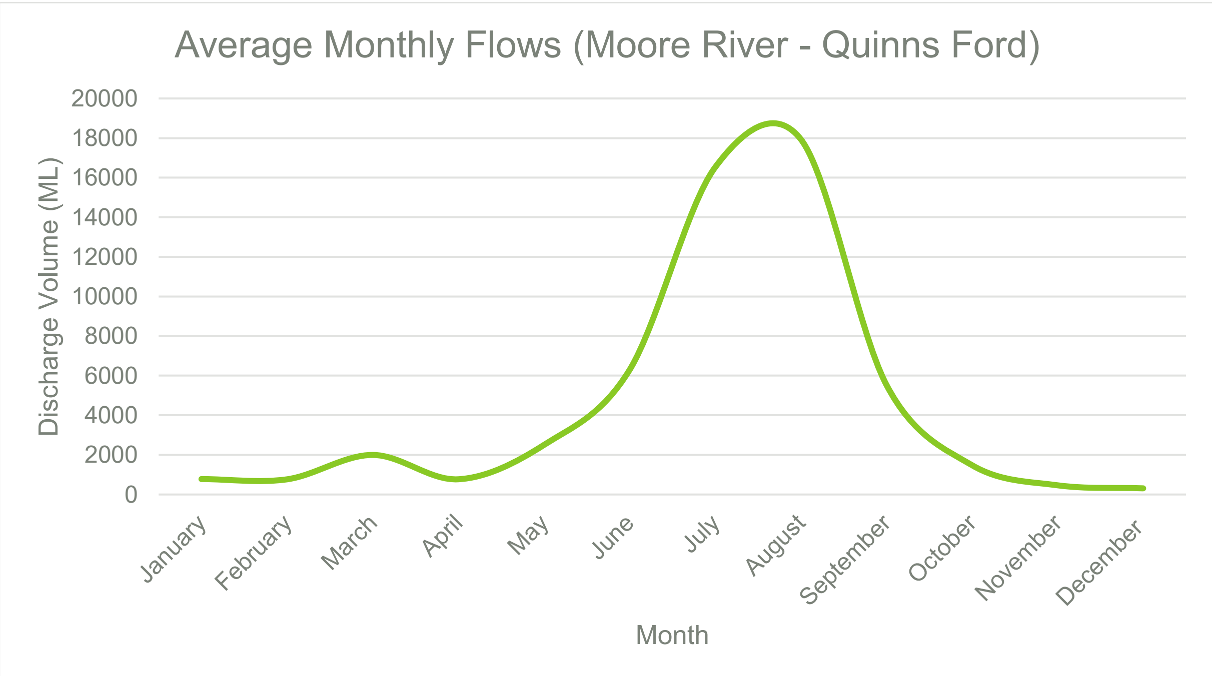


Figure 5-5 Average monthly flow volumes for Moore River-Quinns Ford (station number 617001) (DWER, 2025)

5.3.3 Water quality

Water quality data has been collected by the Department of Water's River Science team as part of the Healthy Rivers Program for a section of Moore River near Regans Ford, located approximately 2km to the south of the proposed Development Envelope. This data was provided by the Department's River Science Team and is reported on in Table 5-1. The water quality data has been compared to the trigger values set by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000). The values have been obtained from Table 3.3.6 from the guidelines for a lowland river in South-west Australia. A lowland river is defined as having an altitude of below 150m, and the monitoring site is at an altitude of approximately 90m.

As observed in the table, most water quality indicators are below or within an acceptable range of the ANZECC 2000 trigger values . However, salinity was recorded to be higher than the trigger values, of brackish quality. Between 1993 and 2002 the Moore River was recorded as having a mean salinity of 10,746 (µS/cm) (Department of Water, 2012). This high salinity in Moore River is due to its large catchment area which stretches north and inland into low-rainfall areas where rivers peter out in salt-lake systems (Department of Water, 2012). Salinity in Moore River varies with the seasons, with the lowest salinity observed during the summer months, which aligns with salinity results for February in 2023 and 2019 shown in Table 5-1. This is because the lower rainfall areas of the catchment do not contribute to the lower Moore River during summer, and fresher groundwater discharge dominated the river flow in the lower reaches (Department of Water, 2012). Turbidity was low (Feb 2023and Feb 2019) to moderate (October 2008). Dissolved oxygen was slightly below the trigger value range at times which may be the result of flow conditions or diurnal variation due to plant photosynthesis patterns which result in lower oxygen levels in the morning, with increasing oxygen releases throughout the day before ceasing photosynthesis at night.

No water quality data was available for Caren Caren Brook but it's likely that the water quality is similarly brackish.

Table 5-1 Water quality data for Moore River near Regans Ford

Water quality indicator	7 February 2023	26 February 2019	24 October 2008	ANZECC (2000) trigger values
Individual samples				
pH (no. units)	6.93	7.10	7.14	6.5-8.0
Temperature (°C)	23.60	23.80	21.40	-
Total Nitrogen (TN) (µg/L)	214	220	560	1200 µg/L
NH_3-N/NH_4-N (sol) (µg/L)	16.00	15.00	5.00	80 µg/L
Total Phosphorus (TP) (µg/L)	17.00	7.00	38.00	65 µg/L
PO_4-P (sol react) (µg/L)	16.0	2.5	2.5	40 µg/L
Turbidity (NTU)	1.90	1.40	18.00	10-20 NTU
Alkalinity ($CaCO_3$) (µg/L)	54,000	47,000	52,000	-
Dissolved Oxygen (DO) (% sat)	68.10	103.30	78.70	80-120%
Conductivity@ 25°C (µS/cm)	3089	2927	6750	120-300 µS/cm
24-hr measurements				
Temperature (°C)	23.53-25.75	22.54-24.03	-	-
pH (no. units)	6.78-7.09	6.62-6.80	-	6.5-8.0
Specific conductivity (mS/cm)	3.08-3.16	2.93-3.00	-	0.12-0.3 mS/cm
Electrical Conductivity (µS/cm)	2,942-3,018	2,800-2,861	-	120-300 µS/cm
Dissolved Oxygen (% sat)	50.70-136.70	62.40-112.30	-	80-120%

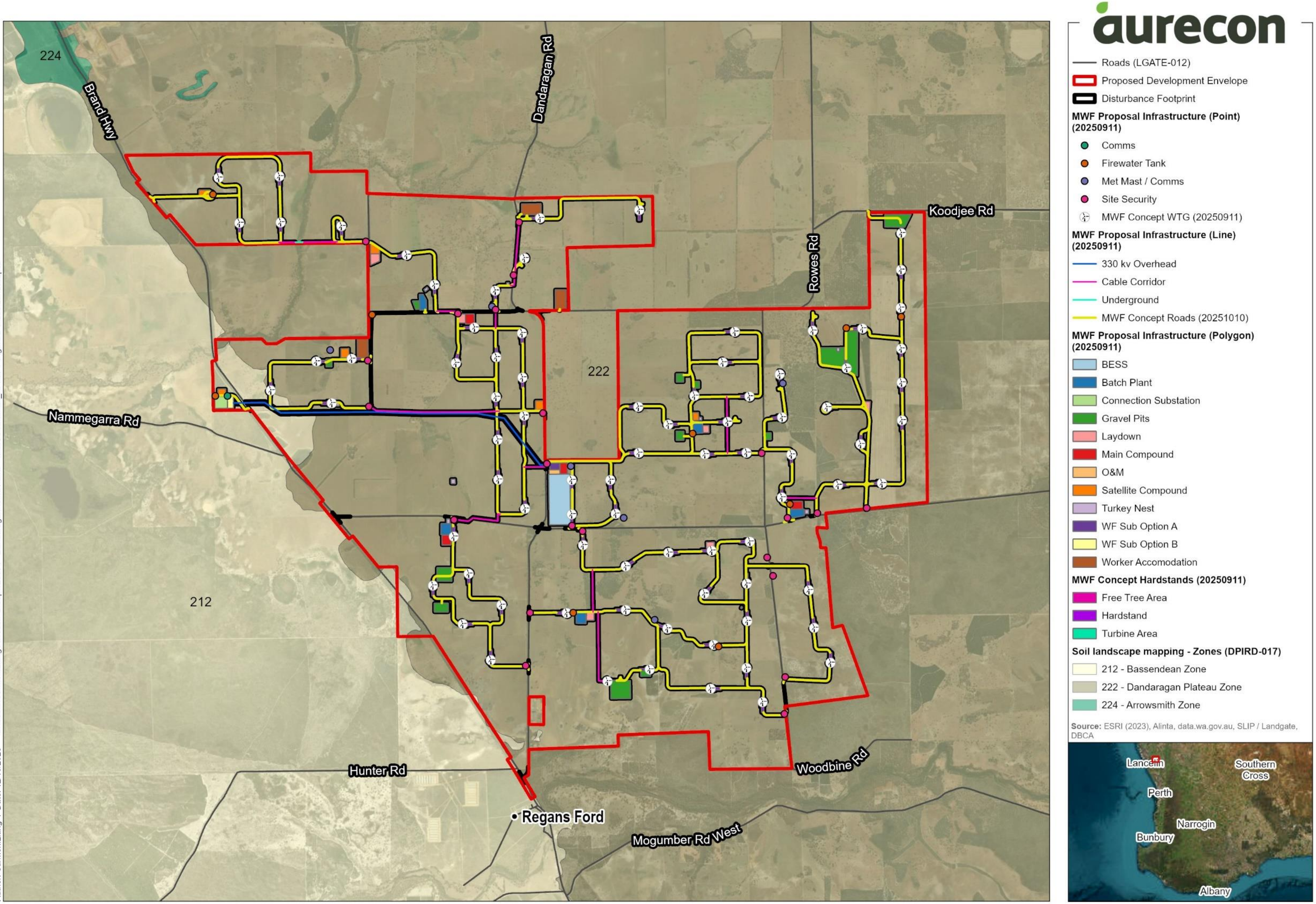
5.4 Soils

5.4.1 Soil landscapes

A review of the Department of Primary Industries and regional Development (DPIRD) Natural Resource Information (Western Australia) Geoportal was undertaken to identify the various soil types at the project area. The project area is located within two distinct soil landscapes, which consist of the Dandaragan Plateau Zone and the Bassendean Zone. The soil landscape descriptions are provided in Table 5-2. The soil landscapes are mapped in Figure 5-6.

Table 5-2 Soil landscapes

Soil landscape	Description	Coverage relative to project area	Salinity risk	Erosion risk
Dandaragan Plateau Zone	Gently undulating plateau with areas of sandplain and some laterite. On Cretaceous sediments. Broad u-shaped valleys 80-150 m deep, smaller v-shaped east of the Gingin Scarp in the south. Soils are formed in colluvium and weathered rock.	Covers majority of project area	Low	Low
Bassendean Zone	Mid Pleistocene Bassendean sand. Fixed dunes inland from coastal dune zone. Non-calcareous sands, podsolised soils with low-lying wet areas.	Covers western slither of project area	Low	Low



Author: Carmen.Liang | Date: 12/10/2025 C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 5-6 Soil Landscapes

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Figure 5-6 : Soil Landscapes

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Job No.: 525974

Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000

5.4.2 Acid sulfate soils

A review of the Australian soil resource information system (ASRIS) acid sulfate soils (ASS) map indicated that the project area has a predominantly low risk potential of ASS occurrence with some higher risk areas towards bodies of water and lacustrine deposits, a summary is provided below and presented in Figure 5-7.

- Extremely low probability and very low confidence (C4) within project area
- Low probability and very low confidence (B4) west of project area
- High probability and very low confidence (A4) in discrete areas within and west of project area (notably in the vicinity of proposed access tracks parallel to Brand Highway and associated bodies of water)

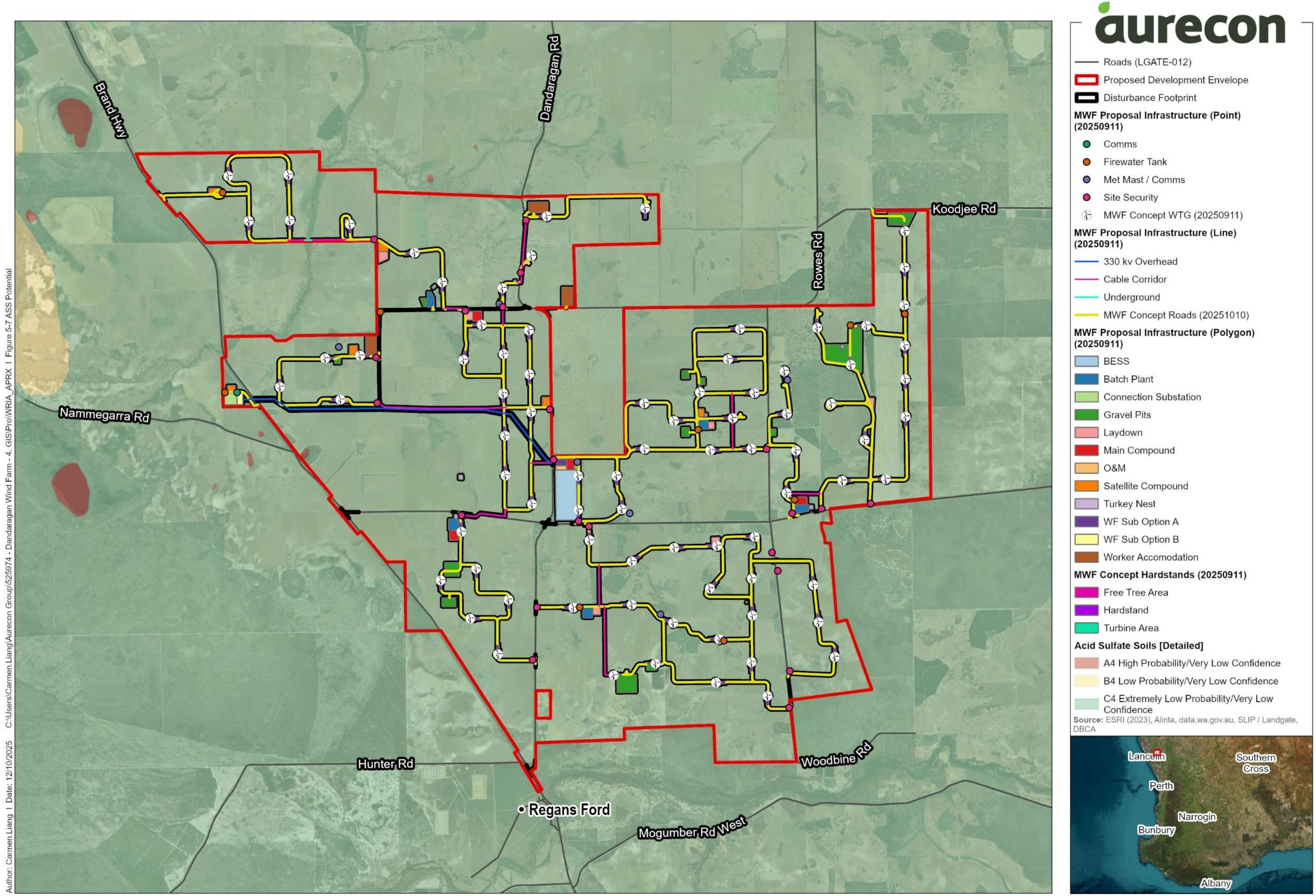

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Figure 5-7 : ASS Potential

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5.5 Geology

The geology at the project area was determined based on the Department of Mines, Petroleum and Exploration, Geological Survey of Western Australia Geoportal (GeoView WA).

The surface geology at the project area largely consists of sediments derived from residual and erosional landforms such as colluvium, alluvium, lacustrine, sandplain, eolian, sheetwash and marine deposits. The surface geology (regolith) at the project area is host to the surficial and superficial aquifers as per the Gingin water allocation plan. The project area is more broadly located within the Perth Basin and the 'Dandaragan Trough'. The Perth Basin was formed as a result of inter-continental rift during the Palaeozoic/Mesozoic leading to the Gondwana break. This resulted in the deposition of successive sedimentary siliciclastic formations mostly consisting of sandstone, siltstone and limestone, forming the intermediate and deep aquifers of the region underlying the project area. Geological formations observed at the project area have been summarised in Table 5-3.

Table 5-3 Summary of geology at the project area

Code ID	Unit name	Period / age	Province	Dominant lithologies	Occurrence in project area
E(e)-wsp	Eolian unit	Cenozoic	Western Coastlands	Eolian sand, silt and clay in sheet deposits and dunes	Covers project area
Cz-sz	Inland eolian and alluvial deposits	Cenozoic-Holocene (3-66 Ma)	Un-classified (regolith)	Includes Lawford, Victoria Plateau, Oakover, Lake George and Lampe Formations (eolian, alluvial deposit and sandstone, siltstone/mudstone)	Western portion
K-CY-xk-s	Coolyena Group	Albian-Maastrichtian (66-113.2 Ma)	Phanerozoic Basin	Sedimentary carbonates including chalk, glauconitic sandstone, siltstone and marl	Central-eastern portion
K-CYo-sll	Osborne Formation	Albian-Turonian (89.8-113.2 Ma)	Phanerozoic Basin	Interbedded sandstone/siltstone/mudstone	Southern portion
K-WRl-ss	Leederville Formation	Hauterivian-Aptian (113.2-132.6 Ma)	Phanerozoic Basin	Interbedded sandstone/siltstone, conglomerate, coal seams	Western portion
JK-Pao-sfl	Otorowiri Formation (Parmelia Group)	Jurassic-Berriasian (137-161.5 Ma)	Phanerozoic Basin	Sandstone, siltstone	North-western portion
JK-PA-st	Parmelia Group	Jurassic-Berriasian (137-161.5 Ma)	Phanerozoic Basin	Sandstone	North-western portion

J-st-PH	Yarragadee Formation	Jurassic (143.1-174.7 Ma)	Phanerozoic Basin	Sandstone, siltstone, limestone	North-western portion

The surface geology is presented in Figure 5-8.

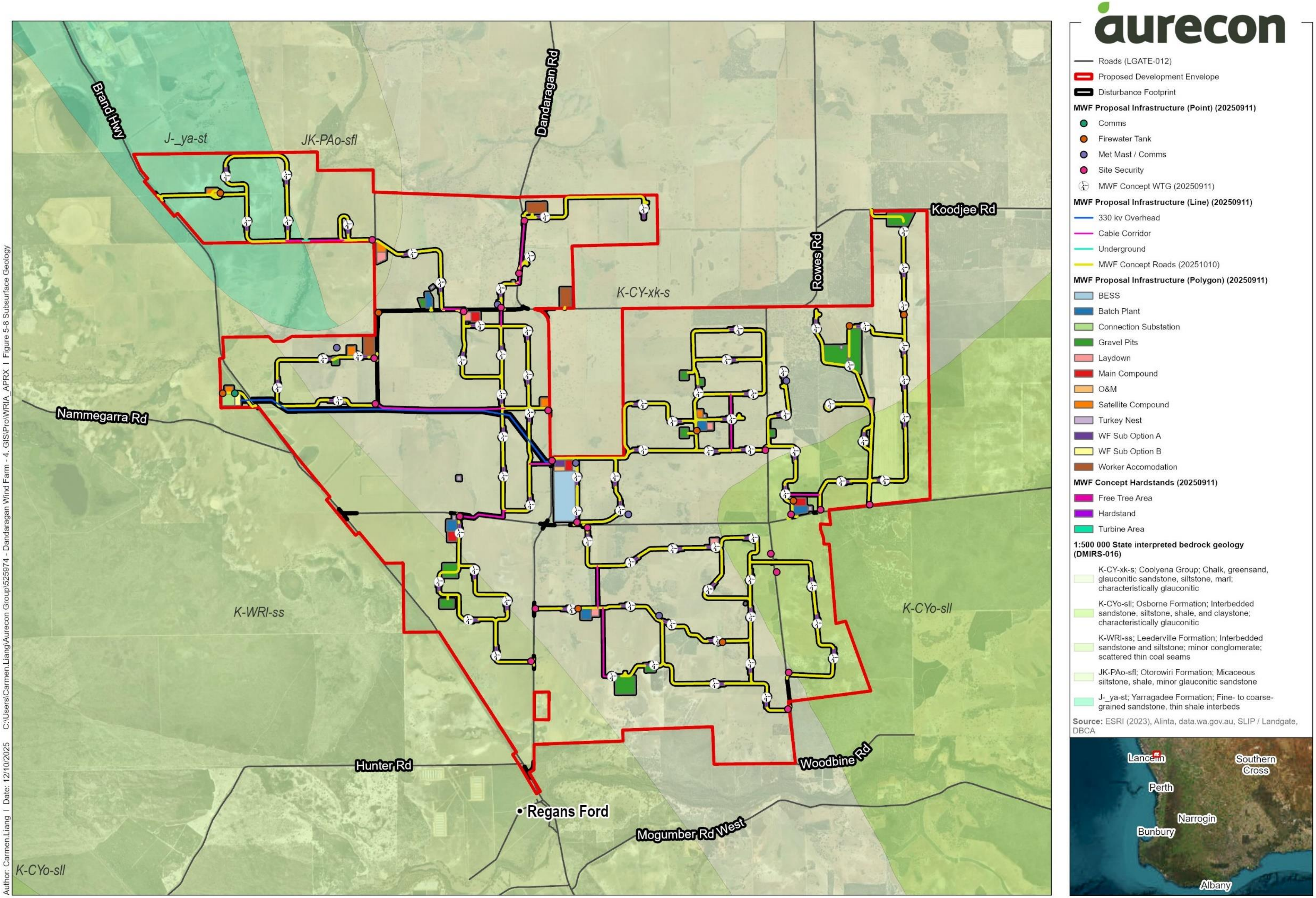

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Figure 5-8 : Subsurface Geology

Version: 1
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Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000

5.6 Hydrogeology

5.6.1 Groundwater allocation plans

The project area is subject to the Gingin groundwater allocation plan and is situated within the Gingin Groundwater Area (DWER-034), which is designated as a Proclaimed Ground Water Area (DWER, 2020). The plan which details relevant groundwater sources and yearly allocations for groundwater extraction and use. The project area primarily overlies three key aquifers: the Surficial, the Leederville-Parmellia Formation, and the Yarragadee Formation aquifers (BOM, 2025). A summary of the allocation plan is provided in Table 5-4 .

Table 5-4 Groundwater allocation plans pertinent to the project area

Groundwater allocation plan	Aquifer	Inferred aquifer depth	Properties	Spatial distribution relative to project area
Gingin groundwater allocation plan, 2015	Surficial (regolith – predominantly erosional landform deposits)	Perched/shallow	Extensive (primarily consisting of sand and clay) Unconfined and unsaturated Direct rainfall infiltration recharge with inferred low recharge delay (days to weeks) Generally freshwater quality (TDS <1,000 mg/L) Generally low bore yields (~100 kL/d) Shallow groundwater levels supporting groundwater dependent ecosystems	Covers entire project area
	Superficial (regolith – predominantly exposed residual)	Shallow	Extensive (primarily consisting of gravel, sand and clay) Unconfined with variable saturated thickness of up to 50 m Direct rainfall infiltration recharge with inferred low recharge delay (days to weeks) Generally freshwater quality (TDS <1,000 mg/L) Generally moderate to high bore yields (up to 2,000 kL/d) Shallow groundwater levels supporting groundwater dependent ecosystems	Covers western slither of project area
	Mirrabooka	Shallow	Partially unsaturated and highly variable aquifer thickness (primarily consisting of sandstone and shale) Semi-confined Drained recharge at outcrops and direct rainfall infiltration with inferred moderate recharge delay (months) Generally freshwater quality (TDS <1,000 mg/L) Highly variable bore yields Contributes to Moore River baseflow during dry seasons	Covers eastern portion of project area

Groundwater allocation plan	Aquifer	Inferred aquifer depth	Properties	Spatial distribution relative to project area
	Leederville	Intermediate	Extensive (primarily consisting of sandstone and shale) Semi-confined to confined with aquifer thickness of up to 550 m Drained recharge at outcrops with inferred moderate to high recharge delay (months to years) Generally freshwater quality (TDS <1,000 mg/L) Generally high bore yields (up to 3,000 kL/d) Contributes to Gingin Brook downstream baseflow (outside of project area)	Covers western portion of project area
	Leederville-Parmelia	Intermediate	Extensive, continuation of Leederville Formation and Parmelia Group (primarily consisting of sandstone and shale) Semi-confined to confined Drained recharge at outcrops with inferred moderate to high recharge delay (months to years) Generally freshwater quality (TDS <1,000 mg/L) Generally high bore yields (up to 3,000 kL/d) Contributes to Moore River baseflow during dry seasons Contributes to Gingin Brook downstream baseflow (outside of project area)	Covers central-eastern portion of project area
	Yarragadee	Deep	Extensive (primarily consisting of sandstone and shale) Unconfined to confined (unconfined at outcropping basin edges, otherwise confined) with aquifer thickness up to 2,000 m Generally freshwater quality (TDS <1,000 mg/L), except along fault lines Generally high bore yields (up to 5,000 kL/d)	Covers entire project area

A summary of water allocations per groundwater sub-area catchments and groundwater sources intersected by the project area has been provided in Table 5-5.

Table 5-5 Allocation limits for project area groundwater sources

Aquifer	Subarea	Allocation limit (ML/yr)	Licensable (general) (ML/yr)	Licensable (public supply) (ML/yr)	Unlicensable (exempt) (ML/yr)	Reserved (water supply) (ML/yr)
Surficial	Namming Lake	300	300	0	0	0
	Victoria Plains	4,400	4,400	0	0	0
Superficial	Namming Lake	10,500	10,465	0	35	0
Leederville	Central Coastal	2,800	2,700	100	0	0
	Northern Coastal	4,100	630	470	0	3,000
	Southern Coastal	1,000	1,000	0	0	0
Mirrabooka	Central Scarp	1,500	1,135	0	365	0
	Northern Scarp	3,700	3,070	0	630	0
	Southern Scarp	800	285	0	515	0
Leederville-Parmelia	Cowalla	19,000	17,617	1,383	0	0
Yarragadee	Cataby	13,000	4,000	0	0	9,000
	Wannamal	1,300	1,300	0	0	0
	Chandala	1,050	1,050	0	0	0

Groundwater allocation availability at the project area is addressed in Section 6.2.2. Groundwater take in the project area is governed by the following constraints and dependencies:

- Groundwater supplies baseflow to Moore River during dry seasons
- Shallow aquifers support terrestrial and aquatic groundwater dependent ecosystems
- Current agricultural land use relies on groundwater extraction for irrigation, water supply and stock & domestic purposes
- Groundwater is sensitive to overextraction, reduced water quality as well as aquifer settlement and compression (Gingin groundwater allocation plan, 2015)

5.6.2 Groundwater bores

96 registered groundwater bores (BOM, 2025) have been identified at the project area (within a ~1km buffer) and have been referenced in Table 5-6 . Groundwater bores identified at the project area are registered for the following uses:

- Exploration (3)
- Irrigation (3)
- Monitoring (14)
- Stock & domestic (13)
- Water supply (7)
- Unknown (56)

As suggested above, a large number of bores extracted from the BOM register did not display a bore purpose and hence was categorised as unknown. Considering the land use context at the project area, it is anticipated that a large portion of the bores with undisclosed purpose are used for irrigation and stock & domestic purposes.

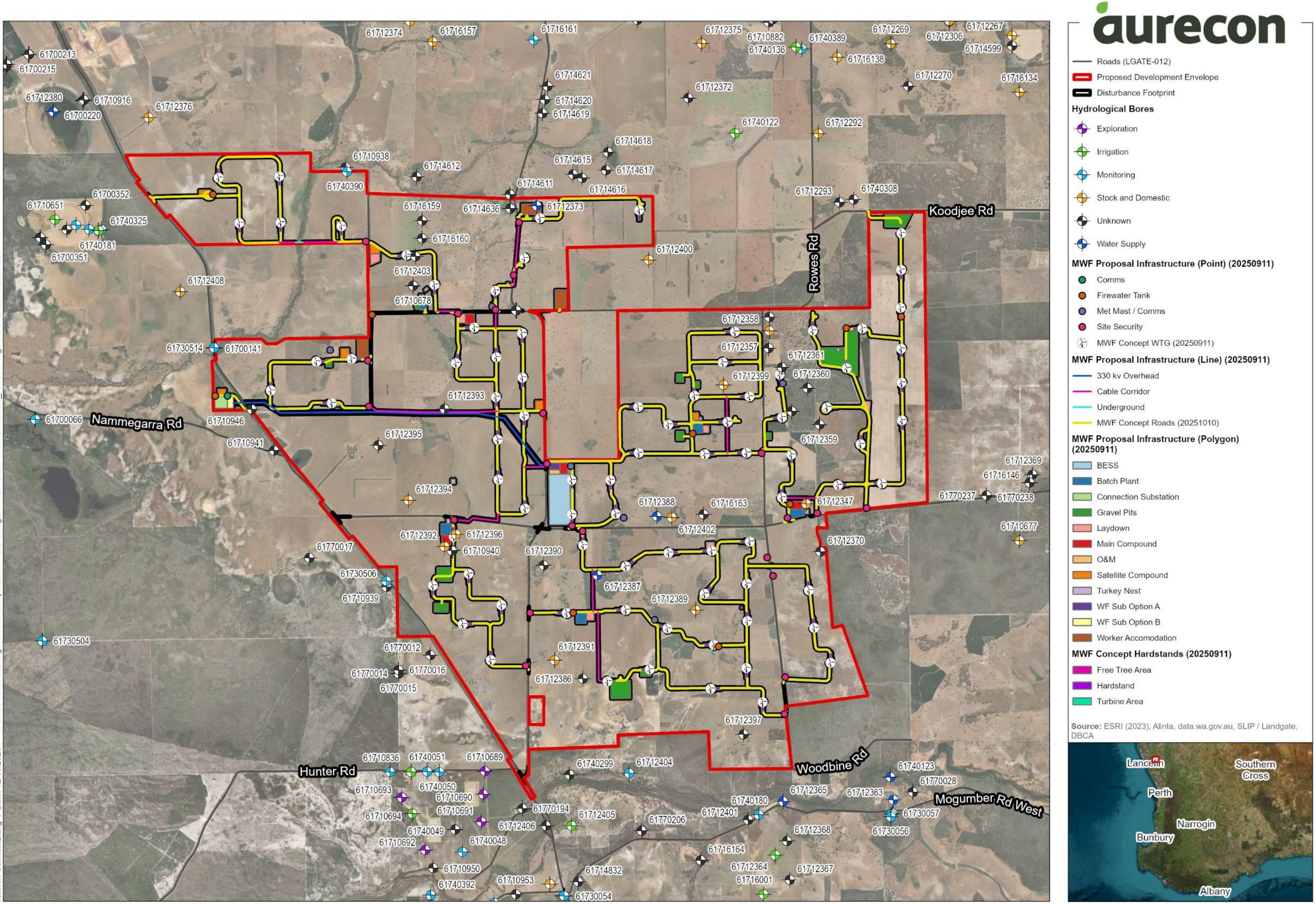
Table 5-6 Groundwater bore summary within project area (including ~1 km buffer)

Bore ID	Drilled Date	Bore Depth (m)	Purpose	Status	Screened geology	Latitude	Longitude
61770219	2018-06-06	202.41	Unknown	Functioning	Yarragadee Formation	-30.89	115.70
61770220	2018-07-01	117	Unknown	Functioning	Parmelia Formation	-30.89	115.70
61730057	1981-12-15	106	Monitoring	Functioning	Parmelia Formation	-30.99	115.78
61710678	1970-02-27	-	Unknown	Unknown	Unknown	-30.88	115.68
61730056	1982-12-16	959	Monitoring	Functioning	Yarragadee Formation	-30.99	115.78
61730055	1981-12-16	580	Monitoring	Functioning	Yarragadee Formation	-30.99	115.78
61714615	-	-	Unknown	Unknown	Unknown	-30.86	115.71
61714612	-	-	Unknown	Unknown	Unknown	-30.86	115.68
61716163	-	-	Unknown	Unknown	Unknown	-30.93	115.74
61714617	-	-	Unknown	Unknown	Unknown	-30.86	115.72
61714616	-	-	Unknown	Unknown	Unknown	-30.86	115.72
61700219	-	40	Unknown	Unknown	Unknown	-30.84	115.60
61716160	-	-	Unknown	Unknown	Unknown	-30.87	115.68
61716159	-	-	Unknown	Unknown	Unknown	-30.87	115.68
61700220	-	26	Unknown	Unknown	Unknown	-30.84	115.60
61700221	-	9	Unknown	Unknown	Unknown	-30.84	115.60
61714618	-	-	Unknown	Unknown	Unknown	-30.86	115.72
61710691	2009-08-15	-	Exploration	Unknown	Unknown	-30.99	115.69
61710690	2009-08-15	-	Exploration	Unknown	Unknown	-30.98	115.69
61710689	2009-08-15	-	Exploration	Unknown	Unknown	-30.98	115.69
61714619	-	-	Unknown	Unknown	Unknown	-30.85	115.71
61714620	-	-	Unknown	Unknown	Unknown	-30.85	115.71
61700352	2006-05-24	-	Unknown	Unknown	Unknown	-30.86	115.60
61730514	1985-02-26	19	Monitoring	Functioning	Unknown	-30.89	115.63
61712356	1961-06-30	-	Stock and Domestic	Unknown	Unknown	-30.89	115.76
61730506	1986-03-06	26	Monitoring	Functioning	Unknown	-30.94	115.67
61712357	1953-06-30	-	Unknown	Unknown	Unknown	-30.89	115.76
61710946	2001-11-22	59.16	Unknown	Unknown	Unknown	-30.90	115.64
61712347	1953-06-30	-	Stock and Domestic	Unknown	Unknown	-30.92	115.77

Bore ID	Drilled Date	Bore Depth (m)	Purpose	Status	Screened geology	Latitude	Longitude
61740050	-	-	Monitoring	Unknown	Unknown	-30.98	115.68
61770081	2006-11-10	184	Unknown	Unknown	Unknown	-30.91	115.76
61714611	-	-	Unknown	Unknown	Unknown	-30.86	115.70
61740390	-	-	Monitoring	Unknown	Unknown	-30.86	115.66
61710652	2006-11-16	48	Irrigation	Unknown	Unknown	-30.87	115.61
61712358	1953-06-30	-	Unknown	Unknown	Unknown	-30.89	115.76
61712359	1953-06-30	-	Unknown	Unknown	Unknown	-30.91	115.77
61712360	1953-06-30	-	Unknown	Unknown	Unknown	-30.90	115.77
61710939	2001-11-21	41.32	Unknown	Unknown	Unknown	-30.94	115.67
61712361	1953-06-30	-	Unknown	Unknown	Unknown	-30.90	115.76
61710940	2003-09-05	179.61	Unknown	Unknown	Unknown	-30.93	115.69
61730515	1985-02-25	35.5	Monitoring	Functioning	Unknown	-30.89	115.63
61710941	2001-11-22	-	Unknown	Unknown	Unknown	-30.91	115.64
61712363	1979-10-15	-	Water Supply	Unknown	Unknown	-30.98	115.78
61710942	2003-11-22	178.33	Unknown	Unknown	Unknown	-30.93	115.68
61770206	1990-06-30	45.7	Unknown	Unknown	Unknown	-30.99	115.73
61712365	-	42.7	Water Supply	Unknown	Unknown	-30.98	115.76
61740299	2001-03-08	60	Unknown	Unknown	Unknown	-30.98	115.71
61710937	2001-11-21	95.48	Unknown	Unknown	Unknown	-30.93	115.68
61710938	2003-08-22	87.47	Unknown	Unknown	Unknown	-30.86	115.66
61712408	-	-	Stock and Domestic	Unknown	Unknown	-30.88	115.62
61712406	1996-09-26	28	Unknown	Unknown	Unknown	-30.99	115.71
61770013	2009-12-15	41.85	Unknown	Unknown	Unknown	-30.96	115.67
61712403	1960-06-30	-	Unknown	Unknown	Unknown	-30.88	115.68
61740181	-	-	Monitoring	Unknown	Unknown	-30.87	115.61
61712402	1987-06-30	-	Stock and Domestic	Unknown	Unknown	-30.93	115.73
61770012	2009-12-16	42	Unknown	Unknown	Unknown	-30.95	115.68
61712405	1996-06-25	40	Irrigation	Unknown	Unknown	-30.99	115.71
61740180	-	-	Monitoring	Unknown	Unknown	-30.99	115.75
61712404	1995-11-11	48	Monitoring	Unknown	Unknown	-30.98	115.72
61712401	-	-	Unknown	Unknown	Unknown	-30.99	115.75

Bore ID	Drilled Date	Bore Depth (m)	Purpose	Status	Screened geology	Latitude	Longitude
61770015	2009-12-16	42	Unknown	Unknown	Unknown	-30.96	115.67
61712400	1970-06-30	-	Stock and Domestic	Unknown	Unknown	-30.88	115.73
61770014	2009-12-16	11.83	Unknown	Unknown	Unknown	-30.96	115.67
61770017	2009-12-10	42	Unknown	Unknown	Unknown	-30.93	115.65
61712399	1977-06-30	90	Stock and Domestic	Unknown	Unknown	-30.90	115.75
61770016	2009-12-16	11.88	Unknown	Unknown	Unknown	-30.96	115.67
61700141	2013-06-19	570.5	Monitoring	Functioning	Yarragadee Formation	-30.89	115.63
61710916	-	40	Unknown	Unknown	Unknown	-30.84	115.60
61740123	2001-11-19	40.5	Water Supply	Unknown	Unknown	-30.98	115.78
61740122	2002-12-18	184	Irrigation	Unknown	Unknown	-30.85	115.75
61700142	2014-06-11	112	Monitoring	Functioning	Leederville Formation	-30.89	115.63
61740308	2003-03-13	71	Unknown	Unknown	Unknown	-30.87	115.78
61712393	1967-06-30	-	Unknown	Unknown	Unknown	-30.91	115.68
61712394	1964-06-30	-	Stock and Domestic	Unknown	Unknown	-30.92	115.68
61712391	1965-06-30	-	Stock and Domestic	Unknown	Unknown	-30.95	115.71
61712392	1967-06-30	-	Stock and Domestic	Unknown	Unknown	-30.93	115.68
61712397	-	-	Unknown	Unknown	Unknown	-30.97	115.75
61712395	-	-	Unknown	Unknown	Unknown	-30.91	115.67
61712396	-	-	Stock and Domestic	Unknown	Unknown	-30.93	115.69
61770028	2000-12-11	46	Unknown	Unknown	Unknown	-30.98	115.79
61712388	1961-06-30	-	Water Supply	Unknown	Unknown	-30.93	115.73
61712390	1961-06-30	-	Unknown	Unknown	Unknown	-30.94	115.71
61712389	1961-06-30	-	Stock and Domestic	Unknown	Unknown	-30.95	115.74
61712292	1961-06-30	-	Stock and Domestic	Unknown	Unknown	-30.85	115.77
61712293	1961-06-30	-	Unknown	Unknown	Unknown	-30.87	115.77
61770194	1996-02-05	-	Unknown	Unknown	Unknown	-30.98	115.70
61712380	1969-06-30	-	Water Supply	Unknown	Unknown	-30.85	115.60
61712386	-	-	Unknown	Unknown	Unknown	-30.96	115.71
61712387	1958-06-30	-	Water Supply	Unknown	Unknown	-30.94	115.72
61740325	-	-	Monitoring	Unknown	Unknown	-30.87	115.61
61712376	1967-06-30	-	Stock and Domestic	Unknown	Unknown	-30.85	115.62

Bore ID	Drilled Date	Bore Depth (m)	Purpose	Status	Screened geology	Latitude	Longitude
61712373	-	-	Water Supply	Unknown	Unknown	-30.87	115.70
61712372	-	-	Unknown	Unknown	Unknown	-30.85	115.74
61712370	-	-	Unknown	Unknown	Unknown	-30.93	115.77
61712368	1986-09-15	120	Unknown	Unknown	Unknown	-30.99	115.76
61714636	-	-	Unknown	Unknown	Unknown	-30.87	115.70



Author: Carmen.Liang | Date: 12/10/2025 C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 5-9 Groundwater Bores

Marri Wind Farm Water Resource Impact Assessment

Figure 5-9 : Groundwater Bores

Version: 1
Job No.: 525974

Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000

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Kilometres

5.7 Sensitive receptors and dependent ecosystems

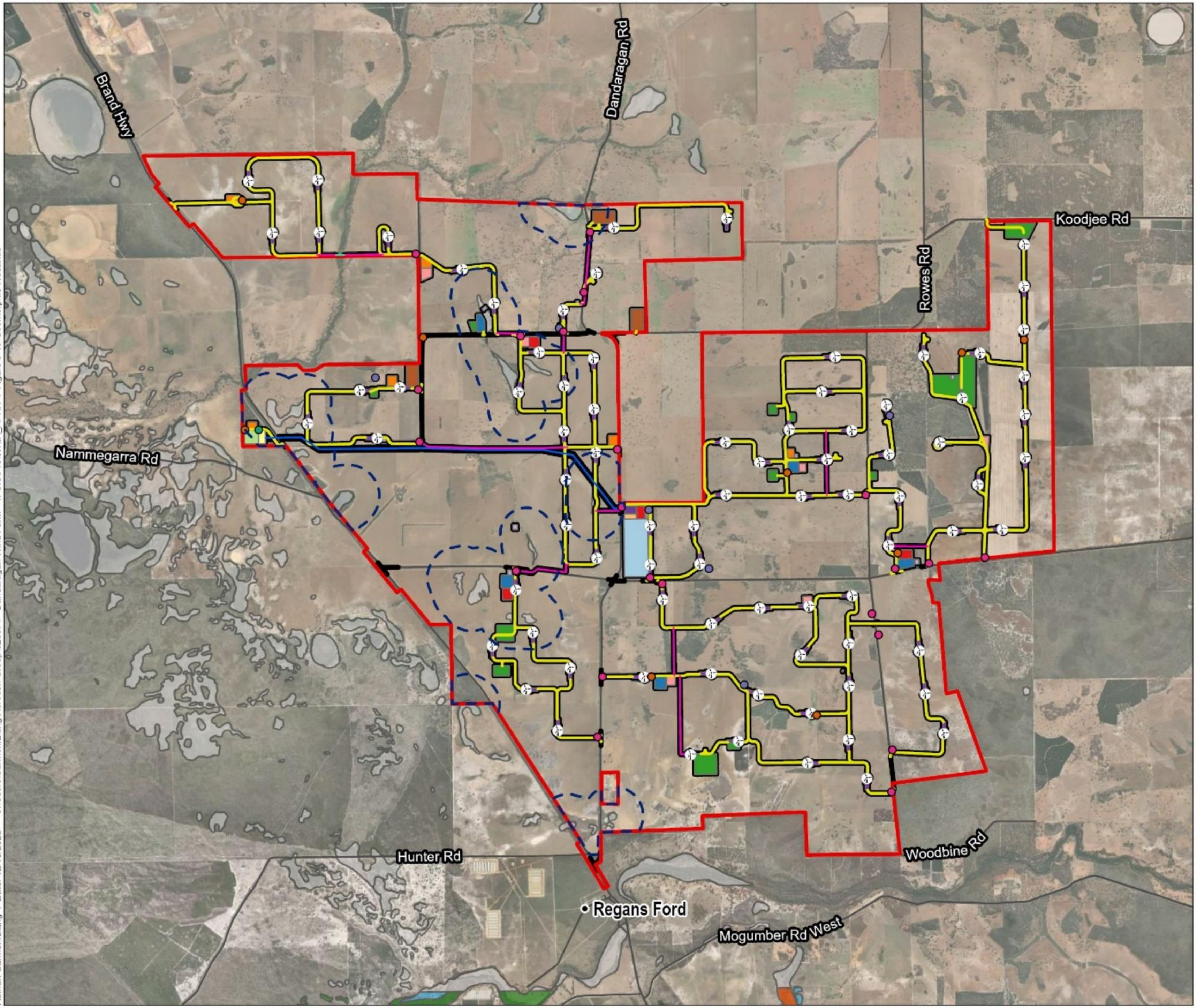
5.7.1 Wetlands

The project does not intersect with any nationally significant wetlands or Ramsar Wetlands and there are no Ramsar Wetlands located downstream. There is a wetland of national importance, Lake Guraga, located approximately 5km west of the proposed Development Envelope. It receives flows from the Caren Caren Brook system (Department of Environment and Conservation, 2009) so there is potential for the project to impact this wetland but impacts are highly unlikely given it is located a significant distance downstream.

Geomorphic wetlands exist within the proposed Development Envelope, as well as downstream of the project area (Government of Western Australia, 2021). The geomorphic wetlands within the project area are mostly classified as Dampland and Palusplain wetland types (shown in Figure 5-10). Wetlands within proximity to development are shown in close view in Figure 5-11. Both wetland types are classified as seasonally waterlogged, but Dampland is located within a basin and Palusplain on flat land (DBCA, 2024). None of these mapped wetlands have been assessed to determine their value and functionality (DBCA, 2018). Additionally, most of these wetlands are located on agricultural land which has already been significantly disturbed but may still hold value for local aquatic ecosystems or migratory birds.

Wetlands with “conservation” and “multiple use” management categories lie downstream of the project area, within the Moore River system (Government of Western Australia, 2021). These wetlands are located 3km downstream, along the Moore River, and beyond. A wetland with a management category of “conservation” means it supports a high level of attributes and functions and are the highest priority for preservation and protection (DBCA, 2024). A wetland with a management category of “multiple use” means the wetlands have few remaining important attributes and functions, and therefore development is permitted but should be considered in the context of ecologically sustainable development.

Where project infrastructure directly intersects the mapped Swan Coastal Plain geomorphic wetlands, recommendations have been made in Section 7.3.3 and 8.3.3. Measures to mitigate and avoid impacts to known wetlands in the receiving environment are discussed further in Sections 7, 8 and 10.



aurecon

- Roads (LGATE-012)
- Proposed Development Envelope
- Disturbance Footprint

MWF Proposal Infrastructure (Point) (20250911)
- Comms
- Firewater Tank
- Met Mast / Comms
- Site Security
- MWF Concept WTG (20250911)

MWF Proposal Infrastructure (Line) (20250911)
- 330 kv Overhead
- Cable Corridor
- Underground
- MWF Concept Roads (20251010)

MWF Proposal Infrastructure (Polygon) (20250911)
- BESS
- Batch Plant
- Connection Substation
- Gravel Pits
- Laydown
- Main Compound
- O&M
- Satellite Compound
- Turkey Nest
- WF Sub Option A
- WF Sub Option B
- Worker Accomodation

MWF Concept Hardstands (20250911)
- Free Tree Area
- Hardstand
- Turbine Area

Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)
- Conservation
- Multiple Use
- Not Assessed
- Resource Enhancement
- 500m Buffer

Source: ESRI (2023), Alinta, data.wa.gov.au, SLIP / Landgate, DBCA

Marri Wind Farm Water Resource Impact Assessment

Figure 5-10 : Geomorphic Wetlands

Version: 1
Job No.: 525974
Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000

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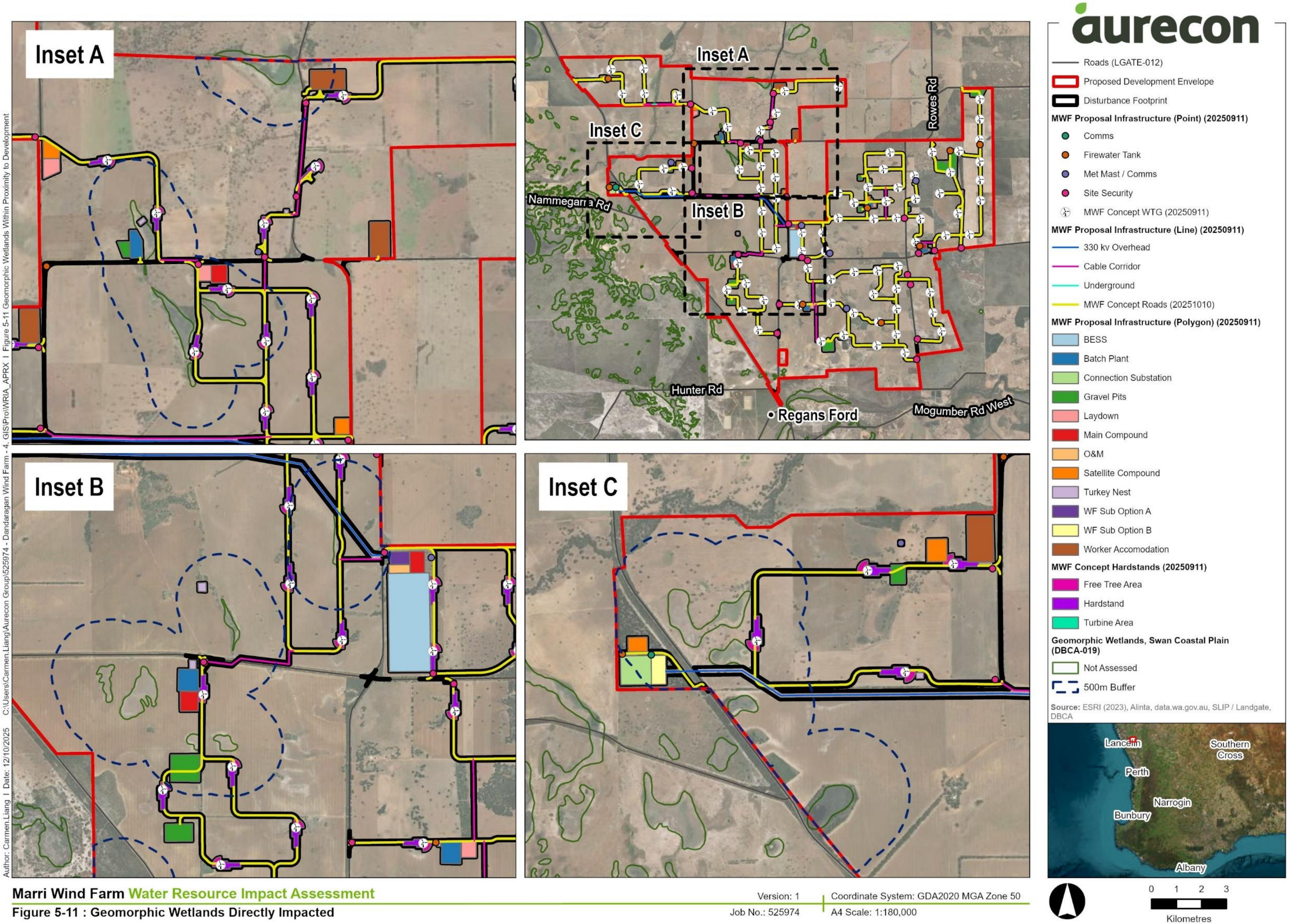
Kilometres



Author: Carmen.Liang | Date: 12/10/2025 C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 5-11 Geomorphic Wetlands Within Proximity to Development

Marri Wind Farm Water Resource Impact Assessment

Figure 5-11 : Geomorphic Wetlands Directly Impacted

Version: 1
Job No.: 525974

Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:180,000

5.7.2 Groundwater dependant ecosystems

Ecosystems that rely on groundwater for all or some of their requirements are classified as Groundwater Dependant Ecosystems (GDEs) and Inflow Dependent Ecosystems (IDEs) (it is noted IDE may also be surface water dependent). Local changes to the hydrological regime at the project area, sensitive GDEs may be impacted as a result of the proposed development. The Australian Government's Atlas of Groundwater Dependent Ecosystems (BOM, 2025) is a spatial tool used to identify three types of GDEs within the proposed Development Envelope, based on Eamus et al (2006) functional classification framework as described in the Australian GDE toolbox (Richardson et al, 2011). These GDEs include:

- Subterranean Ecosystems (Type I) – Subterranean factors that rely on the presence of groundwater, such as aquifers (stygofauna) or cave systems (troglofauna).
- Aquatic Ecosystems (Type II) – GDEs that require surface expression of groundwater such as wetlands and springs.
- Terrestrial Ecosystems (Type III) – GDEs that rely on the presence of groundwater, including all vegetations ecosystems.

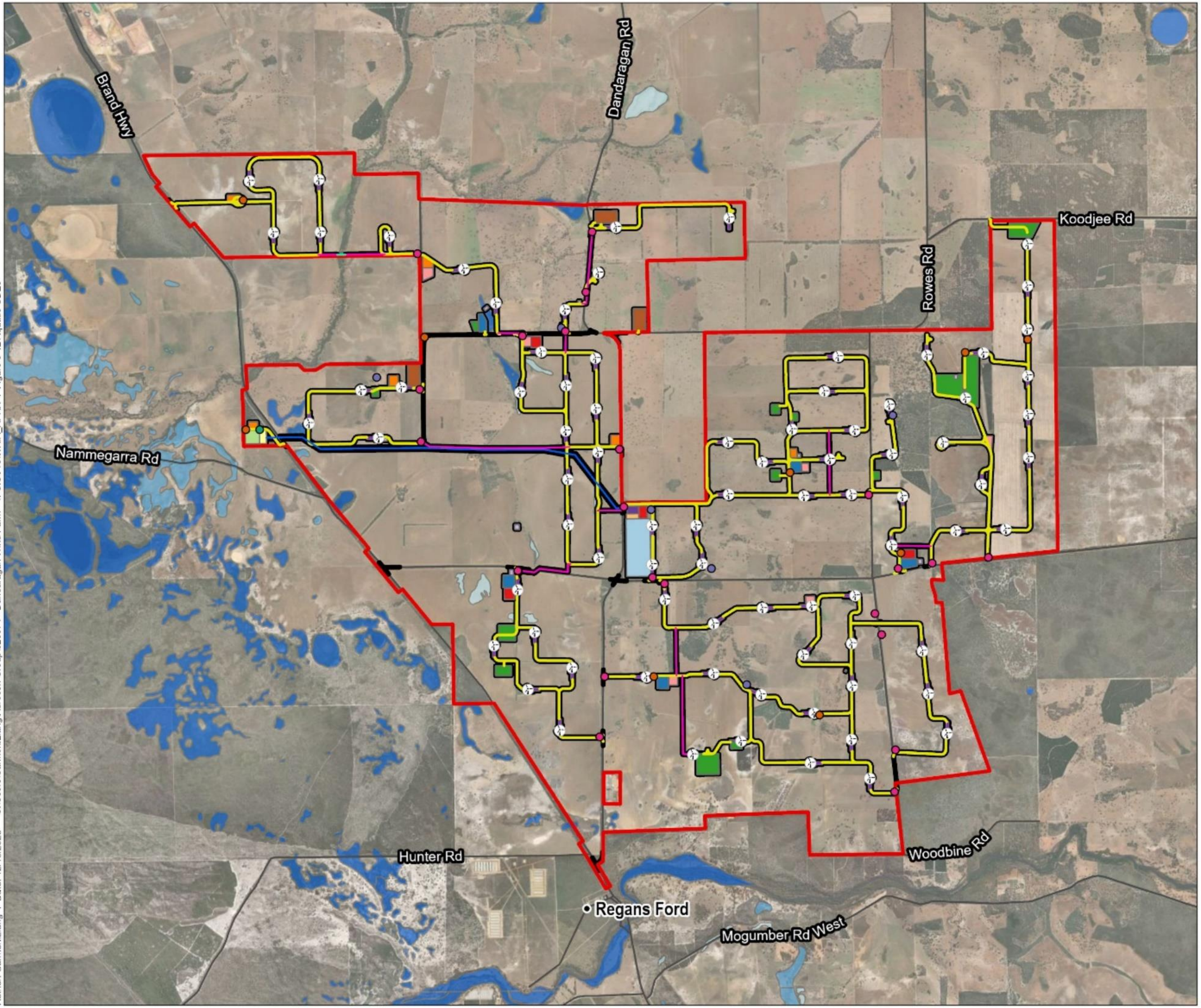
Potentially impacted GDEs within and surrounding the project area have been summarised in Table 5-6 , aquatic GDEs have been represented in Figure 5-12 and terrestrial GDEs in Figure 5-13.

It was found that terrestrial and aquatic GDEs identified within the project area are considered to have considerable variability, ranging from low to high potential of groundwater dependence. Moore River is known for its groundwater dependence during the summer, suggesting it is a gaining stream during drier months. High potential GDEs are particularly susceptible to reducing groundwater levels resulting in diminished baseflow supplying terrestrial and aquatic ecosystems. No subterranean GDEs and spring sites were identified within the project area. Although not specifically identified, there is the potential for the presence of Type I GDEs (aquifer-based stygofauna) given the prevalence of unconsolidated or poorly consolidated deposits across the project area.

Table 5-7 GDEs within and surrounding project area

GDE name	Supplied ecosystem	Ecosystem type	GDE potential	IDE likelihood (out of 10)	River region	Groundwater management area
Terrestrial						
N/A	Bare areas, salt lakes	Vegetation	High (national assessment)	10	Moore-Hill Rivers	Gingin groundwater area
N/A	Low woodland, banksia	Vegetation	Moderate to high (national assessment)	2 to 10	Moore-Hill Rivers	Gingin groundwater area
N/A	Low woodland, banksia attenuata & menziesii	Vegetation	Low to high (national assessment)	1 to 10	Moore-Hill Rivers	Gingin groundwater area
N/A	Medium woodland, marri	Vegetation	Low to moderate (national assessment)	2 to 10	Moore-Hill Rivers	Gingin groundwater area
N/A	Medium woodland, marri & river gum	Vegetation	High (national assessment)	10	Moore-Hill Rivers	Gingin groundwater area
N/A	Medium woodland, marri & wandoo	Vegetation	Moderate to high (national assessment)	2 to 10	Moore-Hill Rivers	Gingin groundwater area
N/A	Mosaic - medium open woodland, marri and shrublands, dryandra heath	Vegetation	Low (national assessment)	2 to 10	Moore-Hill Rivers	Gingin groundwater area
N/A	Mosaic - mixed scrub-heath and shrublands, dryandra thicket	Vegetation	Moderate to high (national assessment)	5 to 10	Moore-Hill Rivers	Gingin groundwater area

GDE name	Supplied ecosystem	Ecosystem type	GDE potential	IDE likelihood (out of 10)	River region	Groundwater management area
N/A	Mosaic – shrublands, hakea scrub-heath and shrublands, dryandra heath	Vegetation	Low to moderate (national assessment)	3 to 10	Moore-Hill Rivers	Gingin groundwater area
Aquatic						
N/A	Dampland	Wetland	Low to high (national assessment)	1 to 10	Moore-Hill Rivers	Gingin planning boundary
N/A	Lake	Wetland	Moderate to high (national assessment)	1 to 10	Moore-Hill Rivers	Gingin planning boundary
N/A		Wetland	Low to high (national assessment)	5 to 10	Moore-Hill Rivers	Gingin planning boundary
N/A		Wetland	Low to high (national assessment)	1 to 10	Moore-Hill Rivers	Gingin planning boundary
Moore River		Watercourse	High (national assessment)	8	Moore-Hill Rivers	Gingin planning boundary
Doghole Pool		Pool	Unclassified (regional studies)	3	Moore-Hill Rivers	Gingin planning boundary



Roads (LGATE-012)
Proposed Development Envelope
Disturbance Footprint

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- Satellite Compound
- Turkey Nest
- WF Sub Option A
- WF Sub Option B
- Worker Accomodation

MWF Concept Hardstands (20250911)
- Free Tree Area
- Hardstand
- Turbine Area

Aquatic GDE
- High potential GDE
- Moderate potential GDE
- Low potential GDE
- Unclassified potential GDE

Source: ESRI (2023), Alinta, data.wa.gov.au, SLIP / Landgate, DBCA

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Kilometres

Author: Carmen.Liang | Date: 12/10/2025 C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 5-12 Aquatic GDEs

Marri Wind Farm Water Resource Impact Assessment

Figure 5-12 : Aquatic GDEs

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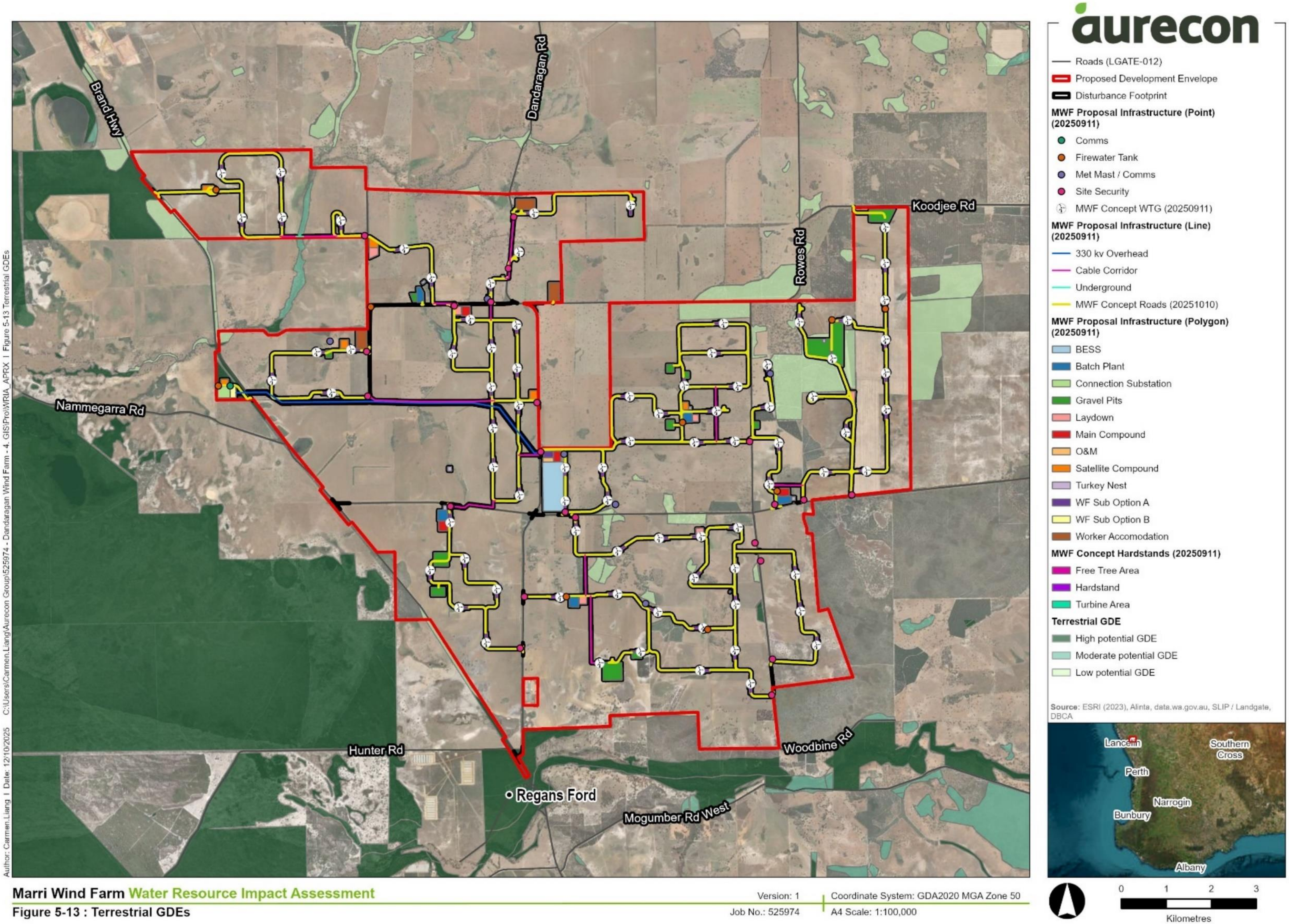
Job No.: 525974
Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000



Marri Wind Farm Water Resource Impact Assessment

Figure 5-13 : Terrestrial GDEs

Version: 1
Job No.: 525974
Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000

6 Water demand and supply

6.1 Water source options

Table 6-1 provides a list and discussion of potential water supply options to fulfil the water demands of the project across its entire lifecycle.

Table 6-1 Water supply source options

Water source option	Discussion	Licensing/procurement of supply
Potable water – trucking	This option would involve trucking potable water to site from a nearby council water supply and storing this onsite in tanks or turkey nest dams. Trucking water to site is a possibility but it is anticipated that high costs would be associated with this option. Water would need to be trucked from towns such as Dandaragan, Moora, Lancelin or Gingin, which are all at least 15km or more from the project area.	Communication with local Councils required
Reticulated water supply	This option would involve pipe connection with a reticulated town water supply. As the project area is at least 15km from a town, this option will likely have a high cost and is anticipated to have higher potential impacts due to the additional infrastructure required.	Communication with local Councils required
Surface water extraction – Moore River, Caren Caren Brook, Namming Lake, farm dams	This option would involve extraction from on-site or nearby surface water sources. No existing surface water licences were noted within the project area and there are limited sources of water from waterbodies (e.g., farm dams) within the proposed Development Envelope. Surface water extraction from Moore River or Caren Caren Brook is unlikely to be feasible as flows in these streams are very low for most of the year due to the seasonal nature of the flow regimes, which is typical for the region. Water extraction from Namming Lake or nearby farm dams may be possible, but this is dependent on the volume required and extraction licensing, and it is unlikely that they could provide the full required volume. These water sources are offsite (approximately 5km from the proposed Development Envelope) and would require the construction of pipes or water trucking to bring the water to site.	Licence(s) would need to be obtained in accordance with the *Gingin surface water allocation plan* (DoW, 2011)

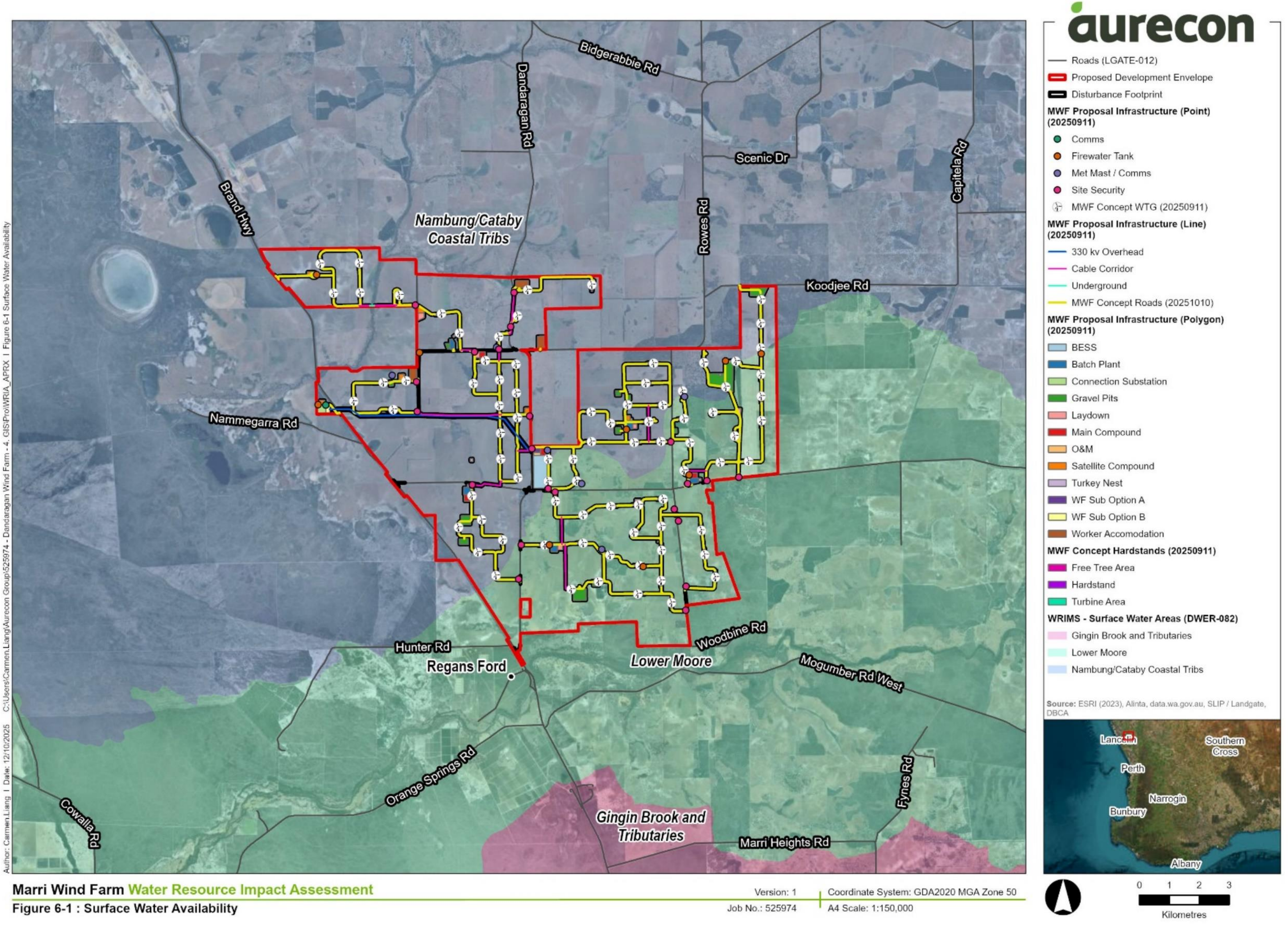
Water source option	Discussion	Licensing/procurement of supply
Groundwater – existing onsite bores	This option would involve obtaining a groundwater allocation from existing onsite bores where possible. Where no new allocations are available, a water trading or leasing agreement would allow for water entitlements to be distributed amongst landholders and/or stakeholders in the same water resource area. This option is likely to provide an adequate volume of water supply, is onsite, and requires minimal additional infrastructure and work.	Allocation would need to be obtained in accordance with the *Gingin groundwater allocation plan* (DoW, 2015)
Groundwater – new groundwater bores	This option would involve the construction of one or more production bores to meet project water demands. Before a groundwater bore can be constructed a groundwater well licence issued by DWER is required. Production bores should be constructed in line with minimum bore construction standards. Licensed bores may require flow metres to report water usage to ensure compliance with water allocation limits. Groundwater allocations may be purchased in areas where allocations are available or traded with existing allocation holders. Depending on the location and type of bore, neighbouring landholders may need to be notified to inform potential impacts to nearby groundwater bores. Extracted groundwater may need to be treated depending on salinity content.	Groundwater well licence (issued by DWER) Purchase or trading of allocations in accordance with *Gingin groundwater allocation plan* (DoW, 2015), DWER and relevant stakeholders and landholders
Water captured by sediment basin	This option would involve using water captured onsite by sediment basin/s to be used as a non-potable water source. Being a sediment basin, there is potential for poor water quality, particularly during rainfall events. It is also unlikely to be reliable due to the seasonality of rainfall. Rainfall is very low in the summer months (see Figure 5-1), and during this time, this water supply option should not be relied upon.	N/A
Wastewater from nearby projects – e.g., mine dewatering sources	This option involves using wastewater from nearby projects, such as mine dewatering sources. As the project area is within the Wheatbelt region, the primary land use is agriculture. However, Cataby Mine is a mineral sand mine which is located approximately 15 km from the proposed Development Envelope. There is potential that wastewater streams from mine dewatering activities could be used as a water supply option. It is likely that the wastewater from this mining process would have a high heavy-metal concentration and may contain traces of uranium, making it unsuitable. The distance to the project area is also a constraint.	Communication with nearby mining companies

Water source option	Discussion	Licensing/procurement of supply
Irrigation scheme (surface water)	Desktop research indicated that agricultural activities in the region primarily rely on irrigation from groundwater sources. While there may be small local or farm-scale surface water usage for irrigation, there is no evidence of a large-scale surface water irrigation scheme that could be utilised as a water supply option for this project.	N/A

6.2 Water availability

6.2.1 Surface water resources

A review of the Government of Western Australia, Department of Water and Environmental Regulation (DWER) Water Register Geoportal determined that there are limited surface water allocations at the project area, with potential to access surface water resources via harvestable dams and/or extraction via lakes/watercourses. No surface water licences were noted at within the project area; all surrounding water licences are for groundwater extraction. The project is located within the Nambung/Cataby Coastal Tribs surface water area and is spatially shown in Figure 6-1.



Marri Wind Farm Water Resource Impact Assessment

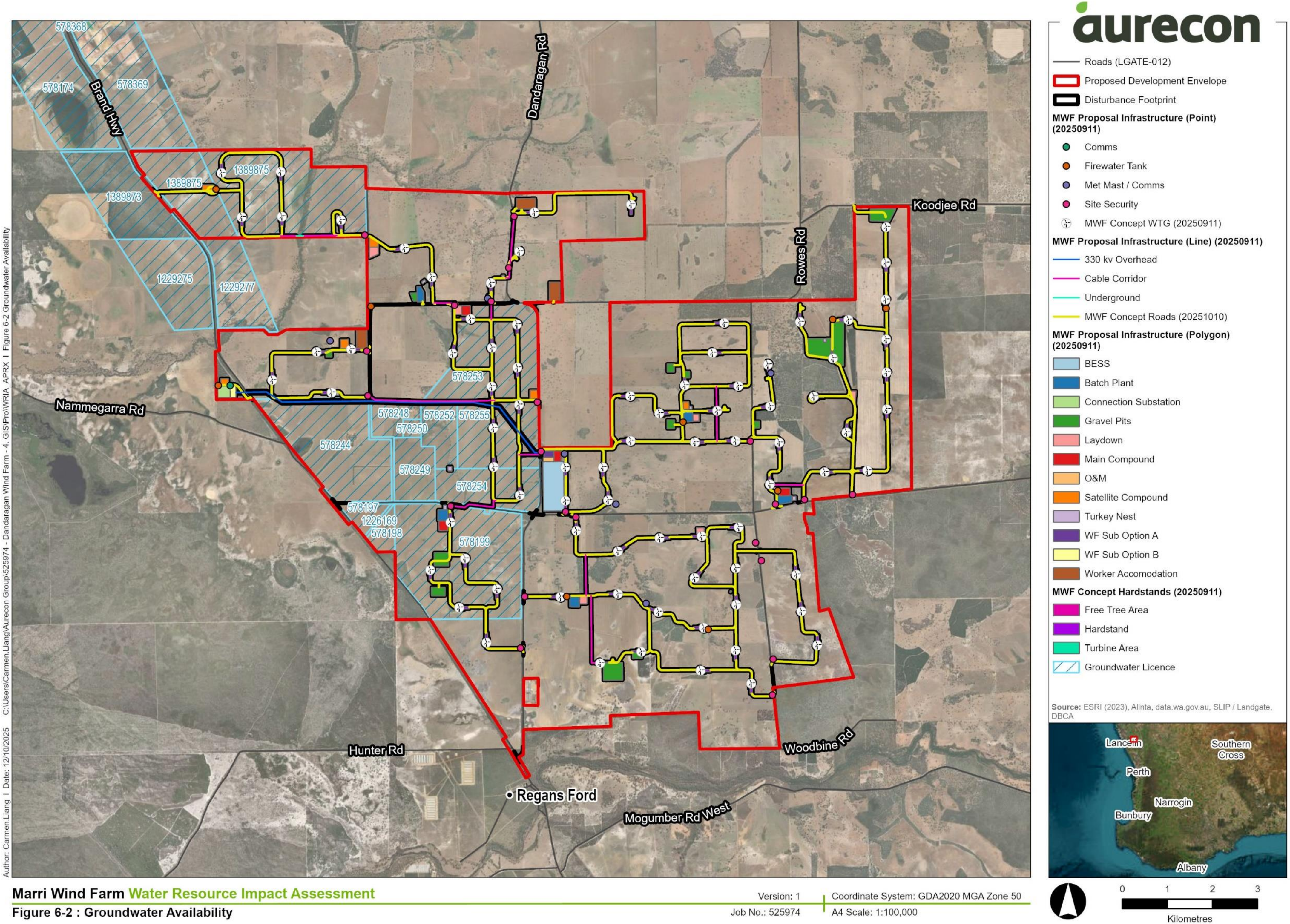
Figure 6-1 : Surface Water Availability

Version: 1
Job No.: 525974
Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:150,000

Surface water availability is expected to be sparse during drier months and nearby watercourses such as Moore River are supplied by groundwater baseflow and generally display low flow. It is therefore unlikely that surface water will be viable as the main water supply, however it could be used as a supplementary supply to meet project water demands.

6.2.2 Groundwater resources

A review of the DWER Water Register Geoportal determined that there are limited groundwater allocations within the project area. Groundwater is fully allocated across the proposed Development Envelope except for a small section which remains available in the north-west. Groundwater resources availability is shown in Figure 6-2, the red dots and hashed polygons refer to existing groundwater licences/lots within and surrounding the project area.



Author: Carmen.Liang | Date: 12/10/2025 C:\Users\Carmen.Liang\Aurecon Group\525974 - Dandaragan Wind Farm - 4. GIS\Pro\WRIA_APRX | Figure 6-2 Groundwater Availability

Marri Wind Farm Water Resource Impact Assessment

Figure 6-2 : Groundwater Availability

Version: 1
Job No.: 525974

Coordinate System: GDA2020 MGA Zone 50
A4 Scale: 1:100,000

Groundwater allocations identified within the proposed Development Envelope have been summarised in Table 6-2.

Table 6-2 Existing groundwater allocations within project area

Licence number	Licence type	Issue date	Expiry date	Parties	Aquifer	Groundwater sub-area	Licence allocation (kL)
110835	Groundwater licence	6/05/2014	31/10/2024	Lawson Grains Pty Ltd	Leederville-Parmelia	Cowalla confined	672,000
95965	Groundwater licence	20/08/2024	14/05/2034	Gen Four Pty Ltd as the Trustee for The Bridgerabbie Farming Trust	Leederville-Parmelia	Cowalla confined	62,750
175697	Groundwater licence	6/05/2015	5/05/2025	Iluka Resources Limited	Leederville-Parmelia	Wedge Island	14,000,000
159716	Groundwater licence	2/08/2018	1/08/2028	Davies, Geoffrey, Davies, Geraldine	Surficial	Victoria Plains	11,900
203934	Groundwater licence	6/02/2020	5/02/2030	Ash, Philip Gregory	Surficial	Victoria Plains	97,150
103555	Groundwater licence	22/05/2018	21/05/2028	Allen, Graham Robert	Surficial	Victoria Plains	3,150

As shown in Table 6-2, a total of approximately 14,800 ML of groundwater allocations have been identified within the proposed Development Envelope shared amongst various parties. It is noted some licences have expired, however it uncertain whether this is actually the case. The total licensable allocations by aquifer and sub-area are referred in Table 5-5. The options for groundwater use across the project area are:

- New allocations could be purchased if available, and extraction bores constructed to supply groundwater for the project;
- A water trading or leasing agreement would allow for water entitlements to be distributed amongst landholders and/or stakeholders in the same water resource area, and extraction bores constructed to supply water for the project or access granted to existing bores by the relevant landholders.

Negotiations are currently underway between the project and relevant landholders/stakeholders to secure sufficient water allocations for construction and operational water requirements It should be noted that a water allocation purchaser that does not already have a licence to take water must apply for a licence under the normal licence assessment process and receive a licence as part of the transaction.

6.3 Project water demand

A high-level project specific estimate of construction, operation and decommissioning water demands have been developed, based on the inputs provided by Alinta and the current project area boundaries. Water demands were estimated based on similar projects, high-level area estimates and standard assumptions to provide anticipated water demands for the project. These estimates are indicative only and do not constitute an exhaustive list of water demands. Demands can be refined when further design details have been determined.

6.3.1 Key assumptions

Table 6-3 provides the assumed footprint of key infrastructure elements which were used to estimate water demand.

Table 6-3 Key assumptions

Footprint of constructed areas			
Item	**Assumed total value**	**Units**	**Source**
WTG foundations	4.83	Ha	Marri Wind Farm Geoportal
Connection Substation	7	Ha	Marri Wind Farm Geoportal
Windfarm Substation	3	Ha	Marri Wind Farm Geoportal
O&M Facilities	2.22	Ha	Marri Wind Farm Geoportal
BESS	50.02	Ha	Marri Wind Farm Geoportal
Meteorological mast foundations	3	Ha	Marri Wind Farm Geoportal
Access roads (unsealed)	73.42	Ha	Marri Wind Farm Geoportal (assumed road width of 7 metres)
Hardstand area	132.44	Ha	Marri Wind Farm Geoportal
Total Disturbed Footprint	275.93	Ha	Calculation

6.3.2 Construction

The inputs to the calculation of construction water demand can be viewed in Table 6-4 below. Key construction activities that require water demand include:

- Dust suppression
- Workforce potable water use
- Concrete construction demand
- Concrete wash-down
- Vehicle wash-down
- Road (unsealed) construction demand
- Hardstand construction demand

Table 6-4 Construction water demand

Item	Number	Units	Assumption
Dust Suppression Demand			
Length of access roads	104881	m	Dust suppression assumed for access roads only
Width of access roads	7	m	Access road width was not provided, a typical width of 7m was assumed
Rate of work	2.5	L/m^2/day	Estimation based on previous study

Item	Number	Units	Assumption
Number of days requiring dust suppression	305	Days	BoM - Between 1997 and 2024, there were an average of 60 days of rainfall >=2mm. Dust suppression assumed necessary for days below 2mm of rain. Rainfall data extracted from Gingin Aero station (station no. 009178).
Total Dust Suppression Demand	**139951**	**kL**	**Calculated - assume 25% of roads are dust suppressed on dry days**
Workforce Potable Demand			
Potable Water Demand for Construction Compound	30	L/person/day	Estimation based on previous study
Workforce	450	Persons	Marri Windfarm Environmental Review Document
Duration of construction	1011	Days	Marri Windfarm Environmental Review Document (3 years, assuming 4 weeks of leave per year)
Total Potable Water Demand	**13649**	**kL**	**Calculated**
Concrete wash-down			
Hourly output of batching plants (total of all 6 plants)	1440	m^3/hour	Marri Windfarm Environmental Review Document
Water inputs for batching	0.2	kL/ m^3	Typical water demand for concrete batching assumed.
Total batching hours	1378	hours	Calculated based on total volume of concrete required in section below.
Total batching water demand	396826	kL	Calculated.
Concrete wash-down demand	0.125	kL/m^3 of concrete poured	Estimation based on previous study
Concrete wash-down demand	**34087**	**kL**	**Calculated**
Concrete Construction Water Demand Concrete demand assumed for permanent infrastructure only (temporary buildings excluded)			
Depth of slabs (WTG foundations & Meteorological mast foundations)	3	m	No information provided, depth of 3m assumed.
WTG foundations	144900	m^3 of concrete	Calculated
Meteorological mast foundations	90000	m^3 of concrete	Calculated
Depth of slabs (building foundations)	0.3	m	No information provided, typical depth assumed.
Connection Substation (foundations)	10500	m^3 of concrete	Calculated - assume 50% of the area requires concrete foundations
Windfarm substation (foundations)	4500	m^3 of concrete	Calculated - assume 50% of the area requires concrete foundations

Item	Number	Units	Assumption
O&M facilities (foundations)	6660	m^3 of concrete	Calculated
BESS	16135	m^3 of concrete	Estimation based on previous study
Total Volume of concrete required	272696	m^3	Calculated
Volume of water per m^3 of concrete	0.2	kL/m^3	Typical water demand for concrete batching assumed
Total volume of water required for concrete	**54539**	**kL**	**Calculated**
Vehicle Wash Down Water Demand			
% of wet days in a year	27%		BoM - Between 1997 and 2024, there were an average of 98 days of rainfall (27% of days in 1 year). Rainfall data extracted from Gingin Aero station (station no. 009178).
% of dry days in a year	73%		BoM - Between 1997 and 2024, there were an average of 267 days of no rainfall (73% of days in one year). Rainfall data extracted from Gingin Aero station (station no. 009178).
Vehicle Wash Down Water Demand (wet days)	10	kL/day	Estimation based on previous study
Vehicle Wash Down Water Demand (dry days)	5	kL/day	Estimation based on previous study
Total	**6420**	**kL**	**Calculated**
Road construction demand			
Water demand for road construction	18.73	L/m^2 of road	Estimation based on previous study
Total volume of water for road construction	**13751**	**kL**	**Calculated**
Hardstand construction demand			
Water demand for hardstand construction	423	kL/WTG	Estimation based on previous study
Total volume of water for hardstand construction	**34686**	**kL**	**Calculated**
Total Construction Water Demand			
Total Water Demand	**297**	**ML**	**Calculated**
Total Water Demand (daily average)	**0.3**	**ML/day**	**Calculated**

6.3.3 Operation

The inputs considered to develop the operational water demand can be viewed in Table 6-5Table 6-5 below. Key operational activities that require water demand include:

- Workforce potable water use

- Vehicle wash down

Table 6-5 Operational water demand

Item	Number	Units	Source
Workforce Potable Demand			
Potable Water Demand for Operations	180	L/person/day	Assume 24-hour workday.
Workforce	10	Persons	Marri Windfarm Environmental Review Document
Duration of operation per year	365	Days	Assume 24/7 operation
Total Annual Potable Water Demand	**0.66**	**ML**	**Calculated**
Vehicle Wash Down Water Demand			
% of vehicles operating as compared to construction phase	20%		Estimation based on previous study
Total Annual Vehicle Wash Down Demand	**0.46**	**ML**	**Calculated**
Total Operational Water Demand			
Operational life	40	years	Marri Wind Farm Environmental Review Document - assume operation every day of the year
Total Water Demand	**45**	**ML**	**Calculated**
Total Water Demand (annual)	**1.12**	**ML/year**	**Calculated**

6.3.4 Decommissioning phase

The inputs used to calculate a water demand for the decommissioning phase of the project can be viewed in Table 6-6. Key decommissioning activities that require water demand include:

- Dust suppression
- Workforce potable water use
- Vehicle wash down
- Vegetation re-establishment

Table 6-6 Decommissioning water demand

Item	Number	Units	Source
Dust Suppression Demand			
Length of access roads	104881	m	Dust suppression assumed for access roads only
Width of access roads	7	m	Access road width was not provided, a typical width of 7m was assumed
Rate of work	2.5	L/m^2/day	Estimation based on previous study

Item	Number	Units	Source
Number of days requiring dust suppression	305	Days	Assume decommissioning period would be the same duration as construction period
Total Dust Suppression Demand	**139951**	**kL**	**Calculated - assume 25% of roads are suppressed on any given day**
Workforce Potable Demand			
Potable Water Demand for Construction Compound	30	L/person/day	Estimation based on previous study
Potable Water Demand for Construction Compound	30	L/person/day	Estimation based on previous study
Workforce	150	Persons	Assume 1/3 of workforce as what was required for construction
Duration of decommissioning	1011	Days	Marri Windfarm Environmental Review Document (3 years, assuming 4 weeks of leave per year)
Total Potable Water Demand	**4550**	**kL**	**Calculated**
Vehicle Wash Down Demand (assumed to be the same as construction)			
% of wet days in a year	27%		BoM - Between 1997 and 2024, there were an average of 98 days of rainfall (27% of days in 1 year). Rainfall data extracted from Gingin Aero station (station no. 009178).
% of dry days in a year	73%		BoM - Between 1997 and 2024, there were an average of 267 days of no rainfall (73% of days in one year). Rainfall data extracted from Gingin Aero station (station no. 009178).
Vehicle Wash Down Water Demand (wet days)	10	kL/day	Estimation based on previous study
Vehicle Wash Down Water Demand (dry days)	5	kL/day	Estimation based on previous study
Total	**6420**	**kL**	**Calculated**
Vegetation Re-establishment			
Area of cleared native vegetation	6563300	m^2	Marri Windfarm Environmental Review Document
Irrigation demand for re-vegetation	0.3	kL/m^2	Research indicates 100-300mm of irrigation for the first year of re-vegetation to ensure establishment. Assumed native species and planting timing aligned with seasons.
Total rehab demand	**19690**	**kL**	**Calculated**
Total Decommissioning Water Demand			
Number of decommissioning days for whole project	1011	days	Assumed same duration as construction phase
Total water demand for decommissioning:	**171**	**ML**	**Calculated**

Item	Number	Units	Source
Total water demand for decommissioning, daily average across project:	**0.2**	**ML/day**	**Calculated**

6.3.5 Demand summary

A summary of the water demand across the life of the project can be viewed in Table 6-7. It is expected that water demand will peak during the construction phase, when concrete production is occurring. Water demand will be low and consistent during the operational phase. The demand will again increase when the decommissioning begins, with a peak when irrigation is required to re-establish native vegetation where it was previously cleared.

Table 6-7 Demand summary

Project Phase	Demand
Total Construction Demand	297 ML
Total Operational Demand (ML)	45 ML
Total Decommissioning Demand (ML)	171 ML
Total Project Demand (ML)	**513 ML**

6.4 Water supply strategy

The construction and operational demands of the project have been estimated at approximately 342 ML, with an additional 171 ML required for decommissioning. Based on the above assessment, groundwater has been identified as the key non-potable water supply source for the project.

The options for groundwater use across the project area are:

- Purchasing of new allocations and construction of extraction bores to supply groundwater for the project;
- Water trading and/or leasing agreements of water entitlements with stakeholders in the same water resource area. Based on the outcomes of water dealings, extraction bores could then be constructed to supply water for the project and/or access to existing bores may be granted by relevant landholders following access agreements.

Alternative water supply options may be considered such as surface water capture/harvesting and/or water trucking to supplement potable water requirements. Groundwater may require treatment if used for potable water supply depending on the level of salinity and turbidity.

7 Construction impacts

7.1 Potential impacts

Construction activities at the site have the potential to adversely impact the surface water and groundwater environment if not managed appropriately. Potential impacts include:

- Clearing / removal of vegetation and earthworks may increase the risk of soil erosion, especially on erosive soils or steep slopes without adequate vegetation. This could lead to increased sedimentation or higher turbidity in local waterways
- Progressive increases in impervious area during construction phase (associated with access tracks, hardstands and buildings) leading to increased runoff volumes, rates and frequency which could lead to increases in erosion in receiving waterways
- New unsealed materials on access tracks could potentially be washed off by runoff into surface water features causing sedimentation.
- Alteration of surface water flow paths and hydrological regimes due to earthworks or infrastructure installation, potentially affecting downstream aquatic and riparian ecosystems.
- Use of heavy machinery and chemicals (fuels, lubricants) presents spill and leakage risks, which could contaminate soil and infiltrate groundwater if not properly managed.
- Material falling off vehicles during transportation and being conveyed by runoff into receiving watercourses may lead to water quality impacts.
- Stockpiling of materials which may affect overland flow paths leading to scour and erosion or stockpiled material being washed into surface water features leading to sedimentation.
- Wash down of mechanical equipment (vehicles, earth-moving plant) can introduce pollutants such as oils, fuels, greases, tars, and solvents to surface water and groundwater sources if not properly contained and treated.
- Concrete wash-water, if not contained, could potentially be washed onto ground and ultimately into surface water features during the construction of foundations and buildings. This could potentially lead to water quality impacts.
- Excavation activities (including installation of new groundwater bores) close to water tables could lead to cross-contamination between soil layers and aquifers.
- Dewatering or groundwater drawdown during excavations may alter groundwater levels and flow patterns, impacting groundwater-dependent ecosystems.
- Disturbance of acid sulfate soils resulting in soil/surface water/groundwater acidification and leaching of heavy metals. The majority of the project area is low risk but there are some high-risk discrete locations in the vicinity of proposed access tracks parallel to Brand Highway and associated bodies of water
- resulting in soil/surface water/groundwater acidification and leaching of heavy metals. Water use for construction needs may impact local water availability or groundwater levels in sensitive areas.

7.2 Qualitative assessment

An assessment of construction impacts and their potential effect on receiving environments, and how this can be managed is shown in Table 7-1. Brief details on suggested management measures are shown in Table 7-1, for more detailed information on management and mitigation measures for construction activities, refer to Section 10.

Table 7-1 Construction impact and qualitative risk assessment

Activity	Potential Impacts	Potential Effect on Receiving Environment	Assessed potential impact and risk	Suggested Management Measures	Assessed residual risk
Clearing / removal of vegetation and earthworks	Increased soil erosion and sedimentation	Increased sedimentation and turbidity in water bodies and waterways (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands) impacting aquatic life and ecosystem health.	Moderate; possible. Medium risk	Erosion and Sediment Control Plan (ESCP) which details erosion and sediment control measures Construction Environmental Management Plan (CEMP)	Low
	Alteration of surface water flow paths and hydrology from earthworks	Changes to hydrological regimes and increased sedimentation and turbidity, impacting aquatic ecosystems and habitats in waterways and waterbodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Erosion and Sediment Control Plan (ESCP) which details temporary construction drainage, erosion and sediment control measures and temporary scour protection.	Low
	Excavation intersecting the watertable and aquifer contamination	Groundwater pollution and aquifer disturbance impacting groundwater dependent ecosystems.	Moderate; possible. Medium risk	Management of dewatering in accordance with *Water Quality Protection Note 13: Dewatering of soils at construction sites* (Department of Water, 2012) and the Environmental Protection Act, 1986	Low

Activity	Potential Impacts	Potential Effect on Receiving Environment	Assessed potential impact and risk	Suggested Management Measures	Assessed residual risk
Placement of hardstands and construction / upgrade of access tracks	Unsealed materials potentially washed off into water features	Sedimentation and water quality impacts leading to habitat degradation in downstream surface water sources (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Erosion and Sediment Control Plan (ESCP); Construction Environmental Management Plan (CEMP)	Low
	Increased stormwater runoff rates, volume and frequency due to the increases in impervious areas	Slight change to hydrological regimes potentially leading to an increased erosion risk impacting aquatic ecosystems and habitats in waterways and waterbodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Erosion and Sediment Control Plan (ESCP) identifying temporary drainage measures and scour protection; Stormwater management for final hardstands and access tracks to be designed in accordance with the *Stormwater management manual for Western Australia* (Department of Water and Environmental Regulation, 2022)	Low
Vehicle, plant and equipment usage onsite	Use of heavy machinery and chemicals (fuels, lubricants) causing spill/leak risks	Introduction of toxic substances into surface and groundwater leading to habitat degradation in downstream waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Minor; likely. Medium risk	Storage of THS in accordance with *Water Quality Protection Note 65: Toxic and hazardous substances* (Department of Water, 2015) Emergency Response Plan in accordance with *Water Quality Protection Note 10: Containment spills – emergency response plan* (Department of Water, 2020)	Low
Washdown of vehicles	Wash down of equipment releasing pollutants (oils, fuels, solvents)	Introduction of toxic substances into surface and groundwater leading to habitat degradation in downstream waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Minor; possible. Low risk	Provision of adequate wash down facilities in accordance with *Water Quality Protection Note 68: Mechanical equipment wash down* (Department of Water, 2013)	Low

Activity	Potential Impacts	Potential Effect on Receiving Environment	Assessed potential impact and risk	Suggested Management Measures	Assessed residual risk
Foundation works and WTG construction	Uncontained concrete wash-water washing into surface waters	Introduction of toxic substances into surface and groundwater leading to habitat degradation in downstream waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Appropriate containment of concrete wash-water Emergency Response Plan in accordance with *Water Quality Protection Note 10: Containment spills – emergency response plan* (Department of Water, 2020)	Low
Installation of masts, facilities, and buildings	Uncontained concrete wash-water washing into surface waters	Introduction of toxic substances into surface and groundwater leading to habitat degradation in downstream waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Appropriate containment of concrete wash-water Emergency Response Plan in accordance with *Water Quality Protection Note 10: Containment spills – emergency response plan* (Department of Water, 2020)	Low
Transportation of and removal of spoil	Material falling off vehicles and transported by runoff into watercourses	Water contamination and sedimentation impacting water quality and habitats in downstream aquatic environments (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Minor; possible. Low risk	Erosion and Sediment Control Plan (ESCP); Construction Environmental Management Plan (CEMP)	Low
Dewatering of shallow excavations	Dewatering or groundwater drawdown altering levels and flow patterns	Harm to groundwater-dependent ecosystems and surface water connections.	Moderate; possible. Medium risk	Management of dewatering impacts in accordance with *Water Quality Protection Note 13: Dewatering of soils at construction sites* (Department of Water, 2012)	Low
Groundwater extraction	Dewatering or groundwater drawdown altering levels and flow patterns	Lowering of water-table and harm to groundwater-dependent ecosystems and surface water connections.	Moderate; possible. Medium risk	Management of groundwater extraction impacts in accordance with *Water Quality Protection Note 13: Dewatering of soils at construction sites* (Department of Water, 2012) and Environmental Protection Act, 1986	Low

Activity	Potential Impacts	Potential Effect on Receiving Environment	Assessed potential impact and risk	Suggested Management Measures	Assessed residual risk
Stockpiling of material	Stockpiling of materials which may affect overland flow paths leading to scour and erosion or stockpiled material being washed into surface water features leading to sedimentation.	Increased turbidity sedimentation and degradation of aquatic habitats and water quality. Alteration of flow in waterways impacting natural hydrological processes.	Minor, likely. Medium risk	Erosion and Sediment Control Plan (ESCP); Construction Environmental Management Plan (CEMP)	Low
Drainage works	Alteration of surface water flow paths and hydrology	Changes to hydrological regimes leading to erosion impacting aquatic ecosystems and habitats in waterways and waterbodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Erosion and Sediment Control Plan (ESCP) identifying temporary drainage measures and scour protection; Final drainage design in accordance with the *Stormwater management manual for Western Australia* (Department of Water and Environmental Regulation, 2022)	Low
Water use for construction needs	Water use for construction needs may impact local water availability or groundwater levels in sensitive areas.	Changes to hydrological regimes impacting aquatic ecosystems and habitats in waterways and waterbodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands). Lowering of water-table and harm to groundwater-dependent ecosystems and surface water connections.	Moderate; possible. Medium risk	Water extractions will follow appropriate licencing and allocations in accordance with the *Gingin groundwater allocation plan* (Department of Water, 2015).	Low
Construction of waterway crossings	Upgrade of existing waterway crossing (if required) of Caren Caren Brook may lead to direct disturbance of the bed and banks	If the bed and banks are destabilised as a result of the works, this may lead to erosion and sedimentation impacting aquatic ecosystems and habitat within Caren Caren Brook.	Minor; likely Medium risk	Waterway crossing to be designed appropriately to minimise disturbance to the bed and bank upstream and downstream and provide adequate erosion / scour protection as required. If a new culvert is required, the design should cater for fish passage subject to confirmation by an aquatic ecologist that fish passage is needed.	Low

7.3 Discussion

7.3.1 Water quantity

The flow regime of watercourses and wetlands located within the project area and downstream of the project area could potentially be impacted. Earthworks, vegetation removal, stockpiling and sedimentation could lead to alterations to flow paths. The placement of hard surfaces could lead to reduced infiltration and increased runoff. Dewatering activities could lead to groundwater drawdown, altering levels and flow patterns and impacting groundwater – surface water interactions within waterways. Water use for construction from either groundwater or surface water sources could also impact the hydrological regimes.

As the disturbed area will only make up a negligible to minor portion of the catchment, dewatering requirements for construction will be small, the impacts to runoff volumes, rates and frequency are likely to be negligible to minor. Water extractions will also be undertaken in accordance with appropriate licencing and allocations, and therefore residual impacts to water quantity from groundwater take or surface water use are also expected to be negligible to minor.

7.3.2 Water quality

Water quality could be potentially impacted from a range of construction activities including earthworks and vegetation removal, construction of hardstand surfaces and access tracks, use of vehicles, washdown of vehicles and transportation and spoil management. These activities could lead to sediment, pollutants and chemicals being discharged to waterways, which has the potential to impact ecosystems and water used for human, stock and recreational purposes. The potential impacts from these activities will be mitigated through the implementation of an erosion and sediment control plan (ESCP), construction and environmental management plan (CEMP) and emergency response plan (ERP). With implementation of the management measures outlined in Table 7-1, the impacts to water quality are anticipated to be negligible to minor.

7.3.3 Geomorphology, erosion and scour

The project has one crossing over a mapped waterway (Caren Caren Brook). At this location, the access road crossing aligns with the existing road which minimises additional impact to the erosion and scour of this waterway. The project may also intersect unmapped agricultural drains. Measures to mitigate the impact of any upgrades to waterway crossings through appropriate design and construction management are provided in Section 10.

A number of mapped geomorphic wetlands are located within the proposed Development Envelope (refer to Figure 5-10 and Figure 5-11). The development layout has been adjusted to avoid direct disturbance of the majority of mapped wetland areas. The following mapped wetlands are intersected:

- Western fringe of mapped wetland adjacent to WP76 – mapped wetland extent is cleared land where it is intersected development footprint. The Batch Plant was adjusted to avoid the majority of the mapped wetland extent
- Very eastern fringe of a mapped wetland adjacent to WP9 – mapped wetland extent is cleared land where it is intersected by development footprint
- Western corner of a mapped wetland north of WP9 intersected by a road – mapped wetland extent is cleared / cropping land where it is intersected by development footprint

- Eastern fringe of wetland north west of WP38 – mapped wetland extent is cleared / cropping land where it is intersected by the development footprint
- Western side of mapped wetland between WP19 and WP63 – mapped wetland extent is cleared / cropping land where it is intersected by development footprint. The road layout has been adjusted to avoid the farm dam/pond within this mapped wetland.
- Eastern fringe of mapped wetland adjacent to WP20 – mapped wetland extent is cleared land where intersected by development footprint.

Although not directly intersected by the development footprint, a number of geomorphic wetlands are located within proximity to the development footprint (refer Figure 5-11 for infrastructure located within 500m of a geomorphic wetland).

None of the mapped wetlands intersected or within proximity to the development footprint have been assigned a management category but may provide habitat value for local or migratory species. It is recommended that the mapped wetlands be assessed and validated via project survey. The suitability and potential need for relocation of infrastructure within 500m of a wetland requires assessment with consideration to the assigned management category (to be determined through assessment) and assessed buffer distance (refer to Section 10 for further details). The process of relocating infrastructure within a known wetland area is outlined below:

- Seek advice from the Department of Water's regional office to confirm assessment requirements for the wetlands at risk
- Undertake wetland extent mapping that confirms the presence or absence of on-ground values within the mapped geomorphic wetland extents
- Evaluate the management category of the wetland
- Relocate infrastructure an appropriate distance (buffer) from any wetlands assessed to have a Conservation category
- Wetlands assessed to have a Multiple Use category may support temporary construction works (e.g., set down) but their hydrologic function should be protected and rehabilitated if disturbance occurs.

With implementation of mitigation measures and layout adjustments made through the design development process, the geomorphological impacts are anticipated to be negligible to minor.

7.3.4 Water users

Water users impacted during construction would be determined based on the water sourcing strategy. As groundwater has been identified as the likely key water source to be used, potential impacts to existing users could occur. A water trading or leasing agreement would allow for water entitlements to be distributed amongst landholders and/or stakeholders in the same water resource area. Negotiations are currently underway between the project and relevant landholders/stakeholders to secure sufficient water allocations for construction and operational water requirements. In the event allocations cannot be traded, allocations will need to be purchased where allocations are available, and extraction bores will need to be constructed to supply groundwater for the project.

8 Operational impacts

8.1 Potential impacts

Operational activities at the site have the potential to adversely impact surface water and groundwater environments if not managed correctly. This includes:

- Erosion of stormwater drainage systems if not appropriately protected / lined reducing effectiveness
- Erosion at stormwater outlets to receiving waterways if appropriate scour protection not provided
- Increased pollutant loading from runoff from operational areas to receiving waterways
- Increased runoff volumes, rates and frequency leading to changes in hydrology in receiving waterways
- Accidental spills of chemicals or fuels from maintenance activities that may lead to contaminants being mobilised into waterways.
- Routine wash down and maintenance of mechanical equipment at the site may pose ongoing contamination risks.
- Inadequate management of wastes and stormwater can degrade adjacent water quality.
- Water use for operational needs may have a very slight impact on local water availability or groundwater levels in sensitive areas.

8.2 Qualitative assessment

An assessment of operational impacts and their potential effect on receiving environments, and how this can be managed is shown in Table 8-1. Brief details on suggested management measures are shown in Table 8-1, for more detailed information on management and mitigation measures for operational activities, please refer to Section 10.2.

Table 8-1 Operational impact and qualitative risk assessment

Activity	Potential Impacts	Potential Effect on Receiving Environment	Assessed potential impact and risk	Suggested Management Measures	Assessed residual risk
Vehicle, plant and equipment usage onsite	Continued risk of contamination from maintenance activities if chemicals or fuels from maintenance vehicles and/or equipment are handled improperly near water resources.	Introduction of toxic substances into surface and groundwater leading to habitat degradation in downstream waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Minor; likely. Medium risk	Storage of THS in accordance with *Water Quality Protection Note 65: Toxic and hazardous substances* (Department of Water, 2015) Emergency Response Plan in accordance with *Water Quality Protection Note 10: Containment spills – emergency response plan* (Department of Water, 2020)	Low
Wash-down of vehicles	Routine wash down and maintenance of mechanical equipment at the site may pose ongoing contamination risks.	Introduction of toxic substances into surface and groundwater leading to habitat degradation in downstream waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Minor; possible. Low risk	Provision of adequate wash down facilities in accordance with *Water Quality Protection Note 68: Mechanical equipment wash down* (Department of Water, 2013)	Low
Continued operation of project area	Increased runoff volumes, rates and frequency leading to changes in hydrology in receiving waterways.	Changes to hydrological regimes and increased sedimentation leading to turbidity, impacting aquatic ecosystems and habitats in waterways and waterbodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Moderate; possible. Medium risk	Final drainage design to be developed in accordance with the *Stormwater management manual for Western Australia* (Department of Water and Environmental Regulation, 2022) Maintenance of permanent drainage, scour protection and control measures, and maintenance of access tracks	Low

Activity	Potential Impacts	Potential Effect on Receiving Environment	Assessed potential impact and risk	Suggested Management Measures	Assessed residual risk
	Insufficient buffers to geomorphic wetlands leading to direct stormwater discharges to the wetlands	Water quality and erosion impacts to the wetlands, impacting aquatic ecosystems and habitat	Moderate; possible Medium risk	Maintenance of vegetated buffers or adjustments to the design to provide sufficient buffer distance to geomorphic wetlands with 'Conservation' status in accordance with *Water Quality Protection Note 6: Vegetation buffers to sensitive water resources* (Department of Water, 2006)	Low
	Inadequate management of wastes and stormwater can degrade adjacent water quality.	Water contamination from untreated wastes and stormwater, increasing pollution level in receiving waterways and water bodies (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands).	Minor; possible. Low risk	Erosion and Sediment Control Plan (ESCP); Operational Environmental Management Plan (OEMP)	Low
	Water use for operational needs may impact local water availability or groundwater levels in sensitive areas.	Reduction in local water availability and lowering of water-table and reduced groundwater availability for nearby users, GDEs and baseflow to surface waters.	Moderate; possible. Medium risk	Extract water within licence conditions Monitoring of groundwater levels and quality at extraction points prior, during and post development activities. Tracking of groundwater take to remain compliant with water license.	Low
Stormwater management	Erosion of stormwater drainage systems if not appropriately protected / lined reducing effectiveness	Increased sedimentation and turbidity in water bodies and waterways (Moore River, Caren Caren Brook, Namming Lake, Lake Guraga, downstream wetlands) impacting aquatic life and ecosystem health.	Moderate; possible. Medium risk	Erosion and Sediment Control Plan (ESCP) which details erosion and sediment control measures; Operational Environmental Management Plan (OEMP); Routine maintenance of drainage system.	Low
	Increased pollutant loading to receiving waterways if stormwater not treated	Increased sedimentation and turbidity in water bodies and waterways (Moore River, Caren Caren Brook, Namming Lake, downstream wetlands) impacting aquatic life and ecosystem health.	Moderate; possible. Medium risk	Stormwater management in accordance with the *Stormwater management manual for Western Australia* (Department of Water and Environmental Regulation, 2022).	Low

8.3 Discussion

8.3.1 Water quantity

The operational phase of the project may result in an altered hydrological regime due to the increase in impervious area associated with new hardstand areas and buildings. The increased runoff resulting from the project will be a small portion compared to the wider catchment and is unlikely to result in any major changes to hydrological regime. The alterations to flow paths is also likely to be localised and minor. It is therefore anticipated that the operational risk to impacts to water quantity is negligible.

8.3.2 Water quality

Increased runoff volumes from new hardstands and buildings could lead to increased loading of sediment and other pollutants to waterways. In addition, if not managed appropriately there is potential for contaminated runoff from vehicle washdown areas or chemical storage areas to be discharged to waterways. A lack of existing vegetated buffers and increased runoff volumes may result in increased risk of impacts to the mapped geomorphic wetlands.

Measures to manage stormwater during operation are recommended within Section 10.2. With the proposed measures in place and considering the project footprint is only a small portion of the wider catchment residual impacts are expected to be negligible.

8.3.3 Geomorphology, erosion and scour

Stormwater outlets will be designed to include appropriate scour protection and dissipation measures to minimise the potential for scour and erosion during the operational phase.

As discussed in Section 7.3.3 the development layout has been adjusted to avoid direct disturbance of wetland features. Some infrastructure is still located within proximity to the mapped wetland extents (refer Figure 5-10 for infrastructure located within 500m of a mapped wetland) with one mapped wetland intersected by a proposed road but as discussed in Section 7.3.3, this mapped wetland appears to be predominantly cropping land with the main wetland feature, a pond, avoided by the road. The management category of the wetlands and associated buffer distance (if required to minimise the potential for indirect impacts) has not been evaluated which may influence the development layout should buffers to the wetland be required. At a minimum it is recommended that the process of relocating infrastructure should follow:

- Undertake project area wetland extent mapping that confirms the presence or absence of on-ground values within the mapped geomorphic wetland extents
- Evaluate the management category of the wetland
- Relocate infrastructure an appropriate distance (buffer) from any wetlands assigned a Conservation category through assessment
- Wetlands given a Multiple Use category through assessment may support temporary operational activities (e.g., set down) but their hydrologic function should be protected and rehabilitated if disturbance occurs.

With the proposed measures in place, residual impacts to the geomorphology of onsite and downstream waterways and wetlands are expected to be minor.

8.3.4 Water users

Water users impacted during operation would be determined based on the water sourcing strategy identified. As groundwater has been identified as the likely key water source to be used, potential impacts to existing users could occur. A water trading or leasing agreement would allow for water entitlements to be distributed amongst landholders and/or stakeholders in the same water resource area. Negotiations are currently underway between the project and relevant landholders/stakeholders to secure sufficient water allocations for construction and operational water requirements In the event allocations cannot be traded, allocations will need to be purchased where allocations are available, and extraction bores will need to be constructed to supply groundwater for the project.

9 Decommissioning impacts

Various impacts to surface water and groundwater are possible during the decommissioning phase of the project if not managed appropriately. It is expected that these impacts would be similar to those expected during the construction phase of the project, as described in Section 7.1 and managed with measures described in Section 7.2.

Through management and mitigation measures (as discussed in Section 10.3), the residual impacts are considered to be a low risk to the surface water and groundwater environment.

10 Management and Mitigation

10.1 Construction measures

During the construction phase, there are potential surface and groundwater impacts that may occur due to clearing and removal of vegetation, earthworks, land disturbance, discharge of runoff and anticipated groundwater extraction. It is expected that all management impacts can be managed through the development and implementation of the following:

- Construction Environmental Management Plan (CEMP) to manage any environmental risks caused by construction activities.
- Erosion and Sediment Control Plan (ESCP) to document the erosion and sediment controls for the construction phase.
- Emergency Response Plan (ERP) for storage, transport, handling and use of chemicals, wastes and other substances that could cause harm to receiving environments. This should be prepared in accordance with *Water Quality Protection Note 10: Containment spills – emergency response* plan (Department of Water, 2020). The plan shall detail a plan for storage, transport, handling and use of chemicals, wastes or other substances that could contaminate water resources of the environment.

These documents will establish the locations and nature of key environmental controls and pre-construction works for mitigating environment risks across the project area.

In addition, the following measures are recommended:

- Appropriate onsite sediment and erosion controls are implemented in accordance with the ESCP
- Containment of concrete wash-water such that pollutants cannot escape to the environment under any foreseeable conditions.
- Adequate wash down facilities shall be provided to contain, treat and then dispose of waste residues at an appropriate location away from water resources in accordance with *Water Quality Protection Note 68: Mechanical equipment wash down* (Department of Water, 2013).
- It is recommended the infrastructure layout is modified where possible to entirely avoid direct disturbance of confirmed geomorphic wetlands (based on field survey by ecologist). Where newly proposed infrastructure is located within 500m of a confirmed geomorphic wetland boundary an ecologist shall assess the management criteria and appropriate buffer distance required based on the value and management category of the wetland in accordance with *A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia* (DBCA, 2017) and *Water Quality Protection Note 6: Vegetation buffers to sensitive water resources* (Department of Water, 2006). Once the buffer is determined, the infrastructure layout shall be adjusted accordingly. Roads or service corridors including unpaved roads may cross the wetland buffer zones, but these should occupy the minimum practical area of the buffer and include stormwater management systems to limit deterioration of the buffer and the protected waters. It is recommended that run-off distribution channels to drain turbid water into filter vegetation are provided in accordance with *Water Quality Protection Note 6: Vegetation buffers to sensitive water resources* (Department of Water, 2006).
- A comprehensive assessment of potential environmental impacts of dewatering shall be undertaken in accordance with *Water Quality Protection Note 13: Dewatering of soils at construction sites* (Department of Water, 2012) before any dewatering activities begin. This assessment will highlight environmental risks and propose management strategies to overcome any significant environmental issues.
- Toxic and hazardous substances (THS) shall be stored in appropriate storage facilities situated away from water resources to prevent chemical and fuel run-off or leaching from causing significant or persistent environmental harm in accordance with *Water Quality Protection Note 65: Toxic and hazardous substances (Department of Water, 2015)*. Facilities shall be constructed so that THS cannot escape to the environment under any foreseeable conditions.

- If supply of water is to be provided by groundwater sources, groundwater licensing and limits will be adhered to and managed in accordance with the *Gingin groundwater allocation plan* (Department of Water, 2015) to prevent over-extraction of groundwater. Groundwater extraction shall be monitored to ensure compliance.
- If groundwater monitoring bores are to be constructed, the siting, construction and drilling process shall align with recommendations in *Water Quality Protection Note 30: Groundwater monitoring bores* (Department of Water, 2006).

10.2 Operational measures

Management and mitigation measures will be undertaken to minimise the impact of operational activities on surface and groundwater environments. It is expected that the majority of potential impacts can be managed through the development and implementation of operational mitigation measures, including:

- Operational Environmental Management Plan (OEMP) to manage any environmental risks caused by operational activities.
- Operational ERP to reflect the operational phase.
- Design of permanent drainage, scour protection, control measures and maintenance of access tracks to prevent turbidity and sedimentation in receiving surface water environments.
- Toxic and hazardous substances shall be stored in appropriate storage facilities situated away from water resources to prevent chemical and fuel run-off or leaching from causing significant or persistent environmental harm in accordance with *Water Quality Protection Note 65: Toxic and hazardous substances* (Department of Water, 2015). Facilities shall be constructed so that substances cannot escape to the environment under any foreseeable conditions.
- Stormwater from roofs and clean paved areas should be directed away from potentially contaminated areas where toxic and harmful substances (THS) are stored or handled. Stormwater that may be contaminated should be treated to reclaim THS or disposed of at a licenced liquid waste facility. Uncontaminated stormwater shall be managed as recommended in the *Stormwater management manual for Western Australia.*
- If supply of operational water is to be provided by groundwater sources, groundwater licensing and limits will be adhered to and managed in accordance with the *Gingin groundwater allocation plan* (Department of Water, 2015) to prevent over-extraction of groundwater. Groundwater levels shall be monitored to ensure compliance.

10.3 Decommissioning measures

A Decommissioning and Rehabilitation Plan (DRP) to manage environmental risks associated with decommissioning activities and ensure the project area is rehabilitated appropriately and effectively.

An ESCP and ERP will also be prepared to reflect the decommissioning phase. As decommissioning impacts are expected to similar to construction impacts, mitigation measures described in Section 10.1 will also apply to the decommissioning phase.

11 Conclusion

The WRIA has considered the potential impacts of the project and appropriate measures to manage these impacts to ensure receiving surface and groundwater environments are not adversely affected.

The Marri Farm Wind Farm is expected to have minimal impact on water resources with the proposed management measures implemented.

Key potential issues relevant to the water resources impacts of the project are summarised below:

- Potential impacts to surface water and groundwater resources are primarily limited to the construction and decommissioning phases of the project. These can be mitigated in such a way that risk becomes negligible to minor. Any layout adjustments avoid where possible confirmed wetlands and required adjustments shall be informed by an ecologist assessment of the wetlands in accordance with state guidelines.
- During the operational phase the key risk will be from stormwater discharges to waterways and wetlands. Providing the stormwater system is designed appropriately, the risk is likely to be low.
- Water demands can be met by existing groundwater bores and licenses assuming there are adequate water allocations available. It is recommended that engagement with DWER and relevant landholders/stakeholders occurs as early as possible to secure sufficient allocations, particularly if water allocations are unavailable.

Overall, impacts can be adequately mitigated through appropriate design and management measures that align with guidelines provided by the Western Australian Government's Department of Water.

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