WATER MANAGEMENT PLAN

LOT 262 (No. 220) QUEELUP ROAD, NORTH BOYANUP

October 2025

Telephone +61 418 950 852

info@accendoaustralia.com.au
PO Box 5178 West Busselton WA 6280
ABN 11 160 028 642

www.accendoaustralia.com.au

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Limitations

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The report is based on site specific conditions encountered and information received at the time of preparation of this report or the time that site investigations were undertaken. Accendo disclaims responsibility for any changes that may have occurred after this time.

The preparation of this report has been undertaken and performed in a professional manner, in consideration of the scope of services and in accordance with environmental consulting practices. No other warranty is made.

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 Background

JW Cross Maintenance Pty Ltd (the applicant) is proposing to extract sand from approximately 16.36 hectare (ha) area within Lot 262 (No. 220) Queelup Road, North Boyanup (herein referred to as the subject site) (refer to **Figure 1** and **Figure 2**).

The available volume of sand (*insitu* volume of approximately 500,000 m^3) is to be extracted, commencing to the south of the subject site and moving in a northerly direction.

The slope of the final contours of the pit will slope from approximately 22.3 m Australian Height Datum (AHD) in the south to 24.6 m AHD in the centre of the extraction area back to 23.7 in the north.

Slopes of the batters at the end of excavation will be retained at 1:6 vertical to horizontal.

1.2 Purpose and Scope

The purpose of this Water Management Plan (WMP) is to review the risks and control measures to appropriately manage minimise the environmental impacts of the extractive industry on both groundwater and surface water in proximity to the subject site.

The scope of the WMP is to cover the following:

- Legislative and regulatory compliance;
- Existing environment;
- Risk assessment water quality impacts;
- Mitigation and measurement measures; and
- Roles and responsibilities in relation to water management.

2 EXISTING ENVIRONMENT

2.1 Location

The subject site is located within Lot 262 Queelup Road, North Boyanup. The subject site is located within the municipality of the Shire of Capel, approximately 10 km southeast of the Bunbury town centre and approximately 150 km south of Perth (refer to **Figure 1** and **Figure 2**).

2.2 Land Use

The subject site is zoned 'Rural' under the Shire of Capel's *Local Planning Scheme No. 8* (LPS 8) and the *Greater Bunbury Region Scheme* (GBRS). The subject site is located within the 'Special Control Area – Strategic minerals and Basic raw materials' under the LPS 8. The proposed extractive industry is a permitted land use within this zone subject to development approval from the Shire of Capel.

Land use to the east and southeast of the subject site is zoned 'Rural' and 'Local Road' under the LPS 8 and 'Rural' under the GBRS. Properties to the north, west and southwest of the subject site are zoned 'Rural' under the LPS 8 and GBRS. Properties that are located to the northeast of the subject site over Queelup Road are zoned 'Rural Residential' under the LPS 8 and 'Rural' under the GBRS.

Historically the subject site has been used for livestock grazing, resulting in the disturbance of the majority of native vegetation onsite. Intact remnant vegetation remains in the southwestern portion, with the remainder of the subject site comprised of mature paddock trees.

2.3 Topography and Soils

The current topography of the subject site can be described as sloping with the elevation ranging from 24 m AHD in the north and northwest corner to 33 m AHD in the centre before falling again to 26 m AHD in the southeast (refer to **Appendix A**).

The subject site is located within the Bassendean System of the Bassendean Zone consisting of fixed dunes inland from coastal dune zone containing non-calcareous sands, podsolised soils with l ow-lying wet areas. The Bassendean system consists of "*Sand dunes and sandplains with pale deep sand, semi-wet and wet soil*" (Natural Resource Information (NRInfo)).

The subject site is located within the Bassendean B1b soil phase consisting of "*very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons*" (NRInfo).

2.4 Climate

The climate of the locality is classified as Mediterranean with warm to hot dry summers and cool wet winters.

The closest weather recording station is Bunbury (Station 9965). Temperatures are highest on average in February, at approximately 30.1°C. July has the lowest average temperature of the year of 7.4°C.

Rainfall for the area is approximately 737.3 mm per annum with approximately 90% of the rain falling during the winter months, April to October inclusive.

During the summer months the dominant wind in the mornings is from the south-east at 17-18 knots, swinging to the south-west at approximately 22 knots in the afternoon. During winter, the winds are most commonly 12-19 knots from no dominant prevailing direction. During storms, winds from the west and north-west can reach 40 knots (BoM 2020).

Rainfall intensity has been calculated using the Bureau of Meteorology (BoM) Intensity-Frequency-Duration (IFD) data system which yields the two hour 1 in 10 (10%) annual exceedance probability storm event for the subject site as 39.1 mm/hr.

2.5 Hydrology

2.5.1 Groundwater

The subject site is located within the Bunbury East and the Bunbury -Yarragadee subarea of the proclaimed Bunbury Groundwater Area.

Three Groundwater monitoring bores and one windmill located in proximity to the extraction area (refer to **Figure 3**) have been monitored monthly for groundwater levels from August 2024 to June 2025 (refer to **Appendix B**). Data from this monitoring period indicates maximum groundwater levels were recorded at 3.7 m below ground level (BGL), 3.9 m BGL and 7.4 m BGL at the windmill, Bore No. 1 and Bore No. 2 respectively, in September 2024. Bore No. 3 which is 8 m BGL was found to be dry over the entire monitoring period. DWER groundwater monitoring bore Bunbury Shallow (BY8A) is located approximately 1.3 km from the southwest corner of the subject site (see **Figure 3**). While no data is available in the peak period of 2024, over a ten year monitoring period groundwater data indicates the highest recorded peak groundwater level was 5.42 m AHD, observed in October 2016 and September 2017. The lowest peak level occurred in September 2023 at 4.18 m AHD, resulting in a range of 1.24 m between the maximum and minimum peak levels. Based on this historical variability, it is possible that groundwater levels during a year with a higher seasonal peak could be up to approximately 1.24 m higher than current observations. A review of annual rainfall statistics shows that the annual total rainfall was the lowest in 2023 and the highest in 2021 with 562 mm and 1019 mm, respectively. The annual rainfall for 2024 was between these two years with a total annual rainfall of 799 mm. To account for possible variation in groundwater levels a safety factor of 1.24 m has been applied to all peak groundwater levels recorded when determining peak groundwater contours (refer to **Figure 4**).

2.5.2 Surface Water

The subject site is located in the Middle Preston subarea of the unproclaimed Preston surface water area, approximately 5km to the south west of the *Rights in Water and Irrigation* (RiWI) *Act 1914* proclaimed Collie River Irrigation district. The subject site is not proclaimed under the *Country Areas Water Supply Act 1947* as a public drinking water source area. The closest public drinking water source area is the Bunbury Water Reserve located approximately 2 km to the west of the subject site.

No surface water features are present within the subject site.

2.5.3 Wetlands

Wetlands within Western Australia are classified on the basis of landform and water permanence pursuant to the Semeniuk (1995) classification system (refer to **Table 1**).

Table 1. Wetland classifications (Semeniuk 1995).

Water Longevity	Landform				
	Basin	Channel	Flat	Slope	Highland
Permanent Inundation	Lake	River	-	-	-
Seasonal Inundation	Sumpland	Creek	Floodplain	-	-
Intermittent Inundation	Playa	Wadi	Barlkarra	-	-
Seasonal Waterlogging	Dampland	Trough	Palusplain	Paluslope	Palusmont

Areas of wetlands in Western Australia have been mapped and this mapping has been converted into a digital dataset that is maintained by the Department of Biodiversity, Conservation and Attractions (DBCA) and is referred to as the '*Geomorphic Wetlands of the Swan Coastal Plain*' dataset. This dataset contains information on geomorphic wetland types and assigns management categories that guide the recommended management approach for each wetland area. The wetland management categories and management objectives are listed in **Table 2**.

Table 2. DBCA wetland management categories (Semeniuk 1995).

Category	Description	Management Objectives
Conservation	Wetlands support a high level of ecological attributes and functions.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: • Reservation in national parks, crown reserves and State owned land, • Protection under Environmental Protection Policies, and • Wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity.
Multiple Use	Wetlands with few remaining attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

There are no wetlands mapped within the subject site. A Multiple Use (MU) wetland (UFI 949) surrounds the northern boundary of the subject site (refer to **Figure 3**). Six Resource Enhancement (RE) wetlands (UFI: 1337, 1338, 1093, 1247, 1442, 1265) are located within 1 km of the subject site. The closest RE wetland (UFI 1337) is located approximately 240 m to the south of the subject site, over Ducane Road. A buffer of at least 50 m will be maintained to all wetlands at all times.

3 EXTRACTION ACTIVITIES

The sand pit will cover an area of approximately 16.35 ha, with a current maximum elevation ranging from 24 m AHD to 33 m AHD. It will be excavated to a maximum depth ranging from 1.96 m BGL to 6.26 m BGL commencing in the south and moving initially in a northerly direction in stages less than 2 ha in size (refer to **Figure 2**). The proposal does not include any crushing of material.

It is estimated that the total maximum volume of sand to be removed will be approximately 500,000 m^3 with a maximum of approximately 50,000 m^3 excavated each year, depending on supply and demand.

The planned end use of the pit is to restore a natural soil profile and return the area to pasture, ensuring that there is no net loss of agricultural land.

3.1 Operational Works

Typical operating hours for quarries will be adopted for the subject site which involves 7 am to 5 pm each Monday to Friday; and at no time on Saturdays, Sundays or public holidays. The site will be worked by 2 - 3 persons, depending on market demand.

3.1.1 Sand Extraction

The sand will be excavated by an excavator and loader to a stockpile or loaded directly to waiting trucks for transport. A summary of the proposed sand extraction activities is provided below:

- Prior to excavation commencing the site will be ground surveyed, the excavation footprint marked out and a 1 m contour plan developed.
- The topsoil will be stripped and stockpiled using a loader.
- An excavator or front-end loader will be used to dig the sand and transport it to a stockpile.
- The sand will then be picked up by a loader and loaded to trucks for transport.
- All static and other equipment, will be located on the floor of the pit to provide visual and acoustic screening.
- Excavation will commence in the south of the pit and then move in a northerly direction. The face and walls of the pit will act as noise barriers.
- Upon completion of each section of pit, the section will be reformed and back filled, where subgrade material is available, to achieve the proposed final contours.
- At the end of excavation, the floor of the pit will be deep ripped, covered by topsoil, and rehabilitated to a constructed soil.

3.1.2 Final Contours

The slope of the final contours of the pit will slope from approximately 22.3 m AHD in the south to 24.6 m AHD in the centre of the extraction area back to 23.7 in the north (refer to **Figure 5**).

Slopes of the batters at the end of excavation will be retained at 1:5 vertical to horizontal.

3.1.3 Equipment

All operational equipment will work on the pit floor to provide maximum sound and visual screening. All equipment and infrastructure will be fully portable to facilitate movement throughout the site required for staged quarrying operations. The site will be secured by locked gates when it is not being actively worked. The boundary fencing will be maintained to prevent inadvertent and unauthorised entry.

Equipment and facilities that may be used onsite are provided in the Table below.

Table 3. Equipment.

Equipment	Description
Site office and/or containers	May be required for the management and security of small items.
Toilet	A portable toilet may be required on site.
Water tanker	Used for dust suppression on the access roads and working floors when required.
Finlay Screen	Used for the screening of sand.
Front end wheel loader	Loaders will be used for the movement of sand and loading road trucks.
Radial Stacker	Used for removing sand material
Excavator	An excavator may be used for the removal of sand material.
Fuel storage	No fuel will be stored onsite.
Light vehicles	Access to and around the site.
Road truck	Removal of sand from site.

3.1.4 Water Usage

Water is only required for dust suppression within the pit and the access road. Water will be sourced offsite from a potable water standpipe, as required.

4 POTENTIAL IMPACTS AND MANAGEMENT

This Section provides and overview of the potential impacts to water resources associated with the proposed land use, and the proposed management measures to address the identified impacts.

4.1 Surface Water

The current water cycle within the subject site consists of inputs from rainwater flowing downhill into the wider drainage system. The development will maintain this process, with all surface water being retained within the excavated areas to enable infiltration through the base of the pit to ensure water quality to the drains is maintained.

An MU wetland is located to the north of the subject site (refer to **Figure 3**). A buffer of at least 50 m from the excavation area to the mapped boundary of all wetlands will be maintained.

MU wetlands are assessed as possessing few remaining ecological attributes and functions, which is characteristic of these mapped areas adjacent to the subject site. While such wetlands can still contribute to regional or landscape ecosystem management, including hydrological function, they are considered to have low intrinsic ecological value. The mapped wetland adjacent to the subject site is not a moving water body and is located within an existing paddock fertilised and containing cow manure. Typically, they have minimal or no native vegetation remaining (less than 10%). Accordingly, there is no legislative requirement to protect or retain them and as such MU wetlands do not preclude development.

The management objective for MU wetlands is to preserve the hydrological functions in the context of the proposed development (EPA 2008). The proposed activities are not proposing to alter the natural surface flow process, with all water being retained within the excavated areas to enable infiltration through stormwater pits to ensure water quality is maintained.

The mobilisation and positioning of equipment is not associated with any impacts to surface water, including stormwater runoff.

4.2 Drainage

Potential impacts associated with sedimentation and erosion from stormwater runoff during the operation of the pit will be minimised by the construction of diversion drains around the excavation areas to divert clean water away from the pit and contain any potentially sediment laden surface water within the pit.

The DWER recommendation is that surface water runoff produced within the excavation area from the two hour, 1 in 10 (10%) annual exceedance probability event should be contained within the pit (DoW 2019). Rainfall intensity has been calculated using the Bureau of Meteorology (BoM) Intensity-Frequency-Duration (IFD) data system (BoM 2021), which yields the two hour 1 in 10% (10%) annual exceedance probability event for the site at 39.1 mm. For every 1 ha area open for excavation at any time a holding volume of 391 m^3 is required. The required holding volume can be readily achieved within the excavated pit. Given the minimum width of the stages range from 88 m to 340 m when 9 m has been extracted to a depth of 1 m the holding volume of the stage will be greater than 792 m^3 to 3,060m^3.

During excavation activities, the surface will be internally drained, with the gradients in the cells being constructed to ensure that no surface water runoff occurs.

A risk assessment relating to surface water and stormwater runoff in consideration of the proposed management measures is provided below. The residual risk associated with sedimentation and erosion from stormwater runoff during the operation of the extractive industry is considered low.

Table 4. Risk assessment associated with surface water and stormwater.

Hazard	Source of Hazard	Potential Impacts	Mitigation	Likelihood	Consequence	Residual Risk
Erosion and sedimentation	Uncontrolled and contaminated stormwater runoff	Erosion and sedimentation resulting in poor surface water quality in surrounding waterways.	Construction of diversion drains around the excavation areas to divert clean water away from the pit and contain any potentially sediment laden surface water within the pit. Excavation undertaken with a gradient to ensure that stormwater is contained within the excavation footprint.	1	2	Low

4.3 Groundwater

Groundwater will not be extracted or dewatered during the operation of the pit and therefore, no impacts to groundwater levels are proposed.

Maximum excavation levels have been determined to ensure at least 0.5 m separation from the maximum groundwater level will be maintained at all times. The final contours of the pit will provide an undulating surface at approximately 22.3 m AHD to 24.6 m AHD. This will provide a separation of at least 0.7 m between the final contours and the maximum groundwater elevation. As previously discussed, a safety factor has been applied to these calculations taking into account historic groundwater levels to ensure annual variability does not preclude this separation. This separation to groundwater is consistent with advice provided by the DWER and subsequently many previously approved extractive industry operations in the southwest.

The specific 2 m separation distance was originally recommended for operations in highly sensitive environments such as Public Drinking Water Areas (PDWA) (refer to *Water Quality Protection Note 15*). Furthermore, it is noted that the *Government Sewage Policy 2019* recommends a 0.6 m to 1.5 m separation distance from the discharge point of an onsite sewage system to groundwater. As opposed to sewage systems, extractive industries are not associated with any environmental discharges (excluding accidental spills which can occur in any land use). The extraction and processing of sand is a chemically free operation with the liquids used being lubricants for machinery and fuel. There will be no storage of chemicals or fuel on the subject site. In addition, the subject site is not adjacent to any environmental sensitive areas (i.e. conservation category or Ramsar wetlands). Therefore, a 0.5 m separation to groundwater is deemed to be suitable in consideration of the low risk nature of the operation.

Table 5. Risk assessment associated with groundwater.

Hazard	Source of Hazard	Potential Impacts	Mitigation	Likelihood	Consequence	Residual Risk
Contamination of groundwater	Machinery	Contamination of groundwater	Maintenance of at least 0.5 m separation from groundwater at all times.	1	2	Low

4.4 Hydrocarbons and Dangerous Goods Management

Hydrocarbons are the only dangerous goods that will be utilised within the proposed subject site for the operation of machinery. However, storage of hydrocarbons on the subject site will not occur.

Servicing of machinery and equipment will not occur onsite further reducing the possibility of contamination.

There is the minor possibility for soil and water contamination as a result of incidental hydrocarbon leakages or spills during the operation of machinery. In such instances the management measures specified below will be implemented.

Table 6. Hydrocarbon and dangerous goods management measures.

Timing	Management Measure
During pit operations	Mobile refuelling of equipment and vehicles will be undertaken on site by a mobile fuelling truck on a hard stand area outside of the pit area.
	Spill kits containing appropriate equipment for control, containment and cleanup of hydrocarbon and chemical spills will be available in appropriate locations onsite and maintained.
	No vehicles or machinery are to be serviced or cleaned within the subject site.

A risk assessment to determine the residual risk associated with the uncontrolled discharge of contaminants is provided below. The risk assessment indicates that with the application of suitable management measures the potential risk associated with uncontrolled discharges is 'Low'.

Table 7. Risk assessment associated with the uncontrolled discharge of contaminants.

Hazard	Source of Hazard	Potential Impacts	Mitigation	Likelihood	Consequence	Residual Risk
Uncontrolled discharge of contaminants to land	Machinery	Contamination of soils and/or water	Refer to Management Measures provided in **Table 6**.	1	2	Low

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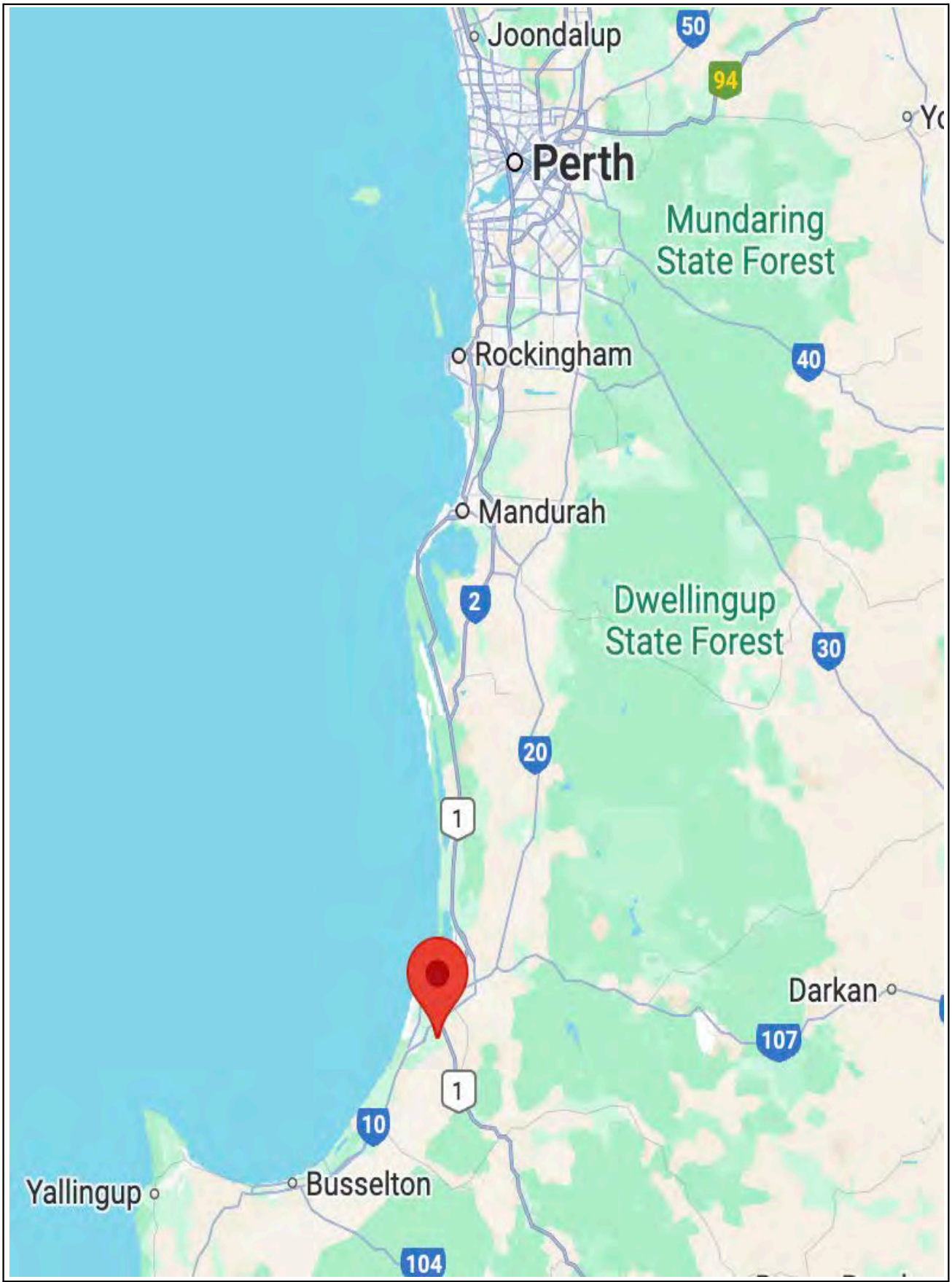
FIGURES



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DRAWING TITLE	Figure 1 – Site Locality	Designed NC	Checked	
		Drawn PN	Approved	
CLIENT	JW Cross Maintenance Pty Ltd	Date	05/06/2025	
		Local Authority	Shire of Capel	
		Sheet 1 of 1		

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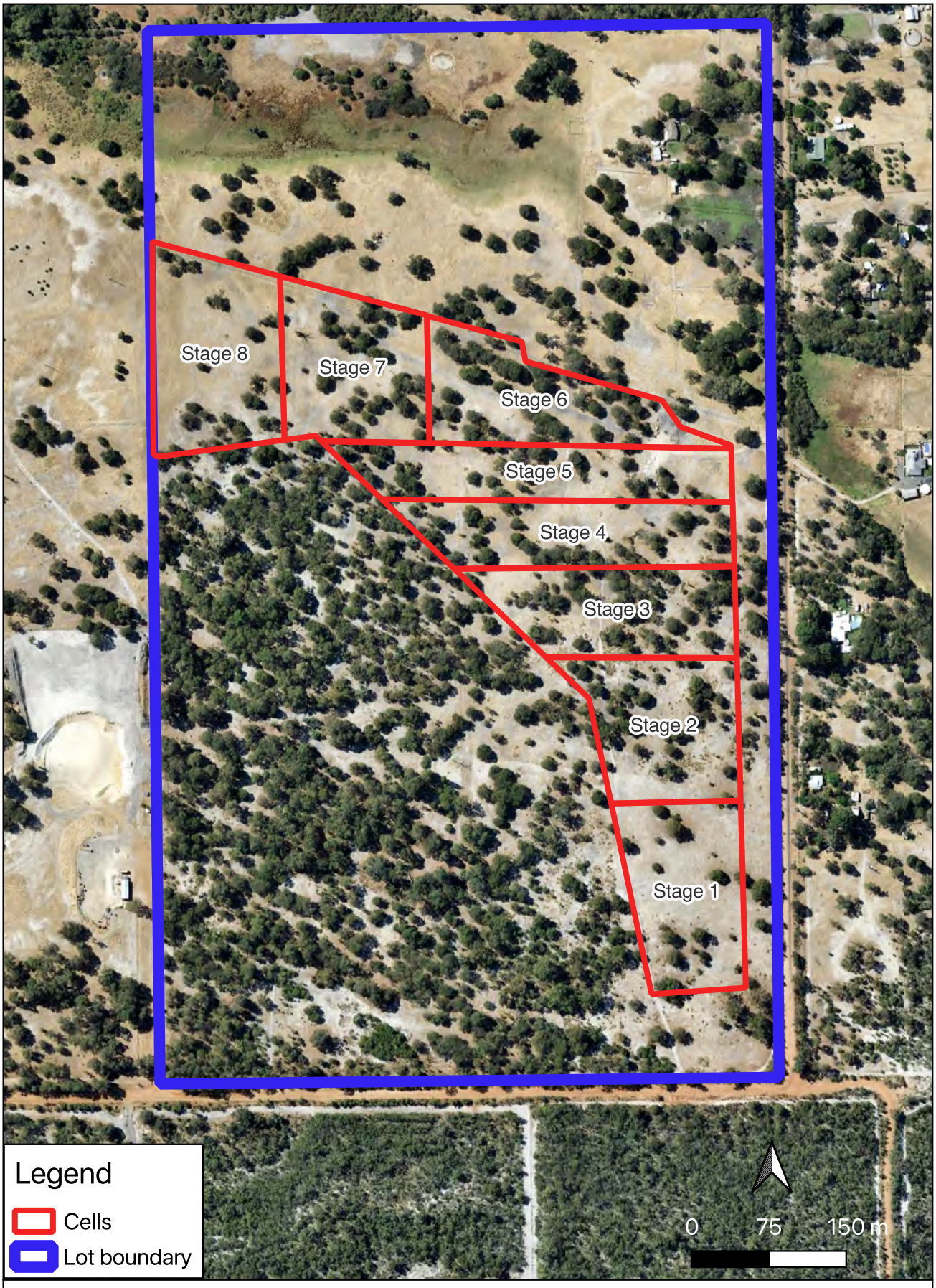
West Busselton
Western Australia 6280
Mobile 0418 950 852



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		2538	Figure 2	B
DRAWING TITLE	Figure 2- Site Extent	Designed NC Drawn PN	Checked Approved	
CLIENT	JW Cross Maintenance Pty Ltd	Date	23/09/2025	
		Local Authority	Shire of Capel	
		Sheet 1 of 1		

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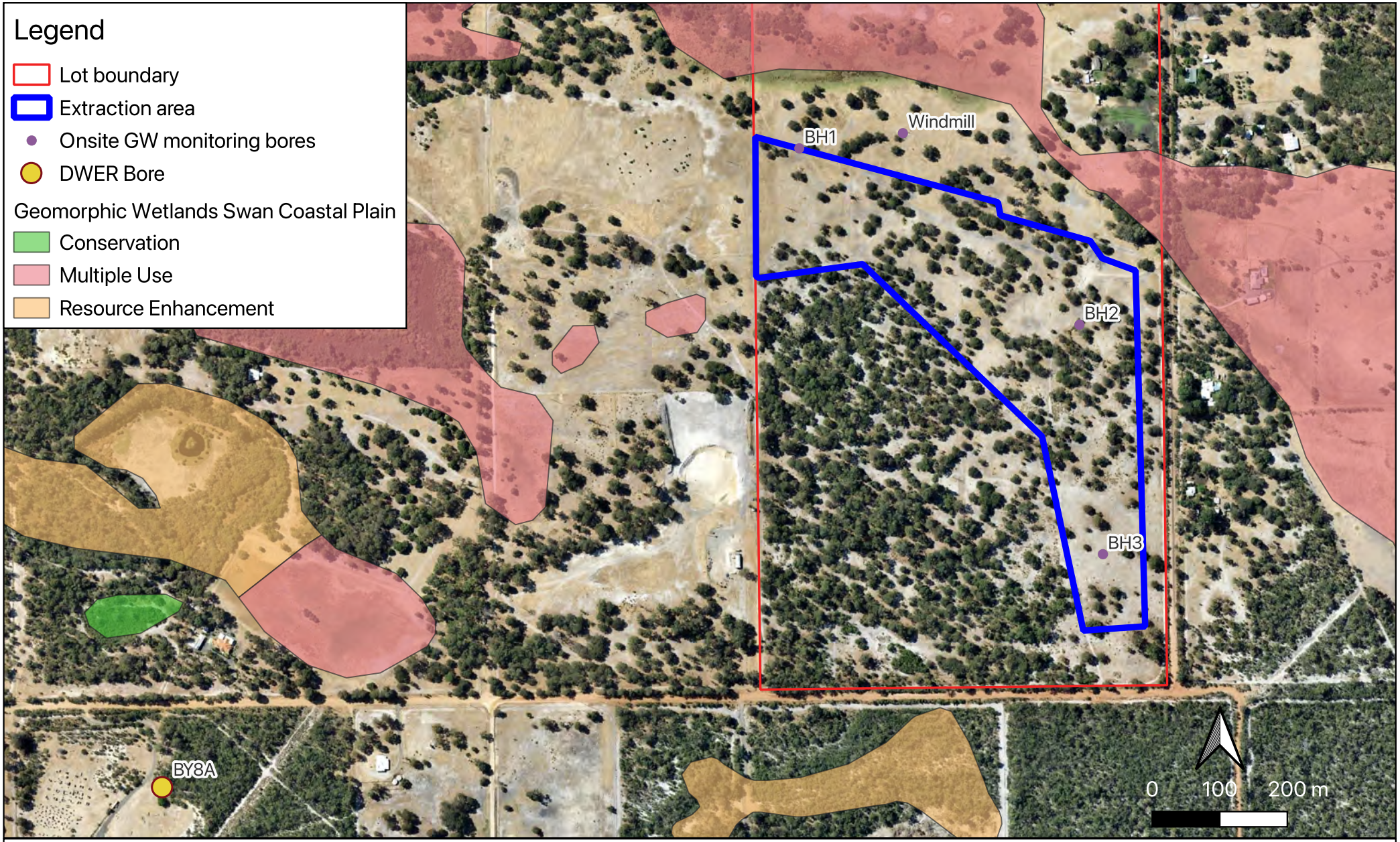

PROJECT	Lot 262 (220) Queelup Rd,North Boyanup
DRAWING TITLE	Figure 3 - Water Features
CLIENT	JW Cross Maintenance Pty Ltd

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Western Australia 6280
Mobile 0418 950 852

Project Number	2538	Designed	PN
Drawing Number	Figure 3	Drawn	PN
Revision	A	Checked	
Date	23/09/2025	Approved	
Sheet 1 of 1		Local Authority	Shire of Capel

PROJECT	Lot 262 (220) Queelup Rd, North Boyanup	Project Number	Drawing Number	Revision
		2538	Figure 4	A
DRAWING TITLE	Figure 4- Groundwater Contours	Designed NC Drawn PN	Checked Approved	
CLIENT	JW Cross Maintenance Pty Ltd	Date	30/09/2025	
		Local Authority	Shire of Capel	
		Sheet 1 of 1		

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Western Australia 6280
Mobile 0418 950 852

Legend

- Final contours
- Extraction area
- Lot boundary

PROJECT	Lot 262 (220) Queelup Rd,Boyanup
DRAWING TITLE	Figure 5 - Final contours
CLIENT	JW Cross Maintenance Pty Ltd

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Western Australia 6280
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Project Number	Drawing Number	Revision
2538	Figure 5	A

Designed NC
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Date 30/09/2025
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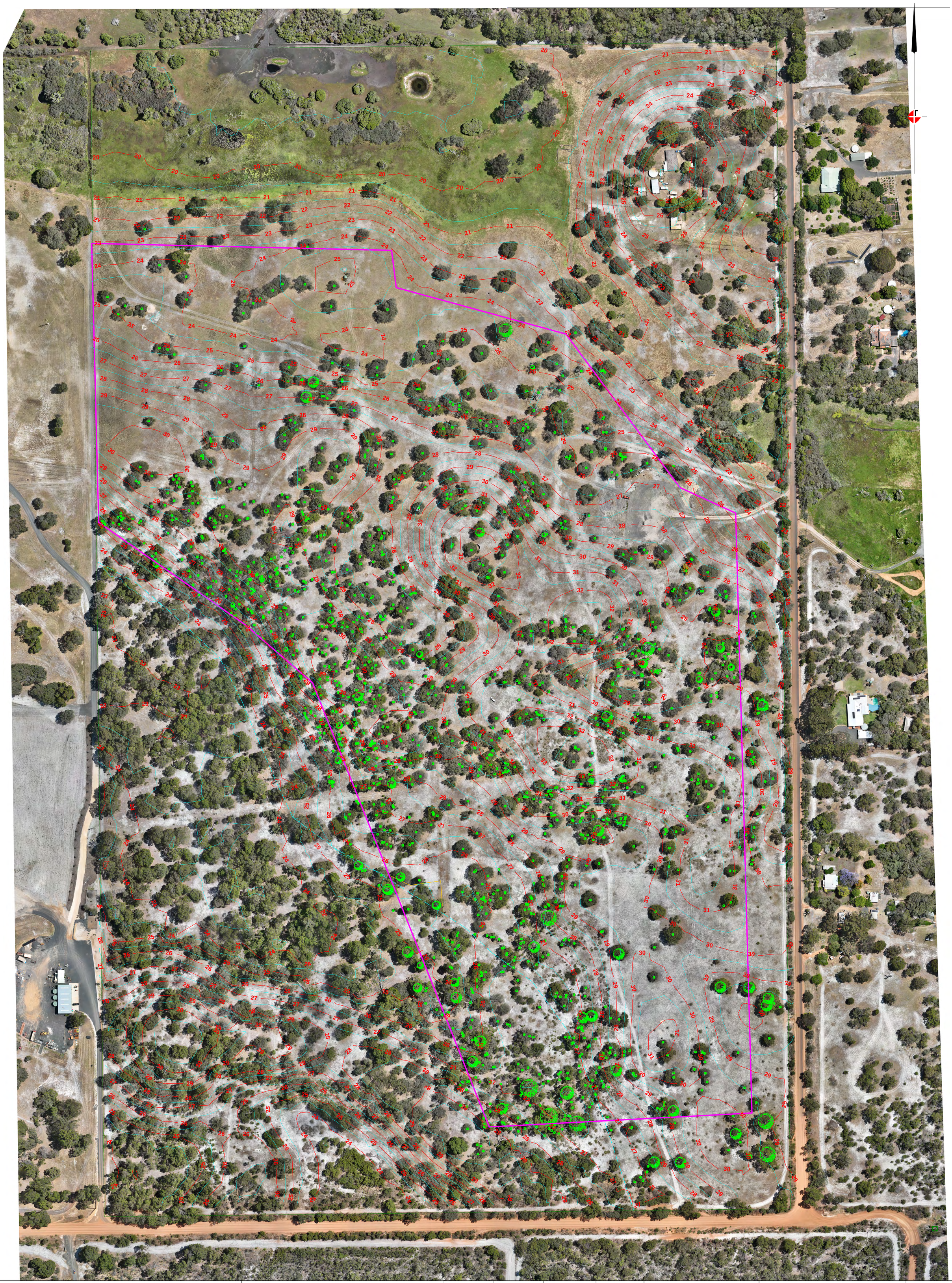
Sheet 1 of 1

APPENDIX A – SITE CONTOUR SURVEY



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CLIENT:	J.W CROSS	Date: 09/12/2024	Drawn: PS	Surveyor: RRe	CHKd: PS
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A.H.D. HEIGHTS DERIVED FROM :	SSM HASTIES 21				

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REVISION SCHEDULE — Sheet 1 of 1

No.	Date	Description

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APPENDIX B - GROUNDWATER MONITORING DATA

QUEELUP BLOCK GROUND WATER RECORD

NOTE: Levels based on depth from natural ground to water table.

DATE	BORE # 1	BORE # 2	BORE # 3	WINDMILL	COMMENTS
19.08.2024	4.4 (metres)	7.6	DRY	4.0	
25.08.2024	4.2	7.5	DRY	4.0	
04.09.2024	4.0	7.4	DRY	3.9	
11.09.2024	4.0	7.5	DRY	3.8	
17.09.2024	3.9	7.7	DRY	3.7	
09.10.2024	3.9	7.8	DRY	3.8	
16.10.2024	3.9	7.9	DRY	3.8	
30.10.2024	4.0	DRY	DRY	3.9	
06.11.2024	4.0	DRY	DRY	3.9	
14.11.2024	4.0	DRY	DRY	3.9	
21.11.2024	4.0	DRY	DRY	3.9	
28.11.2024	4.1	DRY	DRY	3.9	
04.12.2024	4.1	DRY	DRY	3.9	
11.12.2024	4.1	DRY	DRY	3.9	
19.12.2024	4.2	DRY	DRY	4.0	
06.01.2025	4.2	DRY	DRY	4.0	
05.02.2025	4.4	DRY	DRY	4.1	
24.02.2025	4.6	DRY	DRY	4.1	
10.03.2025	4.7	DRY	DRY	4.1	
19.03.2025	4.8	DRY	DRY	4.1	
01.04.2025	4.9	DRY	DRY	4.1	
20.04.2025	4.8	DRY	DRY	4.0	
07.05.2025	4.8	DRY	DRY	3.9	
15.05.2025	4.8	DRY	DRY	3.9	
22.05.2025	4.8	DRY	DRY	3.9	
29.05.2025	4.7	DRY	DRY	3.8	
09.06.2025	4.6	DRY	DRY	3.8	
13.06.2025	4.6	DRY	DRY	3.8	