Dardanup Park Pty Ltd

DARDANUP PARK

LOT 2 HAROLD DOUGLAS DRIVE AND LOT 185 VENN ROAD, DARDANUP WEST SITE-AND-SOIL EVALUATION (SSE)

December 2021
10012-G-E-R-002-SSE Report

WML

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EXECUTIVE SUMMARY

WML Consultants (WML) have been engaged by Mr David Offer, and Mrs Anne-Marie Offer to undertake a Site-and-Soil Evaluation (SSE) for the proposed subdivision (subject land) of Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup West, WA, into 37 rural residential lots (Lot 1001 to 1037), and one balance lot (Lot 1038). The balance lot has not been included as part of this SSE investigation.

An investigation of the subject land was undertaken by WML in September 2021 to assess the site and in-situ soils of their suitability for on-site effluent disposal. This report includes recommendations for effluent disposal systems, locations and sizes in accordance with the Government Sewerage Policy 2019 (GSP2019) and the Australian Standard 1547:2018 "On-site domestic Wastewater Management" (AS 1547).

A reticulated sewerage service is not available for the development; therefore, the effluent disposal system is required to dispose of the wastewater produced by the properties bathrooms and kitchens. Several options were considered for both the treatment system and land application area (LAA). However, it was recommended to treat the generated sewage wastewater from the lots (lots 1001 to 1037) to a secondary level using a Department of Health (DOH) approved Secondary Treatment System (STS) and then applied to a Land Application Area (LAA) via elevated application areas with sub-surface application systems, varying with location.

In summary:

- The subject land is located within the Swan coastal plain catchment and is considered to be within a sewerage sensitive area in accordance with the GSP2019.
- Lots 1001-1007, 1012-1018, 1020-1037: Secondary Treatment of the sewage wastewater with a Secondary Treatment System (STS) with an elevated sub-surface application system.
- Lots 1008-1011 and 1019: Secondary Treatment of sewage wastewater with a Secondary Treatment System (STS) with a sub-surface application system.
- At the time of investigation (7th, 8th and 20th of September 2021), ponding water was present across much of the northern and central portion of the site, with shallow groundwater also prevalent.
- The site is located within a sewerage sensitive area, and as such, requires a minimum vertical separation between the effluent disposal point and groundwater/ponding water of 1.5 m. Elevation of the land application areas for certain lots is required to provide this minimum separation.
- A tributary channel of the Preston River (Gavin's Gully drain) runs through the northern and eastern sections of the site. The GSP2019 typically requires a clearance of 100 m between the waterway channel and an effluent distribution point.
- There are ongoing landowner obligations to ensure that operation and management of the treatment and disposal system are regularly maintained in accordance with relevant health regulations and manufacturer's recommendations.

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1 INTRODUCTION

WML Consultants Pty Ltd ('WML') was engaged by Mr David Offer and Mrs Anne-Marie Offer ('the Client') to determine the potential conditional requirements for subdivision approval for the proposed subdivision at Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup West ('the site'). It is understood the works will include subdividing the 89 ha site into 37 rural residential lots with a minimum lot size of 1.0 ha.

This report presents the works performed on-site, a visual assessment of sub-surface and surrounding site conditions, and results of geo-environmental laboratory testing together with an assessment of the suitability of the site for on-site effluent disposal.

1.1 Site description and proposed development

The site is located to the west of Boyanup-Picton Road on land currently used for agricultural purposes. Lot 2 is located south of Harold Douglas Drive and Venn Road, covering 58.83 ha. Lot 185 is located directly to the east of lot 2 and bounded by Boyanup-Picton Road to the east and another agricultural property to the south. The two lots cover an area of 83.06 ha and are proposed to be subdivided into 37 rural residential lots. The subdivided lots are intended to cover an area of between 10,000 m^2 and 21,700 m^2, with a 29.78 ha portion of Lot 185 remaining undeveloped for agricultural use. This area of Lot 185 is known as Balance Lot 1038 and is not included as part of this site-and-soil evaluation.

Grass covers most of the site, including the shallow sand dune in the south-eastern corner of the site. Peppermint trees cover approximately 15% of the site, generally in the southern two-thirds of the site. Several other trees are also present on the site, such as paperbark trees and eucalyptus trees; however, these are only a small percentage of the vegetation on site. Several residential structures and sheds are located on the border of Lot 2 and Lot 185 on proposed lots 1006 and 1008.

A tributary drainage channel of the Preston River runs east-west through the northern half of the site before running south along the border between the two lots. In September 2021, several locations across the site were noted to have ponding surface water, particularly north of the drainage channel.

From the supplied layout plan, the site ranges in elevation from approximately 22 m AHD in the north-western and southwestern corners to 28 m AHD at the top of the shallow sand dune on the east of Lot 2.

1.2 Available Information

The following information was made available for this report:

- Drawing 21008-1-002a and 21008-1-002a AP '*Concept Plan, Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup*' by Across Planning, showing lot layout, approximate site topography, and available land application areas (LAAs) without and with satellite overlay respectively, dated 3/12/2021.
- Oversby Consulting, Groundwater Monitoring Report B21026, 2021 "*Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup"*
- Drawing B21026 L-001-B '*Ground Water Height Map Plan*' by Oversby Consulting, showing groundwater contours and modelled groundwater height from surface level across the site.
- Drawing B21026 L-002-A '*Ground Water Plan*' by Oversby Consulting, showing groundwater contours across the site.

1.3 Report Objectives

The objectives of the site and soil evaluation were to:

- Assess the sub-surface soil conditions across the site,
- Undertake a site investigation to characterise the sub-surface profile and collect representative soil samples for laboratory testing.

- Assess the suitability of the site for effluent disposal according to Government Sewerage Policy 2019 and AS/NZS 1547:2012,
- Provide provision of setback distances in accordance with the above policies, and
- Provide recommendations for effluent treatment systems, applications systems and propose recommended land application areas.

1.4 Risks and Issues

The following issues/risks were addressed during the intrusive ground investigation:

- The soils capability of retaining nutrients,
- The vicinity to sewage sensitive areas, and
- The suitability of the site for effluent disposal.

2 SITE ASSESSMENT

The site can be broken into two areas based on local topography, vegetation, soil characteristics and groundwater, denoted Zones 1 and 2. These zones are shown in Drawing 10012-G-005 and are described below. This report presents recommendations based on the two zones.

Zone 1: free-draining shallow sand dunes, groundwater not located within 1.5 m of the existing ground surface (Lots 1008-1011 and Lot 1019)

Zone 2: poorly draining and often waterlogged clay to sand with clay (Lots 1001-1007, Lots 1012-1018, Lots 1020-1037)

2.1 Site Key Features

The site's key features in relation to the effluent management for the site are summarised in Table 1 below. Additionally:

- The site is within a Government Sewerage Policy 2019 (GSP 2019) sewage sensitive area (estuary catchments on the Swan and Scott Coastal Plains).
- A large portion of the site is seasonally waterlogged throughout the winter months and into spring.
- A small tributary of the Preston River (Gavin's Gully Drain) runs through the northern half of the site and along the border of Lot 2 and Lot 185.
- The site is not within or near a floodplain area.
- No public drinking water sources are located within 100 m of the site.

Figure 1 indicates the location of the site with overlays from the GSP 2019 showing the sewerage sensitive designated areas.

Figure 1: Site boundaries with sewerage sensitive areas overlayed – site is within a GSP sewerage sensitive zone.

Table 1: Site Assessment

Feature	Description	Level of Constraint	Mitigation Measures
Buffer distances	Most buffer distances in the Government Sewerage Policy 2019 (GSP) are achievable. 30 m clearance must be maintained from private bores used for household/drinking water purposes. 100 m clearance from a waterway or drainage system that discharges into a waterway without treatment.	High	Remove existing residential bore or plan waste disposal system around bore. Where possible, locate all sewerage discharge points 100 m beyond the existing distributary channel. Secondary treatment systems are recommended for all lots.
Climate	Average annual rainfall 718.4 mm (BOM Bunbury Comparison Climate Station No 009965). Estimated average annual pan evaporation 1500 mm (BOM pan evaporation maps)	Low	Not needed (NN)
Drainage	**Zone 1:** Good in-situ drainage conditions observed, sands encountered in test pits, no ponding water observed. **Zone 2**: Poor drainage; the surface is often waterlogged. Low permeability topsoil	High	Elevated land application systems are recommended
Watercourses	A tributary channel (Gavin's Gully drain) branching off of the Preston River runs through the north and east of the site.	High	Where possible, ensure all effluent disposal systems are located a minimum of 100 m away from the channel.
Surface waters	Surface water is present as elevated groundwater and waterlogged areas throughout winter and a portion of spring in the north and through much of the centre to the south of the site.	High	Ground surface to be raised to ensure effluent discharge point maintains 1.5 m clearance from ponding and groundwater.
Erosion & Landslip	No evidence of erosion present	Low	NN
Exposure & Aspect	No physical structure is likely to impede wind exposure. The shallow sand dune in the southeast of the site may reduce wind intensity immediately to the west of the dune.	Low	NN
Flooding	No evidence of flooding was identified on site and is outside the 1:100 AEP floodway and flood fringe areas.	Low	NN

Groundwater	**Zone 1**: Groundwater is greater than 1.5 m below ground level. **Zone 2**: Groundwater has been identified at or above ground level in parts of Zone 2 and is largely 0.25-1.0 m below ground level. A Groundwater Monitoring Report was undertaken by Oversby Consulting, which provides a groundwater height map of the site drawing reference "*B210206-L-003*" based on 10 installed monitoring wells.	High	Elevated land application systems are recommended to provide a 1.5 m vertical separation to groundwater.
Imported Fill	No imported fill was identified on site, other than beneath the existing residential properties on site.	Low	NN
Land Available for Application (LAA)	The majority of the site is exposed soil, with a small area covered in unsealed access roads or with structures present.	Low	The client may need to remove unsealed roads and structures to prepare a suitable application area.
Landform	**Zone 1**: Flat, shallow dunes ranging from approximately 1.0-4.0 m in height. **Zone 2**: Generally flat with no significant sharp elevation changes.	Low	NN
Rock Outcrops	No rock outcrops were identified on site.	Low	NN
Run-on & Runoff	**Zone 1**: Run-on not possible due to elevation. Runoff is likely on the eastern sand dune. **Zone 2**: Run-on possible from the eastern sand dune and potentially from near the existing structures. Runoff is unlikely across most of the site, possible near the distributary channel.	Low	Run-on and runoff are not expected in Zone 1 due to highly permeable sub-soils.
Slope	**Zone 1**: Sand dunes with a maximum slope of approximately 7°. **Zone 2**: Flat, generally less than 1°.	Low	NN
Vegetation	Grass across the majority of the site, peppermint trees cover approximately 15% of the site. A small number of various other trees are in isolated areas of the site.	Low	NN
Salinity	No salt crystals were observed on site.	Low	NN

2.2 Site assessment results

Based on the observed site features, the overall land capability of the subdivision to suitably manage effluent in its current state is constrained and requires specific mitigation measures to allow for the suitable disposal of effluent. The following mitigation measures are a summary of Table 1 above and are recommended to ensure that the risk of environmental contamination is reduced as far as practicable in accordance with the GSP19 and AS 1547:

1. All lots are located within the sewerage sensitive area associated with the Swan Coastal Plain catchment. Therefore, a minimum vertical separation distance of 1.5 m is required for all land application areas. Due to shallow groundwater and poorly draining subsoils resulting in shallow ponding water, the residential lots within Zone 2 require elevation of the land application areas to achieve this minimum separation.
2. To reduce the risk of environmental contamination, treatment of the generated wastewater to a secondary level using a Department of Health approved Secondary Treatment System (STS) is recommended for all lots of the subject land.
3. Application of the effluent should be undertaken using sub-surface application systems.

3 SOIL ASSESSMENT

The site's in-situ soils have been assessed for suitability for on-site sewerage management by a combination of field investigation, laboratory testing and a desktop review of published soil survey information.

3.1 Fieldwork

Fieldwork was undertaken by geotechnical engineers on the 7th, 8th and 20th September 2021 and comprised:

- A site walkover to observe existing surface features and to record photographs,
- 20 machine excavated test pits to a depth of up to 2.5 m,
- 20 dynamic cone penetrometer (DCP) tests to 2.0 m adjacent to each test pit,
- 3 in-situ permeability tests using Talsma-Hallam permeability equipment excavated using a hand auger,
- Collection of representative soil samples for laboratory testing.

3.1.1 In-situ sub-surface profile

The 1:50,000 scale geological map 'Bunbury-Burekup' indicates that the subject land is underlain by three different soil profiles.

1. Guildford Formation: mainly alluvial sandy clay is shown in the north and centre of the subject land.
2. Bassendean Sand: low rounded dunes are present on the east and an isolated area on the west near proposed lots 1017 & 1018.
3. Thin Bassendean Sand over Guildford Formation occupying much of the southern area of the subject land.

The site investigation indicated that the Bassendean Sand to the west of the site is larger than indicated on geological maps, present across much of proposed lots 1019, 1020, 1030, 1031 & 1032. The location of the test pits and permeability tests are shown on Drawing 10012-G-001 attached to this report, with the soil logs attached in Appendix A.

3.1.2 In-situ permeability

Three in-situ permeability tests using the constant head Talsma-Hallam method in accordance with AS/NZS 1547:2012 were undertaken adjacent to TP 6, 8 and 16. Boreholes 90 mm in diameter and 500 mm deep were excavated and filled with water to saturate the surrounding soil. A constant head of water was then applied, and a known volume of water was timed to dissipate. Table 2 below presents a summary of the in-situ field tests.

Table 2: In-situ permeability test results

Location	Depth (m)	In-situ Permeability Test	
		m/s	m/day
TP 6	0.5	7.84×10^{-5}	6.77
TP 8	0.5	8.09×10^{-5}	6.99
TP 16	0.5	6.28×10^{-5}	5.43

The permeability results indicate that the material encountered across the site is indicative of weakly to moderately structured loams in AS NZS 1547:2012.

3.2 Laboratory Soil Testing

Samples of representative materials of the sandy clay material were submitted to Construction Sciences, a NATA accredited laboratory, for Particle Size Distribution (PSD) and Plasticity Index (PI) tests. The laboratory test results are summarised below, with the certificates presented in Appendix B.

Table 3: Summary of Soil Classification Testing

Location	Depth (m)	Test	Moisture Content (%)	PSD			Atterberg's Limits			Soil Classification
				Fines (%)	Sand (%)	Gravel (%)	LL (%)	PI (%)	LS (%)	
TP 1	2.0	PSD/PI	20.9	52	36	12	56	39	16.0	Sandy CLAY (CH)
TP 9	0.3 – 0.8	PSD/PI	22.0	32	68	-	23	10	4.0	Clayey SAND (SC)
TP 18	0.5 – 1.0	PSD/PI	27.3	68	32	-	44	28	12.5	Sandy CLAY (CI)
TP 20	0.5 – 0.7	PSD/PI	20.1	42	58	-	30	17	7.0	Sandy CLAY (CL)
TP 21	0.5	PSD/PI	24.4	59	41	-	51	34	13.0	Sandy CLAY (CH)
TP 21	1.0	PSD/PI	20.0	22	66	12	36	22	9.5	Clayey SAND (SC)
TP 23	1.6	PSD/PI	31.0	64	36	-	-	-	-	Sandy CLAY (CH)
TP 25	1.4	PSD/PI	19.2	31	69	-	35	22	9.0	Clayey SAND (SC)

Notes: All depths are relative to the existing ground surface.
PSD – Particle Size Distribution; LL – Liquid Limit; PI – Plasticity Index; LS – Linear Shrinkage

3.3 Environmental Soil Testing

Samples of representative materials of the encountered soils were submitted to Environmental and Agricultural Testing Services (EATS), a NATA accredited laboratory for Phosphorus Retention Index (PRI) testing. The laboratory test results are summarised below, with the test certificates presented in Appendix B.

Table 4: Summary of the environmental laboratory testing

Location	Depth (m)	Phosphorous Retention Index
TP 4	0.5	30
TP 5	0.5	51
TP 9	0.5	520
TP 13	0.5	174
TP 15	0.5	0.2
TP 18	0.7	> 1000
TP 21	0.5 – 0.7	> 1000
TP 24	0.5	383
TP 25	0.5 – 0.6	> 1000

Notes: All depths are relative to the existing ground surface.
PRI – Phosphorous Retention Index.

3.4 Soil Survey and Analysis

The soil survey indicated that there are two typical sub-surface soil profiles that categorise the site: delineated within Zone 1 and Zone 2. WML have provided a soil assessment for both zones below.

3.4.1 Soil Assessment for Zone 1 - Sands

Table 5 below provides an assessment of the physical and chemical characteristics of the clean sand sub-soil encountered at the site.

Table 5: Soil assessment of the Zone 1 – sand sub-soils.

Feature	Assessment	Level of Constraint	Mitigation Measures
Phosphorous Retention Index	Clean sand: PRI = <5	Medium	The phosphorus retention ability of the in-situ sand is limited, and soil amelioration is required by ripping and mixing the in-situ soils with a loam/clay to provide a minimum 10% clay content and achieve a PRI of greater than 30.
Rock Fragments	Rock fragments were not encountered.	Low	NN
Soil Depth	Topsoil: ≤ 150mm	Low	NN
	Subsoil: >150 mm	Low	NN
Soil Permeability	SAND: Saturated hydraulic conductivity (k_{sat}) < 2.0 m/day.	Low	The subsoil is moderately permeable; consideration to be given to transport of effluent through the soil
Soil Category	Subsoil (>150 mm): clean sand (Category 1)	Low	NN
Water Table Depth	Groundwater was not encountered within 2 m of the surface during the August 2021 investigation.	Low	NN

3.4.2 *Soil Assessment for Zones 2 – Clayey Subsoils*

Table 6 below provides an assessment of the physical and chemical characteristics for the clayey sand to clay sub-soil encountered within at the site.

Table 6: Soil assessment of the Zone 2 clayey sub-soils.

Feature	Assessment	Level of Constraint	Mitigation Measures
Phosphorous Retention Index	Sand with clay subsoil: PRI = 30 Clayey sand to clay subsoil: PRI = 51 to >1000	Low	The clayey sand subsoil is suitable for nutrient retention
Rock Fragments	No coarse fragments we encountered during the investigation	Low	NN
Soil Depth	Topsoil: <300 mm	Low	NN
	Subsoil: >300 mm. Total permeable soil depth greater than 2.0 m	Low	NN
Soil Permeability	Clayey sand to clay: Saturated hydraulic conductivity (k_{sat}) >1.0 m/day.	Low	NN
Soil Category	Subsoil (>200 mm): clayey sands (Category 2) to clay (Category 4)	Medium	The subsoil should be considered to be a low permeability soil
Water Table Depth	Groundwater was encountered between from 0.0 - >1.8 m	High	Imported fill must be used to maintain minimum groundwater clearance to the effluent discharge point of 1.5 m

3.5 Soil Assessment Results

Based on the soils encountered during the investigation, the overall capability of the soil in Zone 2 to suitably manage effluent is satisfactory; however, the soils of Zone 1 require the implementation of certain mitigation measures to become suitable for effluent management. The following mitigation measures are a summary of Table 5 and Table 6 above and are recommended to ensure that the risk of environmental contamination is reduced as far as practicable in accordance with the GSP2019:

1. The phosphorus retention ability of the clean sands (Bassendean Sands) in Zone 1 is low. Blending with an imported loam/clay should be allowed in the design to avoid nutrient overloading of the soils. The resulting clay content of the mixed soil should be approximately 10-20% and achieve a PRI greater than 30. The addition of the clay should not adversely affect the effective drainage of the soils.
2. Due to the elevated and often surface-level groundwater encountered within Zone 2, imported fill will be required to provide a minimum 1.5 m vertical separation from groundwater and ponding surface water across this zone. The imported fill should have a clay content of approximately 10-20% and achieve a PRI greater than 30.

4 RECOMMENDATIONS

4.1 Wastewater Management System

A detailed design of the system is beyond the scope of this report. However, based on the results of the preliminary SSE investigation and the requirements of the Government Sewerage Policy 2019, treatment of the generated wastewater to a secondary level with a Secondary Treatment System (STS) with sub-surface application systems for Zone 1 and elevated sub-surface application systems for Zone 2 can be considered satisfactory.

The primary constraint influencing detailed design is considered to be the vertical separation to groundwater/perched water from the invert level of the application system and the limited drainage potential of the soils within Zone 2.

The following provides a further breakdown of the constraints and recommendations for each lot which should be taken into consideration during detailed design:

Zone 1 – Sands (Lots 1008-1011 and Lot 1019)

- All lots are situated within the Swan coastal plain catchment and are considered to be within a sewerage sensitive zone.
- Lots 1008-1011 and 1019 have a minimum lot size of 1.07 ha and are situated on free-draining shallow sand dunes.
- Groundwater was not encountered during the 2.0 m deep September 2021 investigation. However, due to the lots being based on top of a shallow free draining sand dune, it can be assumed that the peak groundwater within these lots is at least 2.0 m below existing ground level. A groundwater contour map was The land application areas should be placed on the highest, flattest part of the lot where practicable.
- The Category 1 free draining sands have a limited nutrient retention ability and therefore require amelioration using imported fill to create an effective category 2 soil. The in-situ sands should be mixed with a loam/clay to achieve a blend with a 10-20% clay content and achieve a minimum PRI of greater than 30 for a depth to at least 0.5 m below the effluent distribution point. The blending or mixing of the soils should not adversely affect the effective drainage of the soils.
- It is recommended that the generated wastewater is treated to a secondary level with a Department of Health approved Secondary Treatment System (STS) with nutrient removal utilising a sub-surface application system. The final selection of the system should be undertaken by the client from the list of approved Department of Health Secondary Treatment Systems and should achieve a minimum nutrient output of:
    - 20 mg/L of Biochemical Oxygen Demand (BOD)
    - 30 mg/L of Total Suspended Soils (TSS)
    - 10 cfu/100mL of Escherichia (E) coli
- For a typical 6-person residential household, a land application area of 180 m^2 is required based on the in-situ category 2 soil. This calculation is based on the conversion factors provided in Section 2 of Schedule 2 of the GSP19.

Zone 2 – Clayey Sands to Clays (Lots 1001-1007, Lots 1012-1018, Lots 1020-1037)

- All lots are situated within the Swan coastal plain catchment and are considered to be within a sewerage sensitive zone.
- Portions of the lots within Zone 2 were noted to have shallow groundwater/perched water within the September 2021 investigation. The groundwater was encountered between 0.25 m and 1.0 m below existing ground levels. Therefore, to achieve the required minimum vertical setback of 1.5 m, the application areas of the lots within this zone need to be elevated with a sandy loam which has an approximate clay content between 10-20% and achieves a minimum PRI of greater than 30. This soil should be able to be classified a Category 2 soil in accordance with AS 1547.

- Lots 1001-1004, 1007, 1012-1018, 1020-1037 require the import of approximately 1.5 m of suitable fill to create a vertical separation between the effluent discharge point and the ponding/groundwater of 1.5 m.
- Lots 1005, 1006, 1008 require the import of approximately 1.0 m of suitable fill to create a vertical separation between the effluent discharge point and the ponding/groundwater of 1.5 m.
- The western half of Lots 1009-1011 and the north-western portion of Lot 1019 also require approximately 1.0 m of suitable fill to create a vertical separation between the effluent discharge point and the ponding/groundwater of 1.5 m.

- It is recommended that the generated wastewater is treated to a secondary level with a Department of Health approved Secondary Treatment System (STS) with nutrient removal utilising a sub-surface application system. The final selection of the system should be undertaken by the client from the list of approved Department of Health Secondary Treatment Systems and should achieve a minimum nutrient output of:
  - 20 mg/L of Biochemical Oxygen Demand (BOD)
  - 30 mg/L of Total Suspended Soils (TSS)
  - 10 cfu/100mL of Escherichia (E) coli
- For a typical 6-person residential household, a land application area of 180 m^2 is required based on the in-situ category 2 soil. This calculation is based on the conversion factors provided in Section 2 of Schedule 2 of the GSP19.

It is recommended that the design and installation of the effluent management system are carried out by a suitably qualified, licensed plumber or drainer experienced with on-site wastewater disposal systems and an irrigation expert familiar with effluent irrigation equipment to provide further design advice if required. The irrigation plan must ensure the even application of effluent throughout the entire application area.

The property owner has the responsibility for the final selection of the treatment system and shall include the details of it in 'the on-site sewage system approval to install application' form for local government approval.

4.2 Zone 1 and 2 Setback Distances

Setback buffer distances from effluent land application areas and treatment systems are required to help prevent human contact, maintain public amenity and protect sensitive environments. The setback distances provided within Table 7 have been based on a sub-surface application system disposing of a secondary treated effluent through a category 2 soil. The resultant land available for the effluent applications areas within each lot is shown on Drawing "*Concept Plan - 21008-1-002a*".

As can be seen on the supplied 21008-1-002a AP and 21008-1-002a drawings, the majority of the available land application areas achieve a 100 m setback from Gavin's Gully Drain. However, for proposed lots 1006 and 1027, the separation distance is at least 50 m. It should be noted that tLot 1006 comprises an existing swelling, which will be retained. It is recommended that for these lots high levels of nutrient management and reduced irrigation rates be applied.

Table 7: Relevant setback distances for Zone 2 in accordance with GSP 2019 and AS / NZS 1547:2012

Feature	Setback distance
Private bore for household/drinking water purposes	40 m
A drainage system that discharges directly into a waterway or wetland without treatment	100 m
Waterway/watercourse (measured from the edge of the wetland vegetation)	100 m
Vertical distance to peak groundwater levels	1.5 m

Property boundary	20 m
Buildings/houses	4 m
Surface water	50 m
Recreational areas (children's play areas, swimming pools and so on)	10 m
In-ground water tank	10 m
Retaining wall and Embankments, escarpments, cuttings	3 m or 45° angle from the toe of the wall (whichever is greatest)

4.3 Monitoring, Operation and Maintenance

Maintenance is to be carried out in accordance with the DOH Approval of the selected secondary treatment system and manufacturers recommendations. The treatment system will only function adequately if appropriately and regularly maintained.

To ensure the treatment system functions adequately, residents must:

- Have a suitably qualified maintenance service technician for the secondary treatment system at the frequency required by the manufacturer under the local government permit to use.
- Use household cleaning products that are suitable for the Secondary Treatment System.
- Minimise use of non-biodegradable detergents.
- Minimise the use of detergents that use phosphorous.
- Keep as much fat and oil out of the system as possible; and
- Conserve water (AAA-rated fixtures and appliances are recommended).

To ensure the land application system functions adequately, residents must:

- Regularly harvest (mow) vegetation within the application area and remove this to maximise uptake of water and nutrients.
- Monitor and maintain the application system following the manufacturer's recommendations, including flushing the drainage lines; and
- Regularly clean in-line filters.

5 CLOSURE

As a result of our assessment, we recommend that sustainable on-site sewage management and disposal systems can be installed to meet the needs of the proposed residential subdivision. We trust that the information provided satisfies your present requirements and meets with your approval. Should you have any queries, please do not hesitate to contact the author.

We draw your attention to the attached "*Report Limitations*" included with this report. This information sheet is intended to provide additional information about this report and information included within it. This information is provided not to reduce the level of responsibility accepted by WML but to ensure that all parties that rely on this report, and the information contained herein, are aware of the responsibilities that each assumes in so doing.

6 REFERENCES

Department of Health (DoH), '*Approved Secondary Treatment Systems*' 14 November 2019, (Accessed December 2021), https://ww2.health.wa.gov.au/Articles/A_E/Approved-aerobic-treatment-unit

Bureau of Meteorology (BoM), Climate Data Online, '*Monthly rainfall for Bunbury Comparison Monitoring station 009510*', (Accessed November 2021), http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=009510

Government of Western Australia (2019) '*Government Sewerage Policy*'

Standard Australia / Standards New Zealand (2012). AS/NZS 1547:2012 '*On-site domestic-wastewater management.*'

LIMITATIONS

REPORT LIMITATIONS

WML have undertaken investigations, performed consulting services, and prepared this report based on the Client's specific requirements, documents and information supplied, and previous experience. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the Client to transmit the information and recommendations of this report to the appropriate organisations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers.

We performed our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty, expressed or implied, is made as to the professional advice included in this report.

Any data provided by third parties including, but not limited to: sub-consultants, published data, and the Client, may not be verified and WML assumes no responsibility for the adequacy, incompleteness, inaccuracies, or reliability of this information. WML does not assume any responsibility for assessments made partly or entirely based on information provided by third parties.

This repot has been prepared based on investigation locations which are explicitly representative of the specific sample or test points. Interpretation of conditions between such points cannot be assumed to represent actual subsurface information and there are unknowns or variations in ground conditions between test locations that cannot be inferred or predicted.

This report is based upon field and other conditions encountered at the time of report preparation. If unexpected subsurface conditions are encountered, WML shall be notified immediately to review those conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include any contamination or environmental assessment of the site or adjacent sites. The nature of geotechnical investigation differs from the environmental investigation practice. If you require any environmental considerations to be applied to your project, WML can advise on further steps to be undertaken.

Geotechnical assessments are typically based on judgment of the investigation data and visual observations of the site and materials.

This document must not be subject to unauthorised use that is, reusing without written authorisation of WML. Such authorisation is essential because it requires WML to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

DRAWINGS

10012-G-004

Geotechnial Test Locations - Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup West, WA

Legend

- Approximate test pit locations
- Zone 1
- Zone 2

TP 21
TP 25
TP 20
TP 23
TP 24
TP 18
TP 11
TP 16
TP 13
TP 15
TP 14
TP 7
TP 10
TP 9
TP 6
TP 8
TP 5
TP 4
TP2
TP 1

Google Earth

500 m

N

10012-G-005

Geotechnial Test Locations - Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup West, WA

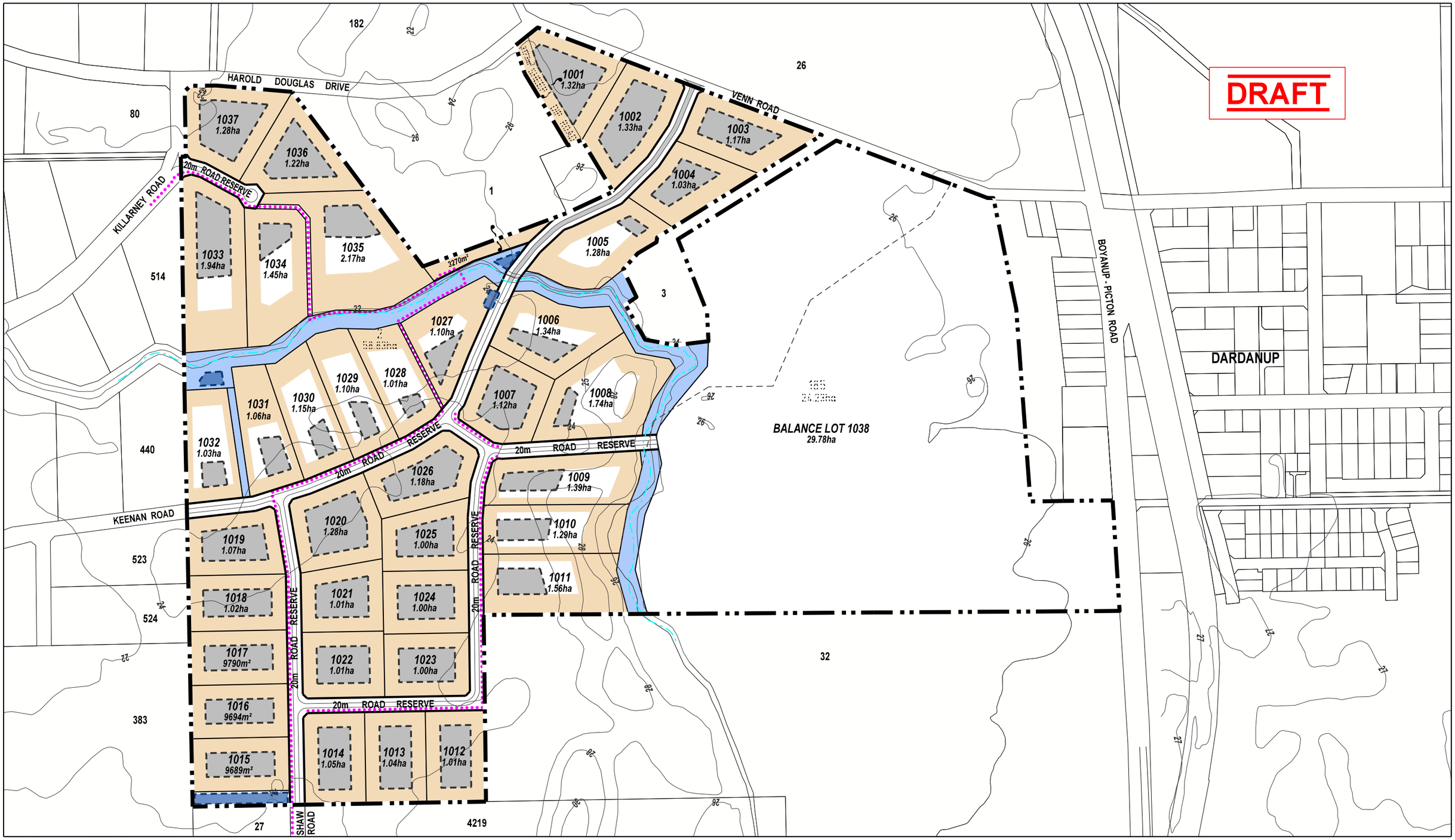
Legend

- Approximate test pit locations
- Zone 1
- Zone 2

TP 1
TP2
TP 4
TP 5
TP 6
TP 7
TP 8
TP 9
TP 10
TP 11
TP 13
TP 14
TP 15
TP 16
TP 18
TP 20
TP 21
TP 23
TP 24
TP 25

HAROLD DOUGLAS DRIVE
VENN ROAD
KILLARNEY ROAD
KEENAN ROAD
SHAW ROAD
BOTANUP - PICTON ROAD
BALANCE LOT 1038
Dardanup
Dardanup Veterinar

Google Earth
500 m
N



This plan has been prepared for planning purposes. Areas, contours and dimensions shown are subject to survey.

CONCEPT PLAN

Lot 2 Harold Douglas Drive and Lot 185 Venn Road, DARDANUP

LEGEND

- SUBJECT SITE
- PROPOSED BOUNDARY
- EXISTING BOUNDARY
- PROPOSED DRAIN RESERVE
- LAND APPLICATION AREA (Secondary treated effluent)
- BUILDING EXCLUSION ZONE
- PROPOSED SUMP
- BRIDLE TRAIL
- 1.0m CONTOURS
- EXISTING DRAIN

Plan No. 21008-1-01a

DATE	3.12.2021
CO-ORDINATES	MGA 50
AERIAL	5.8.2021
REVISION	A

N

50m 0 50 100 150 200

1 : 2500 @ A1 or 1 : 5000 @ A3
ALL DISTANCES ARE IN METRES

ACROSS PLANNING
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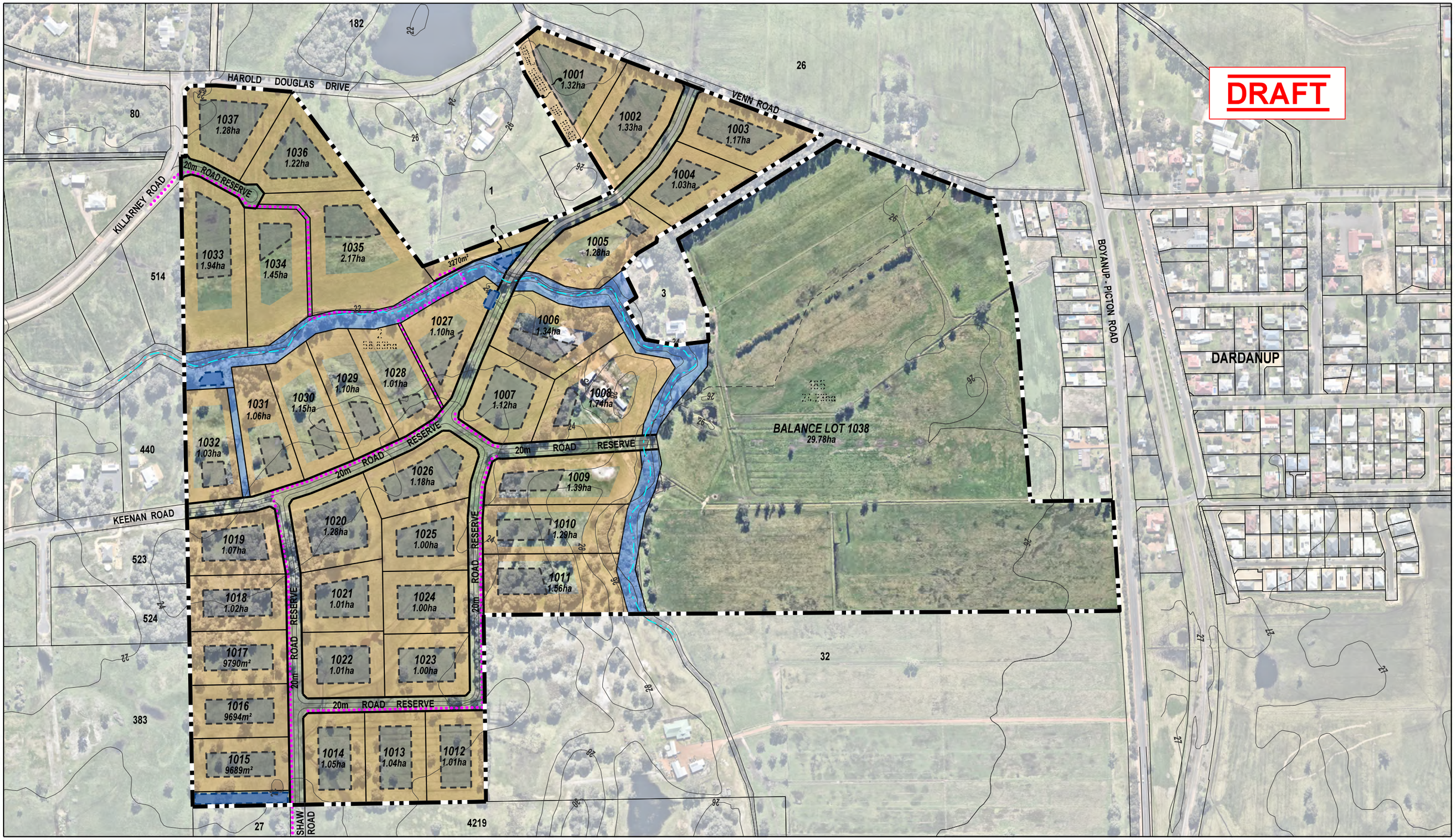

This plan has been prepared for planning purposes. Areas, contours and dimensions shown are subject to survey.

CONCEPT PLAN

Lot 2 Harold Douglas Drive and Lot 185 Venn Road, DARDANUP

LEGEND

- SUBJECT SITE
- PROPOSED BOUNDARY
- EXISTING BOUNDARY
- PROPOSED DRAIN RESERVE
- LAND APPLICATION AREA (Secondary treated effluent)
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- 1.0m CONTOURS
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Plan No. 21008-1-01a

DATE	3.12.2021
CO-ORDINATES	MGA 50
AERIAL	5.8.2021
REVISION	A

N

50m 0 50 100 150 200

1 : 2500 @ A1 or 1 : 5000 @ A3
ALL DISTANCES ARE IN METRES

ACROSS PLANNING
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PHOTOGRAPHIC RECORD

PHOTO SHEET

Job No.:	10012
Job Title:	Geotechnical Investigation
Project:	Dardanup Park
Location:	1 Harold Douglas Drive, Dardanup West, WA
Photo Title	Site Photographs

Figure 1: Looking west across the site from TP 20 location.

Figure 2: Looking southeast across the site from TP 25 location. Ponding water at the ground surface.

Figure 3: A drainage channel stretching from southeast to northwest discharging to the existing drain noted north of TP 16 location.

Figure 4: Water ponding adjacent to TP 13 location.

Figure 5: Looking east from TP 13 location. Ground surface slightly rising towards east.

Figure 6: Looking northwest from TP 11 location. Existing drain on the right and shed structures on the left.

Figure 7: Looking southwest from TP 21 location.

Figure 8: Waterlogging east of the TP 21.

Figure 9: Looking southwest towards observed inundated area located west of TP 5.

Figure 10: Looking east towards observed inundated area located east of TP 5.

Figure 11: Looking southwest from TP 2 location.

PHOTO SHEET

Job No.:	10012
Job Title:	Geotechnical Investigation
Project:	Dardanup Park
Location:	1 Harold Douglas Drive, Dardanup West, WA
Photo Title	Test Pit Profiles

Figure 1: Soil profile at TP 1 location.

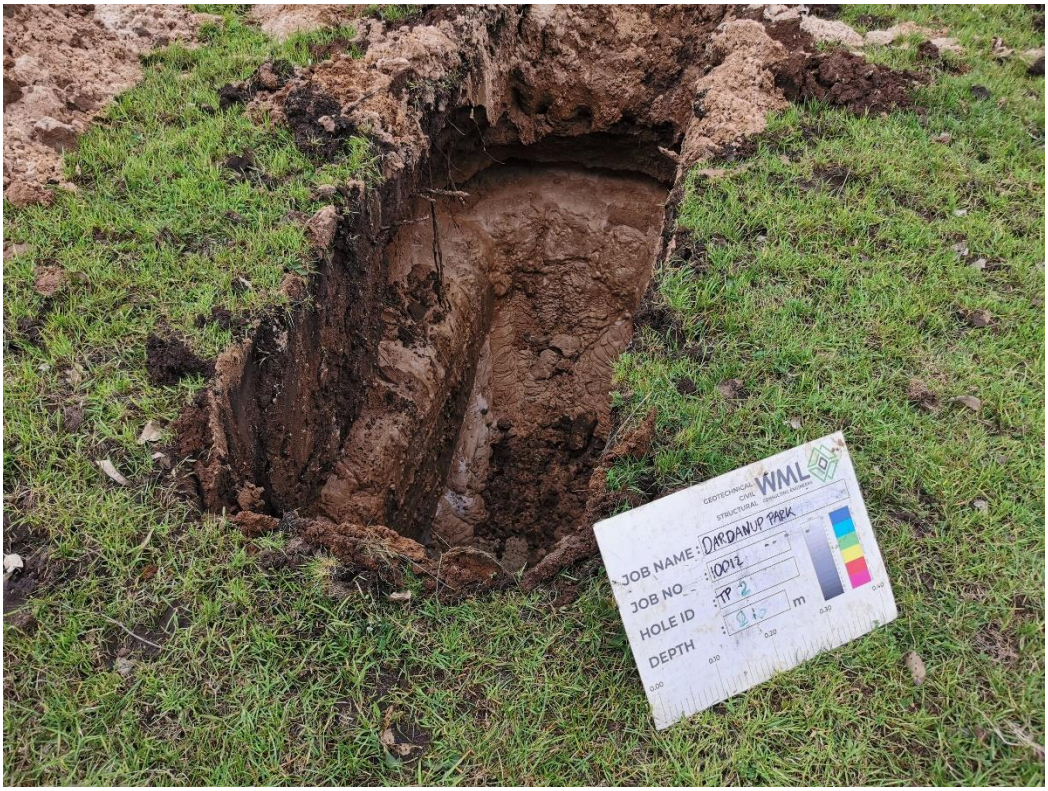

Figure 2: Soil profile at TP 2 location.

Figure 3: Soil profile at TP 4 location.

Figure 4: Soil profile at TP 5 location.

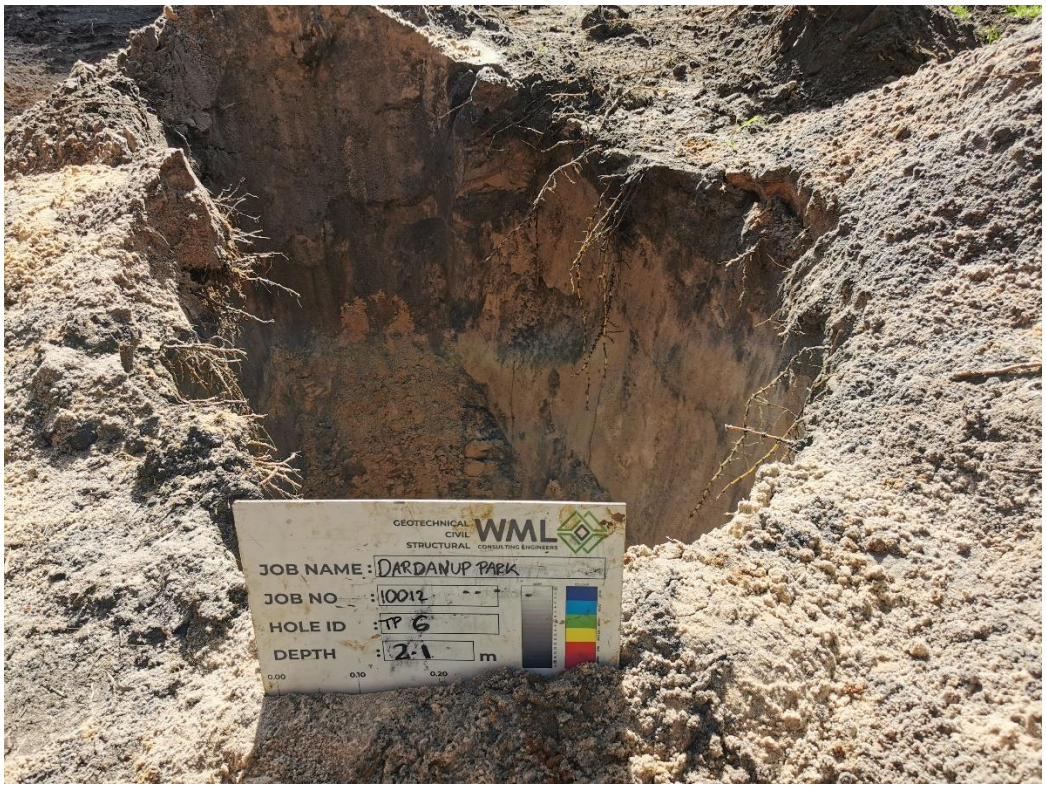

Figure 5: Soil profile at TP 6 location.

Figure 6: Soil profile at TP 7 location.

Figure 7: Soil profile at TP 8 location.

Figure 8: Soil profile at TP 9 location.

Figure 9: Soil profile at TP 10 location.

Figure 10: Soil profile at TP 11 location.

Figure 11: Soil profile at TP 13 location.

Figure 12: Soil profile at TP 14 location.

Figure 13: Soil profile at TP 15 location.

Figure 14: Soil profile at TP 16 location.

Figure 15: Soil profile at TP 18 location.

Figure 16: Soil profile at TP 20 location.

Figure 17: Soil profile at TP 21 location.

Figure 18: Soil profile at TP 23 location.

Figure 19: Soil profile at TP 24 location.

Figure 20: Soil profile at TP 25 location.

APPENDIX A

TEST PIT LOGS

WML accessible expertise	**TRIAL PIT: TP 1**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383095.0 m E 6303088.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 4 0.20 - 0.35 6 0.35 - 0.50 4 0.50 - 0.65 6 0.65 - 0.80 6 0.80 - 0.95 9		SP	**TOPSOIL: SAND**, fine to medium grained, grey, trace of low plasticity fines, moist, loose
	0.5			SP	**SAND**, fine to medium grained, grey slightly mottled pale grey, trace of non-plastic fines, moist, medium dense, BASSENDEAN SAND
▽ 0.9m	1.0			GP	**Sandy GRAVEL**, fine to coarse grained, fine to coarse grained sand, dark brown slightly mottled orange, with low plasticity clay, moist, medium dense, "Coffey Rock" excavated as gravel, sand and cobbles up to 150 mm diameter. Groundwater seepage observed at few locations within the layer
	1.5			CH	**Sandy CLAY**, high plasticity, fine to coarse grained sand, orange mottled red and grey, trace of fine grained gravel, moist, very stiff, GUILFORD FORMATION
	2.0			SC	**Clayey SAND**, fine to coarse grained, high plastictiy clay, orange mottled grey, with fine to medium grained lateritic gravel, wet, medium dense, GUILFORD FORMATION
	2.5				Hole Terminated at 2.50 m Target depth

WML accessible expertise	**TRIAL PIT: TP 2**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382883.0 m E 6303135.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
				CL	**TOPSOIL: CLAY**, low plasticity, dark brown, with fine to medium grained sand and fine roots, moist, soft
		9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 1 0.20 - 0.35 1 0.35 - 0.50 3 0.50 - 0.65 4 0.65 - 0.80 6 0.80 - 0.95 11 0.95 - 1.10 8 1.10 - 1.25 11 1.25 - 1.40 10 1.40 - 1.55 15 1.55 - 1.70 12 1.70 - 1.85 15 1.85 - 2.00 20		CI	**CLAY**, medium plasticity, dark brown mottled brown and orange, with fine to medium grained sand, trace of weekly cemented sand of fine grained gravel size, trace of fine roots, moist, soft, GUILFORD FORMATION
0.65m	0.5			SP	**SAND**, fine to coarse grained, pale yellow mottled orange, trace of low plasticity fines, wet, medium dense, GUILFORD FORMATION
	1.0			CI	**Sandy CLAY**, medium plasticity, fine to medium grained sand, grey mottled brown, moist, stiff, GUILFORD FORMATION
	1.5			CI	**Sandy CLAY**, low to medium plasticity, fine to medium grained weekly cemented sand, pale grey/cream, with fine to medium grained lateritic gravel, moist, stiff/very stiff, GUILFORD FORMATION becoming cream mottled orange at 1.8 m
	2.0				Hole Terminated at 2.00 m Wet Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 4**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382903.0 m E 6303298.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
		9 kg Dynamic Cone Penetrometer		SP	**TOPSOIL: SAND**, fine to coarse grained, black/brown, with low plasticity clay, moist, loose
		Depth (m) Blows 0.05 - 0.20 4 0.20 - 0.35 3 0.35 - 0.50 2 0.50 - 0.65 1 0.65 - 0.80 2 0.80 - 0.95 4		SP	**SAND**, fine to coarse grained, orange, with low plasticity clay, moist, loose, BASSENDEAN SAND
	0.5	0.95 - 1.10 10 1.10 - 1.25 8 1.25 - 1.40 13 1.40 - 1.55 7 1.55 - 1.70 6 1.70 - 1.85 15 1.85 - 2.00 14			
▽ 0.6m				SP	**SAND**, fine to coarse grained, pale yellow mottled orange, moist, very loose/loose, BASSENDEAN SAND groundwater seepage observed at 0.6 m, becomes wet at about 0.95 m becomes medium dense
	1.0				
	1.5				
	2.0				Hole Terminated at 1.60 m Wet Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 5**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383068.0 m E 6303374.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 2 0.20 - 0.35 0 0.35 - 0.50 2 0.50 - 0.65 3 0.65 - 0.80 5 0.80 - 0.95 6 0.95 - 1.10 8 1.10 - 1.25 12 1.25 - 1.40 17 1.40 - 1.55 10 1.55 - 1.70 6 1.70 - 1.85 7 1.85 - 2.00 11		CL	**TOPSOIL: CLAY**, low plasticity, dark brown, with fine grained sand, wet, soft
▽ 0.7m	0.5			CL	**Sandy CLAY**, low plasticity, fine to medium grained sand, dark brown mottled brown, wet, very soft, GUILFORD FORMATION at about 0.5 m becomes firm
	1.0			SP	**SAND**, fine to medium grained, pale yellow mottled orange, wet, medium dense, lateritic soil observed beneath this layer, however not possible to excavate due to wet collapse, GUILFORD FORMATION
	1.5				
	2.0				Hole Terminated at 1.90 m Wet Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 6**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382919.0 m E 6303411.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered	0.5	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 3 0.20 - 0.35 3 0.35 - 0.50 4 0.50 - 0.65 3 0.65 - 0.80 3 0.80 - 0.95 4 0.95 - 1.10 6 1.10 - 1.25 6 1.25 - 1.40 5 1.40 - 1.55 7 1.55 - 1.70 8 1.70 - 1.85 8 1.85 - 2.00 7		SP	**TOPSOIL: SAND**, fine to medium grained, dark grey, with low plasticity fines and fine to medium roots, moist, loose
	1.0			SP	**SAND**, fine to medium grained, pale yellow mottled grey, trace of low plasticity fines, moist, loose, BASSENDEAN SAND at about 0.95 m becoming medium dense
	1.5				
	2.0				at about 1.9 m becoming mottled orange and with fine to medium grained gravel of moderately cemented sand
	2.5				Hole Terminated at 2.10 m Dry Collapse

WML accessible expertise	**TRIAL PIT: TP 7**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383054.0 m E 6303497.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered				SP	**TOPSOIL: SAND**, fine to medium grained, dark grey, with low plasticity fines and fine roots, moist, loose
	0.5	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 4 0.20 - 0.35 5 0.35 - 0.50 4 0.50 - 0.65 5 0.65 - 0.80 5 0.80 - 0.95 5 0.95 - 1.10 5 1.10 - 1.25 6 1.25 - 1.40 5 1.40 - 1.55 4 1.55 - 1.70 11		SP	**SAND**, fine to medium grained, grey, trace of low plasticity fines, moist, medium dense, BASSENDEAN SAND
	1.0			SP	**SAND**, fine to medium grained, pale grey, trace of low plasticity fines, wet, medium dense, BASSENDEAN SAND
	1.5				at 1.7 m 'Coffey Rock' excavated as cobbles, not possible to dig further due to wet collapse Hole Terminated at 1.70 m Dry Collapse
	2.0				
	2.5				

TRIAL PIT: TP 8

SHEET: 1 OF 1

CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383322.0 m E 6303384.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered	0.5	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 1 0.20 - 0.35 2 0.35 - 0.50 3 0.50 - 0.65 3 0.65 - 0.80 3 0.80 - 0.95 3 0.95 - 1.10 3 1.10 - 1.25 3 1.25 - 1.40 3 1.40 - 1.55 3 1.55 - 1.70 3 1.70 - 1.85 4 1.85 - 2.00 3 2.00 - 2.15 5		SP	**TOPSOIL: SAND**, fine to medium grained, grey, trace of low plasticity fines, with fine roots throughout, moist, loose
	1.0			SP	**SAND**, fine to medium grained, grey, trace of low plasticity fines, moist, loose, BASSENDEAN SAND at about 0.6 m becoming grey mottled pale grey and white
	1.5				
	2.0				Hole Terminated at 1.70 m Dry Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 9**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383227.0 m E 6303434.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.5	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 2 0.20 - 0.35 1 0.35 - 0.50 3 0.50 - 0.65 7 0.65 - 0.80 6 0.80 - 0.95 6 0.95 - 1.10 3 1.10 - 1.25 4 1.25 - 1.40 4 1.40 - 1.55 2 1.55 - 1.70 3 1.70 - 1.85 2 1.85 - 2.00 2 2.00 - 2.15 2		CL	**TOPSOIL: CLAY**, low plasticity, dark brown, trace of fine grained sand, with organic matter and fine to medium roots throughout, moist, soft
				SP	**SAND**, coarse grained, brown/orange mottled grey, trace of low plasticity fines, wet, loose, GUILFORD FORMATION
				SC	**Clayey SAND**, fine to medium grained, low plasticity clay, brown mottled dark brown, trace of fine to medium grained gravel, wet, medium dense, GUILFORD FORMATION
0.8m ▽	1.0			SP	**SAND**, fine to medium grained, grey/brown mottled brown, trace of low plasticity clay, wet, medium dense, GUILFORD FORMATION at about 1.4 m becoming loose
	1.5			SP	**SAND**, fine to coarse grained, dark brown mottled pale brown, with low plasticity fines, wet, loose, GUILFORD FORMATION
	2.0				Hole Terminated at 1.80 m Wet Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 10**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383336.0 m E 6303490.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 2 0.20 - 0.35 2 0.35 - 0.50 3 0.50 - 0.65 3 0.65 - 0.80 3 0.80 - 0.95 3 0.95 - 1.10 3 1.10 - 1.25 3 1.25 - 1.40 3 1.40 - 1.55 4 1.55 - 1.70 4 1.70 - 1.85 4 1.85 - 2.00 6 2.00 - 2.15 6		SP	**TOPSOIL: SAND**, fine to medium grained, grey/yellow, trace non-plastic fines and fine roots, dry, loose
	0.5			SP	**SAND**, fine to medium grained, pale yellow mottled yellow, trace of non-plastic fines, dry, loose, BASSENDEAN SAND
	1.0				
	1.5				at about 1.4 m becoming medium dense
	2.0				at about 2 m becoming orange
					Hole Terminated at 2.00 m Dry Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 11**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383450.0 m E 6303660.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 3 0.20 - 0.35 5 0.35 - 0.50 4 0.50 - 0.65 3 0.65 - 0.80 3 0.80 - 0.95 3 0.95 - 1.10 4 1.10 - 1.25 3 1.25 - 1.40 5 1.40 - 1.55 6 1.55 - 1.70 5 1.70 - 1.85 9 1.85 - 2.00 10		SP	**TOPSOIL: SAND**, fine to medium grained, brown, with non-plastic fines and fine roots, moist, loose, at the surface observed some sparse pisolitic gravel (fill)
				SP	**SAND**, fine to medium grained, pale brown slightly mottled grey, trace of non-plastic fines and fine roots, moist, medium dense, BASSENDEAN SAND
	0.5				**SAND**, fine to medium grained, yellow/orange, trace of non-plastic fines and gravel size weakly cemented sand (forming 'Coffey Rock'), moist, loose/medium dense, BASSENDEAN SAND
	1.0			SP	at about 1.1 m becoming medium dense
	1.5				
	2.0				Hole Terminated at 2.00 m Dry Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 13**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383156.0 m E 6303578.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered		9 kg Dynamic Cone Penetrometer		CI	**TOPSOIL: CLAY**, low plasticity, dark brown, trace of fine to medium grained sand, with fine roots, moist, firm
	0.5	Depth (m) Blows 0.05 - 0.20 2 0.20 - 0.35 1 0.35 - 0.50 3 0.50 - 0.65 4 0.65 - 0.80 4 0.80 - 0.95 5 0.95 - 1.10 6 1.10 - 1.25 6 1.25 - 1.40 7 1.40 - 1.55 4 1.55 - 1.70 8 1.70 - 1.85 8 1.85 - 2.00 9		CI	**Sandy CLAY**, medium plasticity, fine to medium grained sand, brown slightly mottled orange, trace of fine roots, moist, firm, GUILFORD FORMATION at about 0.5 m becoming wet
	1.0			SP	**SAND**, fine to medium grained, pale yellow mottled orange, trace of low plasticity fines, and fine roots, wet, medium dense, GUILFORD FORMATION
	1.5				Hole Terminated at 1.20 m Dry Collapse
	2.0				
	2.5				

TRIAL PIT: TP 14

SHEET: 1 OF 1

CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382922.0 m E 6303531.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 3 0.20 - 0.35 4 0.35 - 0.50 3 0.50 - 0.65 3 0.65 - 0.80 4 0.80 - 0.95 5 0.95 - 1.10 5 1.10 - 1.25 4 1.25 - 1.40 4 1.40 - 1.55 7 1.55 - 1.70 6 1.70 - 1.85 8 1.85 - 2.00 6		SP	**TOPSOIL: SAND**, fine to medium grained, dark grey, with non-plastic fines and fine roots, moist, loose
	0.5			SP	**SAND**, fine to medium grained, grey, trace of fine roots and non-plastic fines, moist, loose/medium dense, moisture increasing with depth, BASSENDEAN SAND at about 0.5 m becoming pale grey at about 0.8 m becoming medium dense
	1.0				a coarse tree root at about 1 m
	1.5			GP	**GRAVEL**, fine to coarse grained, dark brown, wet, dense, 'Coffey Rock' excavated as gravel and cobbles
	2.0				Hole Terminated at 1.90 m Dry Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 15**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382838.0 m E 6303546.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
		9 kg Dynamic Cone Penetrometer		SM	**TOPSOIL: Silty SAND**, fine to medium grained, low plasticity silt, dark brown, with fine to medium roots, moist, medium dense
		Depth (m) Blows 0.05 - 0.20 5 0.20 - 0.35 3 0.35 - 0.50 4 0.50 - 0.65 5 0.65 - 0.80 5 0.80 - 0.95 4		SP	**SAND**, fine to medium grained, grey mottled pale brown, trace of non-plastic fines and fine to medium roots, moist, medium dense, BASSENDEAN SAND
	0.5	0.95 - 1.10 4 1.10 - 1.25 5 1.25 - 1.40 3 1.40 - 1.55 7 1.55 - 1.70 6 1.70 - 1.85 10 1.85 - 2.00 12		SP	**SAND**, fine to medium grained, pale brown mottled grey, trace of non-plastic fines, with fine roots, wet, medium dense, BASSENDEAN SAND
▽ 0.7m	1.0				
	1.5				
	2.0				Hole Terminated at 1.90 m Wet Collapse
	2.5				

TRIAL PIT: TP 16

SHEET: 1 OF 1

CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383008.0 m E 6303599.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
Not Encountered	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 4 0.20 - 0.35 5 0.35 - 0.50 4 0.50 - 0.65 3 0.65 - 0.80 3 0.80 - 0.95 4 0.95 - 1.10 4 1.10 - 1.25 4 1.25 - 1.40 8 1.40 - 1.55 9 1.55 - 1.70 5 1.70 - 1.85 2 1.85 - 2.00 1		SP	**TOPSOIL: SAND**, fine to medium grained, grey/brown, with non-plastic fines and fine roots, moist, medium dense
				SP	**SAND**, fine to medium grained, pale grey/pale yellow, trace of non-plastic fines, moist, medium dense, BASSENDEAN SAND
	0.5			SP	**SAND**, fine to medium grained, pale yellow mottled grey, trace of non-plastic fines, wet, medium dense, BASSENDEAN SAND
	1.0				at about 1.7 m becoming orange and loose
	1.5				at about 1.8 m 'Coffey Rock' excavated as gravel and cobbles could not continue excavation due to wet collapse
	2.0				Hole Terminated at 1.80 m Wet Collapse
	2.5				

WML accessible expertise	**TRIAL PIT: TP 18**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383213.0 m E 6303668.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 2 0.20 - 0.35 1 0.35 - 0.50 5 0.50 - 0.65 4 0.65 - 0.80 5 0.80 - 0.95 8 0.95 - 1.10 10 1.10 - 1.25 7 1.25 - 1.40 13 1.40 - 1.55 18 1.55 - 1.70 17 1.70 - 1.85 17 1.85 - 2.00 21		CI	**TOPSOIL: CLAY** medium plasticity, dark brown, trace of fine to medium grained sand, trace of fine to medium roots, moist, soft
	0.5			CI	**CLAY**, medium plasticity, brown mottled orange and grey, trace of fine to medium grained sand and fine to medium roots, moist, firm, GUILFORD FORMATION
				CI	**Sandy CLAY**, medium plasticity, fine grained sand, grey mottled orange, trace of fine to medium roots, moist, firm, GUILFORD FORMATION
	1.0			SP	**SAND**, fine to medium grained, grey mottled orange, trace of non-plastic fines, moist, medium dense, GUILFORD FORMATION at about 1.3 m becoming wet
▽ 1.5m	1.5			SC	**Clayey SAND**, fine to medium grained, medium plasticity clay, orange mottled grey, trace of fine roots, wet, dense, GUILFORD FORMATION
	2.0			SP	**SAND**, fine to coarse grained, grey mottled yellow, with clayey sand and sandy clay lumps, wet, dense, GUILFORD FORMATION
	2.5				Hole Terminated at 2.50 m Target depth

WML accessible expertise	**TRIAL PIT: TP 20**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383384.0 m E 6303871.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 2 0.20 - 0.35 3 0.35 - 0.50 3 0.50 - 0.65 4 0.65 - 0.80 4 0.80 - 0.95 4 0.95 - 1.10 4 1.10 - 1.25 6 1.25 - 1.40 5 1.40 - 1.55 3 1.55 - 1.70 2 1.70 - 1.85 2 1.85 - 2.00 6 2.00 - 2.15 14		CH	**TOPSOIL: CLAY**, high plasticity, black, with fine roots throughout, trace of fine grained sand, moist, soft/firm
0.6m ▽	0.5			CL	**Sandy CLAY**, low plastictiy, fine to medium grained sand, brown mottled grey, with fine roots throughout, moist, firm, GUILFORD FORMATION
	1.0			SP	**SAND**, fine to medium grained, yellow mottled grey, trace of non-plastic fines, wet, medium dense, GUILFORD FORMATION at about 1.4 m becoming loose at about 1.8 m becoming medium dense
	1.5				
	2.0				Hole Terminated at 2.00 m Wet Collapse
	2.5				

TRIAL PIT: TP 21

SHEET: 1 OF 1

CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 383448.0 m E 6303990.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.05 - 0.20 1 0.20 - 0.35 3 0.35 - 0.50 4 0.50 - 0.65 6 0.65 - 0.80 9 0.80 - 0.95 13 0.95 - 1.10 21 1.10 - 1.25 19 1.25 - 1.40 17 1.40 - 1.55 20 1.55 - 1.70 19 1.70 - 1.85 18 1.85 - 2.00 25		OH	**TOPSOIL: Organic CLAY**, medium to high plasticity, dark brown/black mottled brown, with fine roots, trace of fine grained sand, moist, soft
	0.5			CH	**Sandy CLAY**, high plasticity, fine to coarse grained sand, brown mottled grey, trace of fine roots, moist, soft, GUILFORD FORMATION
				CH	**Sandy CLAY**, high plasticity, fine to coarse grained sand, brown mottled grey, wet, firm, GUILFORD FORMATION
	1.0			SC	**Clayey SAND**, fine to coarse grained, medium plasticity clay, brown mottled orange/grey, trace of fine grained gravel, trace of fine roots, moist, stiff, GUILFORD FORMATION
1.2m	1.5			CH	**CLAY**, high plasticity, brown mottled orange/grey, with fine to coarse grained sand, moist, stiff, GUILFORD FORMATION at about 1.85 m becoming very stiff
	2.0				
	2.5				Hole Terminated at 2.50 m Target depth

WML accessible expertise	**TRIAL PIT: TP 23**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382829.0 m E 6303850.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
				SC	**TOPSOIL: Clayey SAND**, fine to medium grained, low plasticity clay, dark brown, moist, loose
	0.5	9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.20 - 0.35 1 0.35 - 0.50 3 0.50 - 0.65 5 0.65 - 0.80 6 0.80 - 0.95 11 0.95 - 1.10 11 1.10 - 1.25 8 1.25 - 1.40 6 1.40 - 1.55 8 1.55 - 1.70 11 1.70 - 1.85 17 1.85 - 2.00 15 2.00 - 2.15 10		OL	**ORGANIC CLAY**, medium plasticity, dark brown, with fine to medium grained sand and fine grained gravel, moist, soft, GUILFORD FORMATION (ALLUVIUM) at about 0.5 m becoming firm
▽ 0.9m	1.0			CH	**Sandy CLAY**, high plasticity, fine to medium grained sand, dark brown slightly mottled grey, with fine roots and trace of fine grained gravel, wet, firm, GUILFORD FORMATION
	1.5			SP	**SAND**, coarse grained, brown, with medium plasticity fines, wet, medium dense, GUILFORD FORMATION
				CH	**Sandy CLAY**, high plasticity, fine to coarse grained sand, brown/orange mottled grey, moist, very stiff, GUILFORD FORMATION
	2.0			CH	**Sandy CLAY**, high plasticity, fine to medium grained sand, brown mottled orange, trace of fine grained gravel, moist, stiff, GUILFORD FORMATION
	2.5				Hole Terminated at 2.40 m Wet Collapse

WML accessible expertise	**TRIAL PIT: TP 24**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382991.0 m E 6303849.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0			CH	**TOPSOIL: CLAY**, high plasticity, black, with fine roots throughout, trace of fine grained sand, moist, soft
		9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.20 - 0.35 2 0.35 - 0.50 1 0.50 - 0.65 1 0.65 - 0.80 3 0.80 - 0.95 4		CI	**Sandy CLAY**, medium plasticity, fine to medium grained sand, dark brown, with fine roots throughout, trace of fine to medium grained gravel, moist, soft, GUILFORD FORMATION
▽ 0.6m	0.5	0.95 - 1.10 5 1.10 - 1.25 5 1.25 - 1.40 4 1.40 - 1.55 7 1.55 - 1.70 7 1.70 - 1.85 10 1.85 - 2.00 10 2.00 - 2.15 12		SC	**Clayey SAND**, fine to coarse grained, medium plasticity clay, dark brown, with fine roots and fine to medium grained gravel, wet, medium dense, GUILFORD FORMATION
	1.0				
	1.5				
	2.0				
	2.5				Hole Terminated at 2.40 m Wet Collapse

WML accessible expertise	**TRIAL PIT: TP 25**	SHEET: 1 OF 1
CLIENT: Dardanup Park Pty Ltd	CONTRACTOR: WML Consultants	LOGGED: A.Gorczynska
PROJECT: Geotechnical Investigation	MACHINE: 8 tonne excavator	LOGGED DATE: 07/09/2021
LOCATION: 1 Harold Douglas Dr, Dardanup West, WA	CO-ORD SYSTEM: MGA94 Zone 51	SURFACE RL:
JOB NO.: 10012	POSITION: 382891.0 m E 6303949.0 m N	CHAINAGE:

WATER	DEPTH (m)	SAMPLES OR FIELD TEST	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION
	0.0			CL	**TOPSOIL: CLAY**, low plasticity, dark brown/black, with fine roots throughout, trace of fine grained sand, moist, soft
		9 kg Dynamic Cone Penetrometer Depth (m) Blows 0.20 - 0.35 1 0.35 - 0.50 3 0.50 - 0.65 6 0.65 - 0.80 10 0.80 - 0.95 14 0.95 - 1.10 16 1.10 - 1.25 13 1.25 - 1.40 14 1.40 - 1.55 13 1.55 - 1.70 15 1.70 - 1.85 16 1.85 - 2.00 19 2.00 - 2.15 17		CH	**CLAYEY**, high plasticity, dark brown slightly mottled pale brown, trace of fine grained sand and fine to medium grained gravel, moist, firm, GUILFORD FORMATION
	0.5				
	1.0			SC	**Clayey SAND**, fine to coarse grained, low to medium plasticity clay, dark brown mottled orange and grey, wet, medium dense, GUILFORD FORMATION
▽ 1.4m	1.5			SP	**SAND**, fine to coarse grained, pale grey slightly mottled pale yellow, trace of non-plastic fines, wet, dense, GUILFORD FORMATION
	2.0				Hole Terminated at 1.70 m Wet Collapse
	2.5				

APPENDIX B

LABORATORY TEST CERTIFICATES

Environmental and Agricultural Testing Services
Unit 5, 4 Mummery Cres
Bunbury WA 6230
Phone: 08 9721 7170
Email: eatsresults@eatswa.com.au
ABN 64 606 311 399

Certificate of Analysis

Client Name:	WML Consultants		
Address:	PO Box 2023, Bunbury, WA, 6231		
Phone No:	9722 3544	Email:	ahollier@wml.com.au
Lab No:	13032	Order No:	Job 10012
Date samples received:	15/9/2021	Report date:	24/9/2021

Sample details: Nine soil samples for phosphorus retention index, collected by client, labelled:
TP4: 0.5 m
TP5: 0.5 m
TP9: 0.5 m
TP13: 0.5 m
TP15: 0.5 m
TP18: 0.7 m
TP21: 0.5 - 0.7 m
TP24: 0.5 m
TP25: 0.5 - 0.6 m

Test Methods: Samples are analysed on an as received basis using a method specified by the Australasian Soil and Plant Analysis Council.

Test Results:

Sample	Phosphorus Retention Index (PRI)
TP4: 0.5m	30
TP5: 0.5m	51
TP9: 0.5m	520
TP13: 0.5m	174
TP15: 0.5m	0.2
TP18: 0.7m	> 1000
TP21: 0.5-0.7m	> 1000
TP24: 0.5m	383
TP25: 0.5-0.6m	> 1000

Rachel Lancaster
BSc (Hort), PgDip (Agribusiness)
End of report

APPENDIX C

GROUNDWATER MONITORING REPORT

Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup

Groundwater Monitoring Report

PREPARED FOR DARDANUP PARK PTY LTD

B21026 October 2021

Oversby Consulting Pty Ltd
ABN 41 887 270 403

DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR
1	October 2020	Submission for Client Review	BCO

Contents

Appendices

1 Introduction

Oversby Consulting has prepared this report on behalf of Dardanup Park Pty Ltd to support the proposed future development of Lot 2 Harold Douglas Drive and Lot 185 Venn Road, Dardanup.

The monitoring programme assists in confirming the pre-development groundwater conditions within the subject land and will be used as a baseline level to support the future development of the area.

The subject land is located within the Shire of Dardanup. The site is approximately 83.06ha and is currently zoned "Rural" under the Greater Bunbury Region Scheme and identified as General Farming in the Shire of Dardanup Local Planning Strategy. The site is bordered by Harold Douglas Drive and Venn Road to the north, rural residential properties to the west, general farming to the south and the town of Dardanup to the east (see Figure L-001, Appendix A).

Oversby Consulting monitored groundwater levels at 10 monitoring bore sites across the subject land between June 2021 and October 2021. The bores were installed as part of this investigation. 6 monitoring runs were undertaken, with the runs generally being done just after periods of extended rainfall. The focus was on tracking the rise and fall of groundwater levels.

The soil type varies across the site. In the north and east it is generally topsoil over clay. In the southern portion, in the low areas the soil profile grades from sandy topsoil to sandy clays at depth, while the higher areas are composed of white sands.

The topography of the site is generally flat to the north and east, noting there is a slight rise that leads to a Bassendean sand dune on the adjoining property along the northern boundary. Much of this flat area has been levelled to assist with flood irrigation practices. The Gavin's Gully Main drain traverses the middle of the subject land, from the southern boundary, before turning 90 degrees to the west, and exiting on the western boundary. To the southwest of this waterway the land is generally composed of medium sand dunes with a low interdunal sandy wetland area. A small rural drain traverses this low-lying area and empties into Gavin's Gully Main Drain. There are numerous small soaks throughout the low lying sandy areas.

In the middle of the site on the sand dune landform, there is a house and rural sheds.

Figure L-001 shows these site features and the bore locations.

1.1 Study Objectives

The specific objectives of this study are to:

- Characterise existing groundwater level conditions and the depth from the surface;
- Provide preliminary recommendations for management of groundwater during and post development.

2 Previous/Current Land Use

The site has been used predominately for livestock grazing and general agriculture since it was cleared of native vegetation. There are some small areas of planted windbreaks and internal fences as well as rural buildings and a house.

3 Previous Groundwater monitoring

There is no known previous analysis of groundwater via monitoring bores for the subject land. Advice from the current and former land managers is that the groundwater tends to fluctuate seasonally, with some portions of the subject land becoming waterlogged in wet winters.

4 Methodology

4.1 Bore Information

The new bores were installed on the 23rd and 24th June 2021 to a depth of approximately 3.5m. They all have lockable metal collars. The placement of the new bores was designed to provide an even network of bores across the subject land. The locations were also chosen to capture the edges of the subject land as well as the effects of the different landforms within the site. Their location can be seen in Figure L-001 as Bores 1-10.

Appendix B contains the bore logs and photos of the soil extracted.

Table 1 provides a summary of each new bore.

Table 1: Bore summary

Monitoring Well	Depth Of Well	Casing Stickup	Bore area specific comments at time of install	Location	
	Mm TOC*	mm		Northings	Eastings
1	4080	560	Wet, spongy ground. No standing water. Minor water in drain 20m away. Loam 200mm then clay loams/clay	33.396746	115.745335
2	4050	490	Wet, spongy ground. No standing water nearby. Loam 200mm then clay loams/clay	33.398574	115.749214
3	3900	550	Approx 100mm loose sediment at bottom of bore. Small puddling in roadside drain. Ground not spongy. Loamy sand to 0.5m. Heavier clay below.	33.396606	115.740729
4	4080	530	Ground not spongy. 5 square metre puddle of surface water 30m away. Clay approx 2m down.	33.398630	115.739831
5	4080	600	Ground not spongy. Drain nearby with no water. Minor amount of clay at 3m down, increasing with depth.	33.400213	115.742917
6	4100	590	Ground not spongy. Clay/sand soil 2.5m down.	33.401200	115.739800
7	4090	550	Sandy loam at top. Red clay 2.5m down. Ground not spongy. Nearby soak had water approx 1.2m below natural surface.	33.405393	115.740125
8	4030	400	Ground not spongy. Minor clay at 3m down. Coffee rock at 2m down.	33.404192	115.743983
9	4050	390	Metal cap on casing up. Sand all the way.	33.402409	115.744479
10	4040	430	Metal cap on casing does not sit right. Sand all the way.	33.400473	115.745263

* TOC = Top of casing

The new groundwater monitoring wells were installed in accordance with the Department of Water (2006) *Water Quality Protection Note – Groundwater Monitoring Bores and the Australian Government Monitoring Bores and the Australian Government – National Water Quality Management Strategy Minimum Construction Requirements for Water Bores in Australia.*

4.2 Groundwater Level Monitoring

Oversby Consulting monitored groundwater levels from the 28th June 2021 to the 25th October 2021. A total of 6 measurements were taken for each monitoring borehole during this period. All measurements were undertaken on the same day for every monitoring run. Generally, the monitoring runs were timed to occur after periods of extended rainfall over multiple days, through to September. This was done to attempt to determine the seasonal maximum levels across the site. As the weather dried in October (noting that there was still record rainfall for the month) the measurement was undertaken to determine that a peak had been reached in September and that levels were now falling.

To obtain the measurement of the groundwater's level, an electrical sounder groundwater probe was lowered into the pipe until it signalled that it had reached the water table. The depth was recorded, and in the office the pipe height above the surface level was subtracted from the recorded measurement to ascertain the depth to the groundwater from the ground's surface.

Notes on the surrounding area such as standing surface water, soak levels and drain flows were also recorded to assist with understanding how water is generally moving within the site.

4.3 Rainfall data

The rainfall for 2021 was generally above average for the subject land, both within the monitoring period and for the year until November. Table 2 shows a summary of the 2021's rainfall compared to the average rainfall. This above average rainfall suggests that the data collected is likely to be representative of a wet year and close to or at the maximum levels likely to be experienced at the site.

Table 2: 2021 Rainfall

Month	2021	Average	Comments
January	0.2	11.2	
February	54.6	9	
March	36.4	20.3	
April	74	37.5	
May	147.8	99	
June	101	135.5	
July	199.8	142.4	Wettest July in 20+ years
August	108.2	117.7	
September	95.2	80.1	
October (to 25th)	95.6	33.2	Approximately 20mm above the wettest October on record by the date of recording
Total to date	912.8	685.8	

5 Results and Discussion

5.1 Groundwater Level Recorded

Table 3 provides a summary of the level for each bore at each monitoring run. The September 20th results were used as the general seasonal maximum. This reading was equal to or higher than all other times that each bore was measured. Table 4 shows the shallowest depth of water from the surface (highest groundwater) as well as the height of the groundwater in metres AHD based on this reading. The ground surface contours were produced from LiDAR. Full details of each monitoring run can be found in Appendix B.

Table 3: Groundwater Level record

Monitoring Well	Depth to water from surface (mmbgl)					
	28/06/2021	19/07/2021	16/08/2021	30/08/2021	20/09/2021	25/10/2021
1	2200	1400	1070	1040	1040	1040
2	2930	200	230	230	190	270
3	490	230	250	360	250	330
4	1790	350	410	490	380	710
5	1900	600	510	500	500	670
6	860	240	220	200	180	170
7	1350	450	510	580	490	730
8	750	120	130	140	130	170
9	1730	1050	720	720	630	720
10	2560	1780	1330	1430	1330	1540

Table 4: Highest groundwater recorded

Monitoring Well	Shallowest depth to groundwater from surface (mbgl)	Surface level at bore (mAHD)	Groundwater level (mAHD)
1	1.04	22.32	21.28
2	0.19	24.07	23.88
3	0.25	21.45	21.2
4	0.38	21.83	21.45
5	0.5	22.75	22.25
6	0.18	21.97	21.79
7	0.49	21.55	21.06
8	0.13	23.51	23.38
9	0.63	23.42	22.79
10	1.33	23.15	21.82

Using the bore information as well as the collected data on ponding surface water (taken as reflecting groundwater rising to the surface), soaks and drainage features including the small rural drains, a groundwater contour plan was developed for the site.

From this plan, it can be seen that the groundwater is locally influenced by the landform features and soil types of the site.

There is a general trend of a decreasing groundwater contours from east to west, however the presence of the sand dunes and Gavin's Gully provide localised influences. The two main sand dune areas in the middle of the site and on the western boundary cause some minor mounding of groundwater, with the water then seeping out around the base. Gavin's Gully provides a localised draw down, as it is incised 1.5m+ into the surrounding ground, it also allows the other local rural drains to discharge any surface flow and rising groundwater into the drain.

In the southwest corner, due to the land sloping away to the south west, the groundwater contours are also drawn in a south west direction.

Bore 1 was located in dense clay. As such the surface water was only able to infiltrate at a very slow rate. While the surface of the land was waterlogged, this surface water continually flowed off the surface and into nearby rural drains, rather than infiltrating into the superficial groundwater layer. For the other more permeable clayey soils however, the rainfall was able to infiltrate and this led to shallow groundwater readings.

The groundwater contour plan can be seen in Figure L-002 and a depth map can be seen in Figure L-003 (Appendix A).

6 Recommendations & Conclusions

Following on from the key findings above, the below recommendations and conclusions can be made:

i. Given the above average and extended rainfall throughout 2021, and the presence of the large rural drain moving water away, the levels are considered to be effectively maximum groundwater levels for the site. Most of the bores on the clay soils or away from the higher sand dunes had water within 500mm of the surface. Once the groundwater came close to these levels, it was relatively stable over a very wet winter and spring. This suggests that the water moves off the site either via groundwater lateral flows or surface flows, halting any further rise.

ii. A future year of level monitoring is not likely to be needed due to the aspects outlined in point (i) above and has been confirmed by Department of Water and Environmental Regulation (DWER). DWER also stated that the Shire will need to confirm that the information is sufficient for the Site and Soil Evaluation, which is being undertaken as a separate exercise.

iii. The placement of clean, porous fill on top of the insitu heavier soils may create a new perched groundwater table. Management of groundwater levels, so as to protect future roads, buildings and other infrastructures will need to take this into account.

iv. Any controlling of the groundwater levels needs to take into account the direct discharge volume of water into the rural drainage network which is generally considered constrained by its ability to take any increased flows. If free draining subsoil systems are used, then the effect is likely to be minimal and unlikely to cause any issues to future peak stormwater flow rates.

v. Any lowering of the groundwater will need to consider the impact on mobilising nutrients within the soil profile and the effects this may have on downstream sensitive ecosystems.

vi. Any lowering of the groundwater will need to consider the potential for Acid Sulphate Soils and the appropriate remediation required.

vii. Future groundwater management will need to consider the fact that the site is within a Sewage Sensitive Area.

Appendix A Figures

N

W E

S

● 1 NEW GROUND WATER MONITORING BORE LOCATION

DIAL BEFORE YOU DIG www.1100.com.au

THE ORIGINAL OF THIS DRAWING WAS PRODUCED USING COLOUR SEPARATION FOR GREATER CLARITY. WORKING WITH A BLACK AND WHITE COPY MAY CAUSE ERRORS. IF THIS DRAWING IS NOT IN COLOUR THEN YOU DO NOT HAVE THE CORRECT PRESENTATION.

WARNING

SERVICES LOCATIONS SHOWN ARE INDICATIVE ONLY AND MUST NOT BE USED FOR EXCAVATIONS. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

WAPC REF: .

REV	DATE	ISSUE DESCRIPTION	DRAWN	DESIGN	CHECK
A	29/6/21	ISSUED FOR APPROVAL	KJB	BO	BO

STATUS: **ISSUED AS PRELIMINARY**

SCALE: 1:4000 (@ A1) 0 50m 100 150 200 250 300 350

CLIENT

DISCLAIMER
ALL DIMENSIONS TO BE CHECKED ON SITE BY CONTRACTOR PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE. NOT FOR CONSTRUCTION UNLESS STAMPED BY CERTIFYING AUTHORITY

Oversby Consulting

PROJECT: VENN ROAD, DARDANUP WA

DRAWING TITLE: MONITORING BORE LOCATIONS AND SITE CHARACTERISTICS

PROJECT No.	DRAWING No.	REVISION
B21026	L-001	A

N

W E

S

HAROLD DOUGLAS DRIVE

VENN ROAD

KILLARNEY ROAD

KEENAN ROAD

BOYANUP - PICTON ROAD

1
1.04m BGL
22.32m AHD

2
0.19m BGL
24.70m AHD

3
0.25m BGL
21.45m AHD

4
0.38m BGL
21.83m AHD

5
0.50m BGL
22.75m AHD

6
0.18m BGL
21.97m AHD

7
0.49m BGL
21.55m AHD

8
0.13m BGL
23.51m AHD

9
0.63m BGL
23.42m AHD

10
1.33m BGL
23.15m AHD

LEGEND

EXTENT OF SITE

1
NEW GROUND WATER MONITORING BORE LOCATION

0.18m BGL
21.97m AHD

24.0

24.0

DIAL BEFORE YOU DIG
www.1100.com.au

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WARNING

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WAPC REF: .

REV	DATE	ISSUE DESCRIPTION	DRAWN	DESIGN	CHECK
A	5/10/21	ISSUED FOR APPROVAL	KJB	BO	BO

STATUS

ISSUED AS PRELIMINARY

SCALE

0 20 40 60 80 100

SCALE 1:2500

CLIENT

DISCLAIMER
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Oversby Consulting

PROJECT

VENN ROAD, DARDANUP WA

DRAWING TITLE

GROUND WATER PLAN

PROJECT No.	DRAWING No.	REVISION
B21026	L-002	A

N

W E

S

HAROLD DOUGLAS DRIVE

VENN ROAD

KILLARNEY ROAD

KEENAN ROAD

BOYANUP - PICTON ROAD

1
1.04m BGL
22.32m AHD

2
0.19m BGL
24.70m AHD

3
0.25m BGL
21.45m AHD

4
0.38m BGL
21.83m AHD

5
0.50m BGL
22.75m AHD

6
0.18m BGL
21.97m AHD

7
0.49m BGL
21.55m AHD

8
0.13m BGL
23.51m AHD

9
0.63m BGL
23.42m AHD

10
1.33m BGL
23.15m AHD

LEGEND

EXTENT OF SITE

1
0.18m BGL
21.97m AHD
NEW GROUND WATER MONITORING BORE LOCATION

24.0
24.0

DEPTH TO NSL

-20	to	-0.2	m	
-0.2	to	0	m	
0	to	0.25	m	
0.25	to	0.5	m	
0.5	to	1.0	m	
1.0	to	1.5	m	
1.5	to	2.0	m	
2.0	to	2.5	m	
2.5	to	3.0	m	
3.0	to	3.5	m	
3.5	to	4.0	m	
4.0	to	4.5	m	
4.5	to	20	m	

DIAL BEFORE YOU DIG www.1100.com.au

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WARNING

SERVICES LOCATIONS SHOWN ARE INDICATIVE ONLY AND MUST NOT BE USED FOR EXCAVATIONS. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

WAPC REF: .

REV	DATE	ISSUE DESCRIPTION	DRAWN	DESIGN	CHECK
B	4/10/21	GWL DEPTHS ADDED	KJB	BO	BO
A	29/6/21	ISSUED FOR APPROVAL	KJB	BO	BO

STATUS
ISSUED AS PRELIMINARY

SCALE
0 20 40 60 80 100
SCALE 1:2500

CLIENT

DISCLAIMER
ALL DIMENSIONS TO BE CHECKED ON SITE BY CONTRACTOR PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE. NOT FOR CONSTRUCTION UNLESS STAMPED BY CERTIFYING AUTHORITY

Oversby Consulting

PROJECT
VENN ROAD, DARDANUP WA

DRAWING TITLE
GROUND WATER HEIGHT MAP PLAN

PROJECT No.	DRAWING No.	REVISION
B21026	L-003	B

Appendix B Monitoring details

Venn Road Groundwater Monitoring Field Data

Monitoring Event 28/06/2021

Monitoring Well	Depth To Water	Depth Of Well	Casing Stickup	Depth To Water	Bore area specific comments	Location	
	mmTOC	mmTOC	mm	mm bgL		Northings	Eastings
1	2760	4080	560	2200	Wet, spongy ground. No standing water. Minor water in drain 20m away. Loam 200mm then clay loams/clay	33.396746	115.745335
2	3420	4050	490	2930	Wet, spongy ground. No standing water nearby. Loam 200mm then clay loams/clay	33.398574	115.749214
3	1040	3900	550	490	Approx 100mm loose sediment at bottom of bore. Small puddling in roadside drain. Ground not spongy. Loamy sand to 0.5m. Heavier clay below.	33.396606	115.740729
4	2320	4080	530	1790	Ground not spongy. 5 square metre puddle of surface water 30m away. Clay approx 2m down.	33.398630	115.739831
5	2500	4080	600	1900	Ground not spongy. Drain nearby with no water. Minor amount of clay at 3m down, increasing with depth.	33.400213	115.742917
6	1450	4100	590	860	Ground not spongy. Clay/sand soil 2.5m down.	33.401200	115.739800
7	1900	4090	550	1350	Red clay 2.5m down. Ground not spongy. Nearby soak had water approx 1.2m below natural surface.	33.405393	115.740125
8	1150	4030	400	750	Ground not spongy. Minor clay at 3m down. Coffee rock at 2m down.	33.404192	115.743983
9	2120	4050	390	1730	Metal cap on casing up. Sand all the way.	33.402409	115.744479
10	2990	4040	430	2560	Metal cap on casing does not sit right. Sand all the way.	33.400473	115.745263

General Comments: 25mm of rain in preceeding 24 hours. No other rain in proceeding 4 days.

Monitoring Event 19/07/2021

Monitoring Well	Depth To Water	Depth Of Well	Casing Stickup	Depth To Water	Bore area specific comments
	mmTOC	mmTOC	mm	mm bgL	
1	1960		560	1400	Ground surface muddy, Nearby drain has small amount of water in it.
2	690		490	200	Surface ponding around bore
3	780		550	230	Ground Dry - Ponding approximately 50m away
4	880		530	350	Ground dry - no ponding nearby
5	1200		600	600	Ground dry - small ponding in dip near gat. No water in drain
6	830		590	240	Ground dry - no ponding nearby
7	1000		550	450	Ground dry - ponding approximetly 30m away. Nearby soak has water approximately 0.3m below natural surface.
8	520		400	120	Ground almost waterlogged - ponding 10m away
9	1440		390	1050	Ground dry
10	2210		430	1780	Ground dry

General Comments: 5mm of rain in preceeding 24 hours and 18mm in last 5 days. Approx 100mm more rainfall for year than average.

Monitoring Event 16/08/2021

Monitoring Well	Depth To Water	Depth Of Well	Casing Stickup	Depth To Water	Bore area specific comments
	mmTOC	mmTOC	mm	mm bgL	
1	1630		560	1070	Bore surrounded by heavy clay. No significant standing water.
2	720		490	230	Bore surrounded by a significant puddle of standing water. Spongy ground.
3	800		550	250	Heavy clay around bore. Large puddles of standing water 5-10m away.
4	940		530	410	Heavy clay around bore. Dry ground. Standing water approx 50m away.
5	1110		600	510	Clay with some loam around bore. Dry ground. Some standing water approx 30m away.
6	810		590	220	Clay with some loam. Dry ground.
7	1060		550	510	Clay and loam soil. Dry ground.
8	530		400	130	Ground mostly dry, some spongy areas. Mostly clay, some loam. Standing water approx 10m away.
9	1110		390	720	Dry ground. Sandy soil.
10	1760		430	1330	Dry ground. Sandy soil.

General Comments: Approximately 18mm of rain over the past week, with less than 1mm falling over the past three days.

Monitoring Event 30/08/2021

Monitoring Well	Depth To Water	Depth Of Well	Casing Stickup	Depth To Water	Bore area specific comments
	mmTOC	mmTOC	mm	mm bgL	
1	1600		560	1040	Surrounding ground relatively dry. No standing water. Long grass in the area of the bore.
2	720		490	230	Bore surrounded by squelchy, heavy clay.
3	910		550	360	Surrounding clay dry. Some standing water approx 10-15m away.
4	1020		530	490	Surrounding clay dry. No standing water.
5	1100		600	500	Surrounding clay dry. Standing water approx 10 and 30m away.
6	790		590	200	Surrounding clay/loam dry. No standing water.
7	1130		550	580	Surrounding loam dry. No standing water. Water in nearby soak approx 0.1m below natural ground.
8	540		400	140	Surrounding clay somewhat squelchy. Standing water approx 20m away.
9	1110		390	720	Surrounding sand dry. No standing water.
10	1860		430	1430	Surrounding sand dry. No standing water.

General Comments: Approx 9mm of rain falling over the past week, with around 5mm in the past three days.

Monitoring Event 20/09/2021

Monitoring Well	Depth To Water	Depth Of Well	Casing Stickup	Depth To Water	Bore area specific comments
	mmTOC	mmTOC	mm	mm bgL	
1	1600		560	1040	Relatively dry ground. Long grass around bore.
2	680		490	190	Bore surrounded by boggy ground.
3	800		550	250	Surrounding clay relatively dry. Standing water approx 10-15m away.
4	910		530	380	Surrounding clay dry. Waterlogged ground approx 40m away.
5	1100		600	500	Surrounding clay dry. Some boggy ground due to cows approx 10m away.
6	770		590	180	Dry ground.
7	1040		550	490	Dry loam.
8	530		400	130	Ground slightly squelchy. Standing water approx 10m away.
9	1020		390	630	Dry sand.
10	1760		430	1330	Dry sand.

General Comments: Approximately 40mm of rain falling in the past week, with around 8mm in the past three days. (30mm of rain on Thursday 16/09/2021)

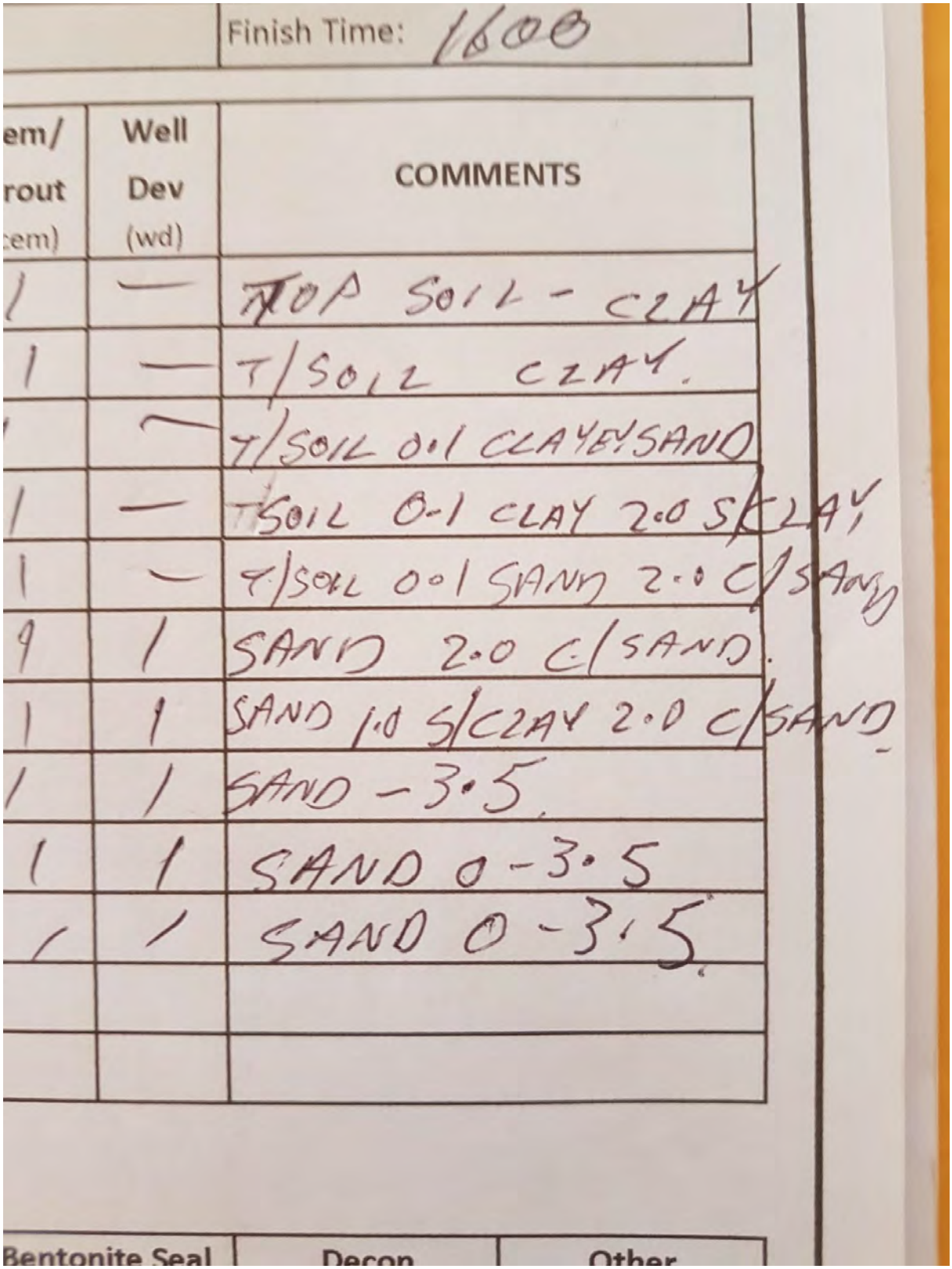
Monitoring Event 25/10/2021

Monitoring Well	Depth To Water	Depth Of Well	Casing Stickup	Depth To Water	Bore area specific comments
	mmTOC	mmTOC	mm	mm bgL	
1	1600		560	1040	Damp grass surrounding bore.
2	760		490	270	Damp ground around bore.
3	880		550	330	Damp ground. Standing water approx 10-15m away.
4	1240		530	710	Damp ground around bore.
5	1270		600	670	Damp ground around bore.
6	760		590	170	Damp ground around bore.
7	1280		550	730	Relatively dry ground.
8	570		400	170	Damp ground. Standing water approx 10-15m away.
9	1110		390	720	Dry sand around bore.
10	1970		430	1540	Damp sand around bore.

General Comments: Approximately 50mm of rain in the past week, with around 7mm in the past three days.

Bore Logs and Photos.

Note, bores details are in order from 1-10.



Finish Time: 1600

em/ rout (em)	Well Dev (wd)	COMMENTS
1	—	TOP SOIL - CLAY
1	—	T/SOIL CLAY.
1	—	T/SOIL 0-1 CLAYEY SAND
1	—	T/SOIL 0-1 CLAY 2.0 S/CLAY
1	—	T/SOIL 0-1 SAND 2.0 C/SAND
9	1	SAND 2.0 C/SAND.
1	1	SAND 1.0 S/CLAY 2.0 C/SAND
1	1	SAND - 3.5.
1	1	SAND 0-3.5
1	1	SAND 0-3.5.

Bentonite Seal | Decon | Other

Bore 5

Bore 4

Bore 3

Bore 2

Bore 1

Bore 10

Bore 9

Bore 8

Bore 7

Bore 6

Appendix C Department of Water and Environmental Regulation Advice

Contact Details

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