



29 Hercules Crescent
Albany WA 6330
98421575

Denmark Office: Unit 7, 40 South Coast Highway
Denmark WA 6333
98481309

Esperance Office: Unit 2A, 113 Dempster Street
Esperance WA 6450

enquiry@biodiversesolutions.com.au

ABN 46 643 954 929

Ref: MSC00429

1st April 2021

Department of Water and Environmental Regulation
Prime House
8 Davidson Terrace
Joondalup, WA 6027

Application to Clear Native Vegetation – Supporting Information

Lot 56 Diagram 61012, Big Grove WA

To whom it may concern,

Bio Diverse Solutions has been engaged by Jonathan Rowe (the applicant) to prepare a letter of support for a clearing permit application at Lot 56 Diagram 61012, Big Grove WA (here in referred to as the Subject Site). The client submitted a clearing permit application for the Subject Site which was received by the Department of Water and Environmental Regulation (DWER) on the 9th October 2020.

The preliminary assessment of the application by DWER identified a number of areas in which information available was insufficient for the requirements of the assessment. The DWER outlined additional information required to support the application in Schedule 1. Schedule 1 as outlined by the DWER is shown in Table 1.

Table 1: Schedule 1 - Additional Information (DWER)

Item	Information Requirements	Specifications	Rationale
1.	Further information detailing the chemistry of the soils to determine nutrient holding capacity and depth to the shallowest water table within the application area. Proposed nutrient management measures (phosphorus and nitrate application) are also required.	It is recommended that you contact the Department of Primary Industries and Regional Development (DPIRD) to identify appropriate methods that would enable you to undertake the proposed activities without causing land degradation. Please note that DWER will seek advice from the Commissioner of Soil and Land Conservation (the Commissioner) on the supplied information and/or proposed nutrient management measures.	A DPIRD site inspection of 11 December 2020 identified a high risk of eutrophication if fertilisers are used within the application area. This risk is likely to remain high if the area is cleared of vegetation. Given the above, the Commissioner advised that the proposed clearing is at variance with Clearing Principle (g).

This letter has been prepared to address the additional information requested by DWER and provide further support to the application by identifying site characteristics of the site, the clearing and land use proposal and subsequent risk of eutrophication and environmental impact.

1. Site Characteristics

A desktop assessment was conducted by Senior Hydrologist Chiquita Cramer to investigate the geological and hydrological conditions of the site to evaluate the potential impacts (in particular eutrophication) of the proposed clearing and land use on the surrounding environment. The Subject Site and the proposed clearing area are shown on Figure 1, attached.

Site Soils and Groundwater levels

Database searches using the NRInfo Portal (Department of Primary Industries and Regional Development, 2020) shows the Subject Site lies within the Mount Manypeaks System (242Mm) and is described as '*Granitic hills and headlands, on the southern edge of the Albany Sandplain Zone, with shallow gravel, bare rock grey shallow sandy duplex and sandy gravel. Low woodland, scrub heath and mosses and lichens on rocks.*'

Great Southern Geotechnics (GSG) conducted a geotechnical investigation on the 26th February 2021 at a proposed shed location within the Subject Site. GSG constructed three test pits to 1600mm depth, the approximate location of the three test pits is shown on Figure 1. Results of the investigation are documented in the Site Classification Report (Attachment 1), in summary the report showed that soils at the site consisted of (to slightly varying depths);

- Topsoil (sand with silt) (0-250mm depth) over;
- Sand with silt (250-700mm depth) over;
- Sand (700-1600mm depth)

No groundwater was encountered during the investigation to a depth of 1600mm at any of the three test pits.

In addition to the geotechnical investigation a private production bore was installed at the Subject Site on the 15th of March 2021 by Albany Irrigation and Drilling. As part of the bore installation a soil profile log was prepared, the soil log prepared by Albany Irrigation and Drilling has been included as Attachment 2. The soil profile at the location of the bore is shown in Table 2 and the approximate location of the bore is shown on Figure 1. The soil profile as logged by Albany Irrigation and Drilling is consistent with the soil logs prepared by GSG and the soil classification given by DPIRD.

Table 2: Soil profile of production bore (AID, 2021)

Depth (m)	Sample description and drilling comments
0-1	Top soil into brown medium sand
1-2	Brown medium sand into yellowish medium sand
2-3	Yellowish medium sand into lime sand medium
3-4	Lime sand medium into soft coffee rock
4-6	Soft coffee rock into shite gritty clay
6-8	White gritty clay into decomposed granite
8-17	Decomposed granite into hard granite

During bore installation the groundwater was found to be 6m below ground level, as shown in Attachment 2.

Surface Water

Surface water from the majority of the proposed clearing area drains in a north easterly direction towards Shoal Bay Retreat roadside drain. Shoal Bay Retreat roadside drain has been mapped by DWER as not connecting to any other waterway, roadside drainage network or Princess Royal Harbour as shown on Figure 1. This indicates that any surface water collected in the drain is likely to infiltrate, this conclusion is supported by the sandy flat nature of the area in which the drain is located.

The southern portion of the proposed clearing area has steeper slopes and drains in a northerly direction towards a low point on the site (where most surface water is likely to pond and infiltrate) before draining in a

north easterly direction towards the neighbouring property to the east and ultimately to Shoal Bay Retreat roadside drain. There is no seasonal creeks or drains entering/leaving the Subject Site nor evidence of scouring from available imagery that may suggest large volumes of surface water leaving the site via sheet flow. Surface water runoff from the site is likely to be very minimal (if at all) and limited to extremely high intensity rainfall events. Instead, it is anticipated rainfall runoff from the site is likely to be directed to low points throughout the site where it is expected to be lost via infiltration, evaporation and/or transpiration.

2. Proposed operations and nutrient management measures

The applicant is proposing to parkland clear 2.7ha of land within the 14ha Subject Site. Within the 2.7ha of proposed clearing area the applicant proposes to leave several areas of parkland clearing and estimates approximately 20% of the proposed clearing area will remain vegetated.

The applicant has selected the clearing area with environmental consideration. The proposed clearing area is surrounded by remnant vegetation to further protect the area from wind and water erosion and minimise surface water runoff from the site. The applicant has avoided clearing in more environmentally susceptible areas such as on the hill and steeper slopes in the south of the site and the lower lying areas closer to Princess Royal Harbour in the north.

The applicant proposes to use the site for rural residential purposes this includes the construction of a dwelling, a chicken pen containing 4-6 chickens, grazing of 2-5 sheep for grass and weed reduction, a vegetable patch and fruit trees. The applicant will not be using the site for any type of agricultural business and at no time does the applicant propose to raise large numbers of livestock (J Rowe 2021, pers. Comm., 12 March).

The applicant does not propose to use any chemicals or fertilisers on the Subject Site. They plan to grow their own food organically and plan to build garden beds and soil nutrient density with regenerative principles (keeping soil covered with ground covers; minimising soil disturbance, including 'no dig' beds; ensuring pasture diversity and rotation; and integrating sheep and chickens to the land on rotation).

3. Discussion and Conclusion

The Subject Site and associated clearing/land use proposal whilst in close proximity to an Environmentally Sensitive Area (ESA) being Princess Royal Harbour poses minimal risk of eutrophication and environmental impact to the harbour and surrounding area for the following reasons;

- The applicant proposes to clear only 19% of the Subject Site of which approximately 20% (of the 19%) will remain vegetated (patches of trees and parkland clearing).
- The location of the clearing area has been selected with thought and consideration to the surrounding environment avoiding areas that have a higher risk of eutrophication and environmental degradation.
- The operations proposed by the applicant is of a rural residential and self-sustaining nature. No chemicals or fertilisers will be used on site and livestock numbers will be consistent with that of a rural residential nature (2-5) rather than an agricultural property.
- Soils on the site generally consist of sands/silty sands over coffee rock over clay. The sand profile (0-4m) allows for adequate infiltration and prevents surface water runoff from the site avoiding potential transportation of nutrients. The silts, deeper coffee rock and clay layers are generally associated with a high phosphorus retention index and therefore an increased ability to uptake any nutrients that may have percolated through from the surface.
- The groundwater was found to be 6 metres below ground level in the central portion of the site and of the proposed clearing area, based on this it is estimated that at least 2m of separation to maximum groundwater level is achieved across the majority of the proposed clearing area, further reducing potential transportation of nutrients via groundwater through flow.

-
- There is no evidence of reoccurring/seasonal surface water runoff from the site. It is likely that the majority of surface water runoff is contained onsite where it is lost via infiltration, evaporation and transportation. Any potential surface water runoff from the site will be directed towards Shoal Bay Retreat roadside drain via the neighbouring property allowing for further infiltration/evaporation/transportation opportunities. Shoal Bay Retreat does not appear to discharge directly to Princess Royal Harbour.

If you have any queries regarding the information presented in this letter please feel free to contact me via email or phone on 9842 1575.

Kind regards,



Chiquita Cramer
Senior Hydrologist
Bio Diverse Solutions
chiquita@biodiversesolutions.com.au

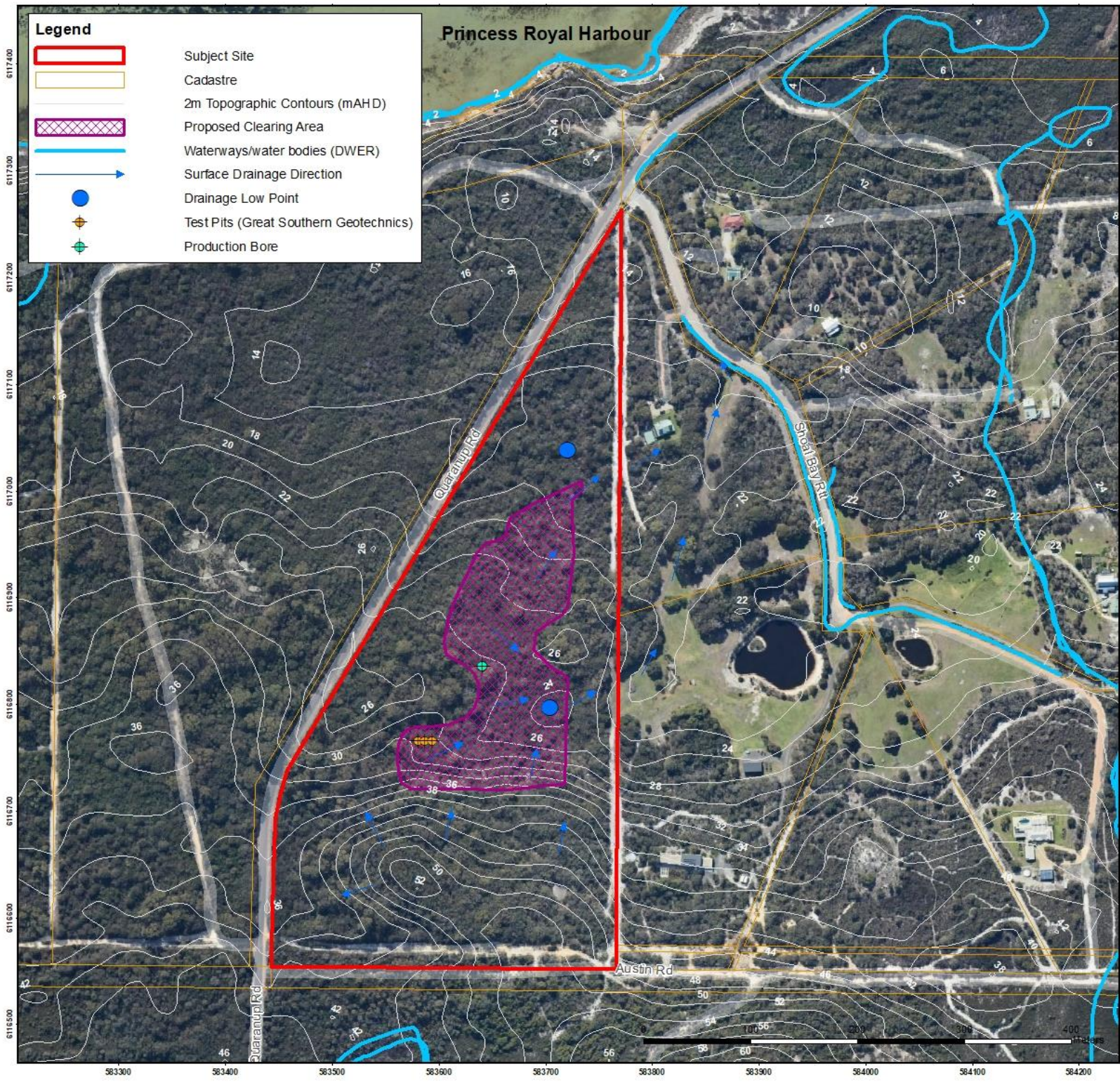
c/o Jonathan Rowe

References

Albany Irrigation and Drilling (2021) *Drillers Field Log*. Prepared for Jonathan Rowe 15th March 2021.
Department of Primary Industries and Regional Development (2021) *NRInfo Portal* (accessed March 2021).
Great Southern Geotechnics (2021) *Site Classification Report – Lot 56 Quaranup Road, Big Grove WA 6330*. Prepared for Jonathan Rowe.
Albany Irrigation and Drilling (2021) *Drillers Field Log*. Prepared for Jonathan Rowe 15th March 2021.
Jonathan Rowe (2021) Personal communication on the 12th March 2021.

Attachments

Attachment 1 - Site Classification Report – Lot 56 Quaranup Road, Big Grove WA 6330 (Great Southern Geotechnics, 2021)
Attachment 2 - Drillers Field Log (Albany Irrigation and Drilling, 2021)



Albany Office: 29 Hercules Crescent
Albany, WA 6330
(08) 9842 1575

Denmark Office: 7/40 South Coast Highway
Denmark, WA 6333
(08) 9846 1399

Esperance Office: 24/113 Dempster Street
Esperance, WA 6450



Scale
1:3,500 @ A3
GDA MGA 94 Zone 50

Data Sources
Aerial Imagery: WA Now, Landgate Subscription Imagery
Cadastre, Relief Contours and Roads: Landgate 2017
IRIS Road Network: Main Roads Western Australia 2017
Overview Map: World Topographic map service, ESRI 2012

CLIENT Jonathan Rowe
Autobarn Mechanical and Electrical Services
Level 1/35 Capital Road
Malaga WA 6090

Figure 1: Site Assessment

BAL Assessor CC	Q4 Check GM	Drawn by CC
STATUS FINAL	FILE MSC0429	DATE 23/03/2021



Attachment 1

Site Classification Report – Lot 56 Quaranup Road, Big Grove WA 6330 (Great Southern Geotechnics, 2021)



Site Classification Report

Jonathon Rowe

Lot 56 Quaranup Road, Big Grove WA 6330

Thursday, 4 March 2021

Presented By: M.Coffey

Great Southern Geotechnics Pty Ltd

5a 209 Chester Pass Rd, Albany WA

1.0 INTRODUCTION

As authorised by **Jonathon Rowe**
a site classification for the proposed building envelope at **Lot 56 Quaranup Road, Big Grove WA 6330**
was performed on the **26/02/2021**

2.0 GENERAL

This site investigation was carried out to determine the:

- Surface site conditions
- Subsurface soil profile
- Subsurface soil characteristics/parameters

This information is gathered to establish the swell/shrink characteristics of the underlying soils due to soil moisture changes under normal climatic conditions, and the probable amount of surface movement that may occur.

To allow for the determination of the site classification, the scope included:

- Observations of site conditions that may impact on the site classification,
- Sufficient test pits drilled and sampled to an appropriate depth, and
- Laboratory testing of samples.

3.0 SITE INVESTIGATION

Site conditions and test pit locations were recorded and are shown in Appendix 1 .

The field investigation consisted of **3** boreholes excavated on-site to depths of up to **1.6** m using a hand held auger.

These test holes were located across the proposed building envelope.

All soil layers encountered were visually assessed and classified on-site.

IMPORTANT NOTE: We have endeavoured to locate the test holes so that they are representative of the subsurface materials across the intended building site. However, soil conditions may change dramatically over short distances and our investigations may not locate all soil variations across the site.

4.0 LABORATORY TESTING

Results of any relevant laboratory testing performed are shown in **Appendix 2.** (Test Results)

5.0 SITE CLASSIFICATION

In accordance with Australian Standard 2870 (2011) Residential slabs and footings, the area shown on the accompanying site plan of [Lot 56 Quaranup Road, Big Grove WA 6330](#) is classified as class **A**

A Class: The Characteristic Surface Movement (Ys) that the site may experience due to variations in subsurface moisture conditions during normal climatic changes was calculated to be 0mm - (refer to AS2870 – Section 2). This Ys value indicates that the underlying soil profile has little to no potential to swell/shrink under normal climatic changes. This swelling &/or shrinking of the soils, particularly clay soils, is attributed to the absorption &/or loss of moisture.

The site classification was determined by visual assessment of relevant site conditions, analysis of the soil profiles revealed by the Test Pit logs, and laboratory testing of samples taken from the boreholes.

Comments. The building envelope should be stripped of all vegetation and topsoil, with any areas of soft, loose or wet material selectively excavated to provide a firm, working base.

All test pit profiles noted are recorded from existing ground levels as on the day of investigation and any removal or addition of imported material will alter the results found. The Site classification is valid only in the state of which the investigation was conducted on the day.

This report and associated documentation was undertaken for the specific purpose described in the report and shall not be relied on for other purposes. This report was prepared solely for the use by **Jonathon Rowe** and any reliance assumed by other parties on this report shall be at such parties own risk.

6.0 EXPLANATION

Clay-based soils have the potential to change volume and shift when a change in moisture occurs. These types of materials are called 'reactive soils' with the amount that the soil is likely to shift defining how 'reactive' it's considered to be.

Some soils have a greater potential to change volume than others, and this amount of potential needs to be measured to ensure footings are designed in a way that helps protect structures from any soil surface movement.

Site Class	Foundation	Characteristic Surface Movement
A	Most sand and rock sites with little or no ground movement from moisture changes.	
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes.	0mm to 20mm
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes.	20mm to 40mm
H₁	Highly reactive clay sites, which may experience high ground movement from moisture changes.	40mm to 60mm
H₂	Highly reactive clay sites, which may experience very high ground movement from moisture changes.	60mm to 75mm
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes.	> 75mm
P	Sites which include filled sites, soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.	



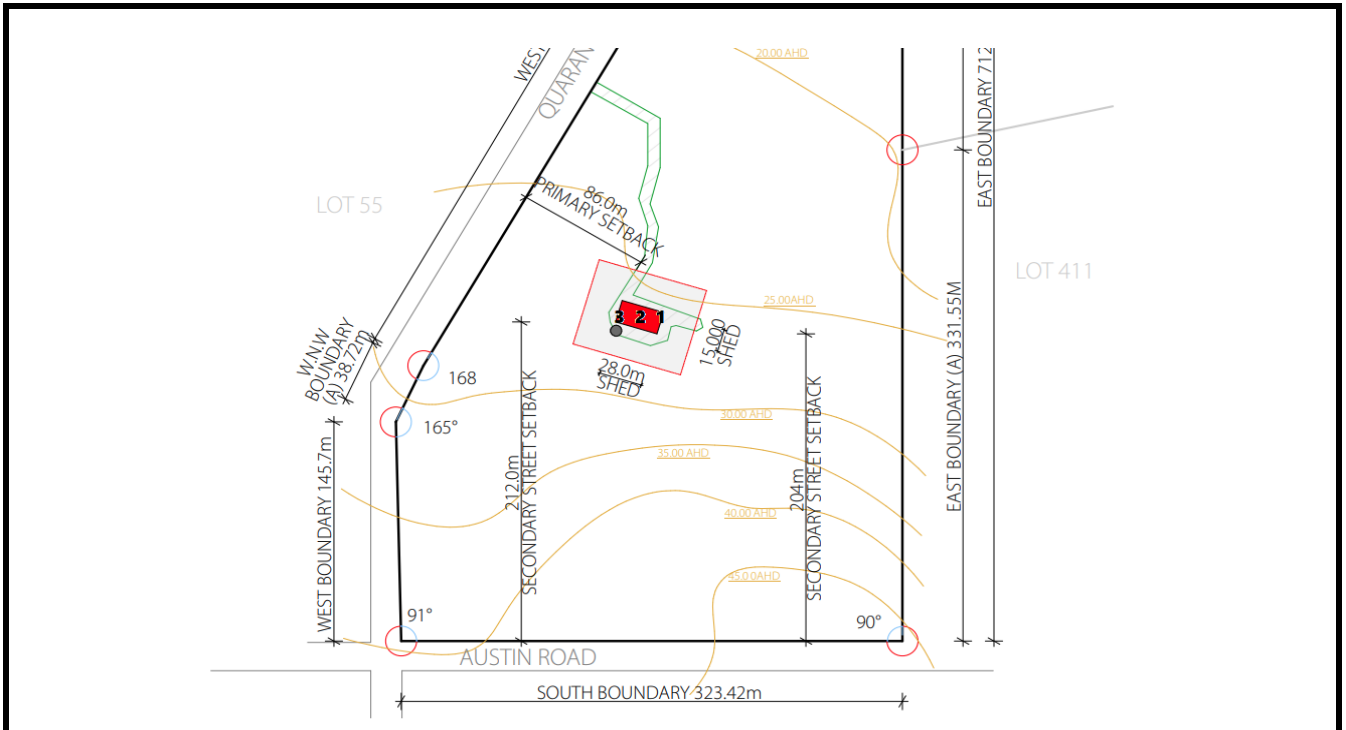
Appendix 1


Test Pit Logs

Figure 1 - Lot 56 Quaranup Road, Big Grove WA 6330



Figure 2 - Approximate Test Pit Locations



 GREAT SOUTHERN GEOTECHNICS CONSTRUCTION MATERIALS TESTING	Job No: 4013
	Client: Jonathon Rowe
	Project: Lot 56 Quaranup Road, Big Grove WA 6330

	Job No 4013	Report 4013/1	Sheet 7 of 12
---	--------------------	----------------------	----------------------

Client: Jonathon Rowe Project: Lot 56 Quararup Road, Big Grove WA 6330 Project No.: - Location: Proposed Building Envelope Test Pit No.: TP1 Sample No. 4013G1	Operator/Contractor: GSG Equipment type: Hand Held Auger Excavation Method : 100mm Auger Position: See site plan Elevation: n/a
--	---

Date Commenced: 26/02/2021	Logged By: J.Kernutt	Excavation Dimensions: Depth 1.6 (m) Width 0.3 (m)
----------------------------	----------------------	---

Depth Below Surface (mm)	Layer Depth (mm)	Material Description	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sampler/Test
		SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components						
0 - 250	250	(Topsoil) SAND with silt: Grey, fine to medium. Roots and root fibres.	D-M	L-M		No water table encountered.		
250 - 700	450	SAND with silt: White, fine to medium.	M	L-M				
700 - 1100	400	SAND: Brown, fine to medium.	M	L-M				
1100 - 1500	400	SAND: Yellow/cream, fine to medium.	M	L-M				
1500 - 1600	100	SAND: Light brown, fine to medium.	M	L-M				

Comments	Pit Terminated at: (mm) below ground level ✓ or *
	Target Depth <input checked="" type="checkbox"/> 1600 Cave In <input type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> Lack of Reach <input type="checkbox"/>

Materials Consistency/Strength		Rock	Cementation	Water
Cohesive VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard	Non-Cohesive VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense CO - Compact	EL - Extremely Low VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High	IN - Indurated PC - Poorly Cemented MC - Moderately Cemented WC - Well Cemented	Water first Encountered Moisture D - Dry M - Moist W - Wet General N/A - Not Applicable N/D - Not Determined

Test Pit No. 1 - Excavation



Test Pit No. 1 - Spoil



	Job No 4013	Report 4013/1	Sheet 9 of 12
---	--------------------	----------------------	----------------------

Client: Jonathon Rowe Project: Lot 56 Quararup Road, Big Grove WA 6330 Project No.: - Location: Proposed Building Envelope Test Pit No.: TP2 Sample No. 4013G2	Operator/Contractor: GSG Equipment type: Hand Held Auger Excavation Method : 100mm Auger Position: See site plan Elevation: n/a
--	---

Date Commenced: 26/02/2021	Logged By: J.Kernutt	Excavation Dimensions: Depth 1.6 (m) Width 0.3 (m)
----------------------------	----------------------	---

Depth Below Surface (mm)	Layer Depth (mm)	Material Description	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sampler/Test
		SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components						
0 - 400	400	(Topsoil) SAND with silt: Grey, fine to medium. Roots and root fibres.	M	L-M		No water table encountered.		
400 - 600	200	SAND with silt: Grey, fine to medium.	M	L-M				
600 - 1100	500	SAND: White, fine to medium.	M	L-M				
1100 - 1500	400	SAND: Brown, fine to medium.	M	L-M				
1500 - 1600	100	SAND: Yellow/cream, fine to medium.	M	L-M				

Comments	Pit Terminated at: (mm) below ground level ✓ or *
	Target Depth <input checked="" type="checkbox"/> 1600 Cave In <input type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> Lack of Reach <input type="checkbox"/>

Materials Consistency/Strength		Rock	Cementation	Water
Cohesive VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard	Non-Cohesive VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense CO - Compact	EL - Extremely Low VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High	IN - Indurated PC - Poorly Cemented MC - Moderately Cemented WC - Well Cemented	Water first Encountered Moisture D - Dry M - Moist W - Wet General N/A - Not Applicable N/D - Not Determined

Test Pit No. 2 - Excavation



Test Pit No. 2 - Spoil



	Job No 4013	Report 4013/1	Sheet 11 of 12
---	--------------------	----------------------	-----------------------

Client: Jonathon Rowe Project: Lot 56 Quaranup Road, Big Grove WA 6330 Project No.: - Location: Proposed Building Envelope Test Pit No.: TP3 Sample No. 4013G3	Operator/Contractor: GSG Equipment type: Hand Held Auger Excavation Method : 100mm Auger Position: See site plan Elevation: n/a
--	---

Date Commenced: 26/02/2021	Logged By: J.Kernutt	Excavation Dimensions: Depth 1.6 (m) Width 0.3 (m)
----------------------------	----------------------	---

Depth Below Surface (mm)	Layer Depth (mm)	Material Description	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
		SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components						
0 - 300	300	(Topsoil) SAND with silt: Grey, fine to medium. Roots and root fibres.	M	L-M		No water table encountered.		
300 - 800	500	SAND: White, fine to medium.	M	L-M				
800 - 1300	500	SAND: Brown: fine to medium.	M	L-M				
1300 - 1600	300	SAND: Yellow/cream, fine to medium.	M	L-M				

Comments	Pit Terminated at: (mm) below ground level ✓ or *
	Target Depth <input checked="" type="checkbox"/> 1600 Cave In <input type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> Lack of Reach <input type="checkbox"/>

Materials Consistency/Strength		Rock	Cementation	Water		
Cohesive VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard	Non-Cohesive VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense CO - Compact	EL - Extremely Low VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High	IN - Indurated PC - Poorly Cemented MC - Moderately Cemented WC - Well Cemented	Water first Encountered		
				Moisture D - Dry M - Moist W - Wet		
				General N/A - Not Applicable N/D - Not Determined		



Test Pit No. 3 - Excavation



Test Pit No. 3 - Spoil







COLOURS

	BLACK - BROWN (bk)		BLUE (bl)		ORANGE (or)
	BROWN (br)		BLUE - GREEN (bl/gr)		RED (rd)
	GREY - BROWN (gy/br)		GREEN (gr)		RED - BROWN (rd/br)
	GREY (gy)		YELLOW (yl)		PINK (pk)
	BLUE - GREY (bl/gy)		YELLOW - BROWN (yl/br)		PURPLE (pr)

MOISTURE CONDITION OF SOIL

TERM	DESCRIPTION
Dry	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running.
Moist	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when handling. Granular soils tend to cohere and free water forms on hands when handling.

PARTICLE SHAPES

ANGULAR	SUB-ANGULAR	SUB-ROUNDED	ROUNDED
			

PARTICLE SIZES

BOULDERS	COBBLES	COARSE GRAVEL	MEDIUM GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
>200mm	63-200mm	20-63mm	6-20mm	2.36-6mm	0.6-2.36mm	0.2-0.6mm	0.075-0.2mm	0.002-0.075mm	<0.002mm

GRAIN SIZE

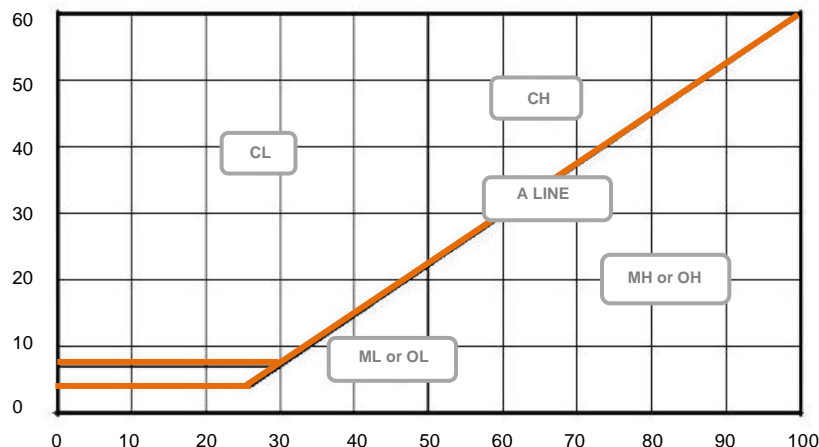
SOIL TYPE (ABBREV.)	CLAY (CL)	SILT (SI)	SAND (SA)			GRAVEL (GR)		COBBLES (CO)	
SIZE	< 2µm	2-75µm	Fine 0.075-0.2mm	Medium 0.2-0.6mm	Coarse 0.6-2.36mm	Fine 2.36-6mm	Medium 6-20mm	Coarse 20-63mm	63-200mm
SHAPE & TEXTURE	Shiny	Dull	angular or sub angular or sub rounded or rounded						
FIELD GUIDE	Not visible under 10x	Visible under 10x	Visible by eye	Visible at < 1m	Visible at < 3m	Visible at < 5m	Road gravel	Rail ballast	Beaching

CLASSIFICATION CHART

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60mm and basing fractions on estimated mass)				GROUP SYMBOLS	TYPICAL NAMES	
COARSE GRAINED SOILS More than 50% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than 50% of coarse fraction is larger than 2.36mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	GW	Well graded gravels, gravel-sand mixtures, little or no fines	
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	GP	Poorly Graded gravels and gravel-sand mixtures, little or no fines, uniform gravels	
		GRAVELS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	GM	Silty gravels, gravel-sand-silt mixtures	
			'Dirty' materials with excess of plastic fines, medium to high dry strength	GC	Clayey gravels, gravel-sand-clay mixtures	
	SANDS More than 50% of coarse fraction is smaller than 2.36mm	CLEAN SANDS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	SW	Well graded sands, gravelly sands, little or no fines	
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands	
		SANDS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	SM	Silty sands, sand-silt mixtures	
			'Dirty' materials with excess of plastic fines, medium to high dry strength	SC	Clayey sands, sand-clay mixtures	
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2mm					
	SILTS AND CLAYS Liquid limit less than 50	DRY STRENGTH	DILATANCY	TOUGHNESS		
		None to low	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with low plasticity. Silts of low to medium Liquid Limit.
		Medium to high	None to very slow	Medium	CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
	SILTS AND CLAYS Liquid limit greater than 50	Low to medium	Slow	Low	OL	Organic silts and organic silt-clays of low to medium plasticity.
		Low to medium	Slow to none	Low to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, silts of high Liquid Limit.
		High to very high	None	High	CH	Inorganic clays of high plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Medium to high	None to very slow	Low to medium	OH	Organic clays of high plasticity
		HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel and frequently by fibrous texture	Pt

PLASTICITY CHART

For laboratory classification of fine grained soils



PLASTICITY

DESCRIPTIVE TERM	OF LOW PLASTICITY	OF MEDIUM PLASTICITY	OF HIGH PLASTICITY
Range Of Liquid Limit (%)	≤ 35	> 35 ≤ 50	> 50

DESCRIPTION OF ORGANIC OR ARTIFICIAL MATERIALS

PREFERRED TERMS	SECONDARY DESCRIPTION
Organic Matter	Fibrous Peat/ Charcoal/ Wood Fragments/ Roots (greater than approximately 2mm diameter)/ Root Fibres (less than approximately 2mm diameter)
Waste Fill	Domestic Refuse/ Oil/ Bitumen/ Brickbats/ Concrete Rubble/ Fibrous Plaster/ Wood Pieces/ Wood Shavings/ Sawdust/ Iron Filings/ Drums/ Steel Bars/ Steel Scrap/ Bottles/ Broken Glass/ Leather

CONSISTENCY – Cohesive soils

TERM	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
Symbol	VS	S	F	St	VSt	H
Undrained Shear Strength (kPa)	< 12	12 – 25	25 – 50	50 – 100	100 – 200	> 200
SPT (N) Blowcount	0 – 2	2 – 4	4 – 8	8 – 15	15 – 30	> 30
Field Guide	Exudes between the fingers when squeezed	Can be moulded by light finger pressure	Can be moulded by strong finger pressure	Cannot be moulded by fingers. Can be indented by thumb nail	Can be indented by thumb nail	Can be indented with difficulty with thumb nail

CONSISTENCY – Non-cohesive soils

TERM	VERY LOOSE	LOOSE	MEDIUM DENSE	DENSE	VERY DENSE	COMPACT
Symbol	VL	L	MD	D	VD	CO
SPT (N) Blowcount	0 – 4	4 – 10	10 – 30	30 – 50	50 – 100	> 50/150 mm
Density Index (%)	< 15	15 – 35	35 – 65	65 – 85	85 – 95	> 95
Field Guide	Ravels	Shovels easily	Shovelling very difficult	Pick required	Pick difficult	Cannot be picked

MINOR COMPONENTS

TERM	TRACE	WITH
% Minor Component	Coarse grained soils: < 5% Fine grained soils: <15%	Coarse grained soils: 5 – 12% Fine grained soils: 15 – 30%
Field Guide	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary components	Presence easily detectable by feel or eye, soil properties little different to general properties of primary component

GEOLOGICAL ORIGIN

	TYPE	DETAILS
TRANSPORTED SOILS	Aeolian Soils	Deposited by wind
	Alluvial Soils	Deposited by streams and rivers
	Colluvial Soils	Deposited on slopes
	Lacustrine Soils	Deposited by lakes
	Marine Soils	Deposited in ocean, bays, beaches and estuaries
FILL MATERIALS	Soil Fill	Describe soil type, UCS symbol and add 'FILL'
	Rock Fill	Rock type, degree of weathering, and word 'FILL'.
	Domestic Fill	Percent soil or rock, whether pretrucible or not.
	Industrial Fill	Percent soil, whether contaminated, particle size & type of waste product, ie brick, concrete, metal

STRENGTH OF ROCK MATERIAL

TERM	SYMBOL	IS (50)	(MPA)	FIELD GUIDE TO STRENGTH
Extremely Low	EL	≤0.03		Easily remoulded by hand to a material with soil properties.
Very Low	VL	>0.03	≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxle sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low	L	>0.1	≤0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3	≤1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	H	>1	≤3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	>3	≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High	EH	>10		Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK MATERIAL WEATHERING CLASSIFICATION

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water.
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. Rock may be highly discoloured, usually be iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.



Attachment 2

**Driller's Log – Lot 56 Quaranup Road, Big Grove WA 6330 (Albany Irrigation and
Drilling, 2021)**

