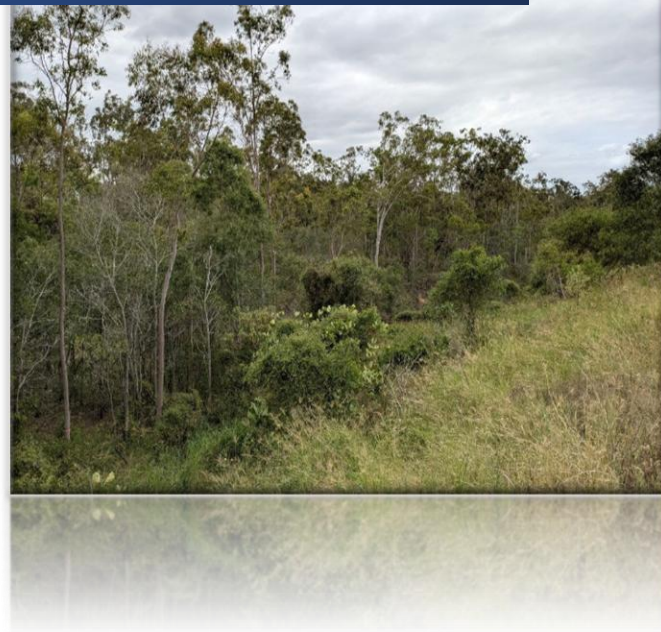




Gallagher Environmental

Dispersive Soil Management Plan (DSMP): 'Tranche 1A' Development, Undullah



Client: Charlie Resolved Pty Ltd

Report No: GE25.019.R1b

Date: 28th April 2025



DOCUMENT CONTROL

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	Client:	Charlie Resolved Pty Ltd
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REVISION & CHECKING HISTORY

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APPENDIX A: BORELOGS

APPENDIX B: LABORATORY RESULTS

1. INTRODUCTION

1.1 DSMP Overview

Gallagher Environmental (GE) was commissioned by Charlie Resolved Pty Ltd to prepare a Dispersive Soil Management Plan (DSMP) for the proposed 'Tranche 1A' residential subdivision located at Undullah.

The purpose of the assessment is to define the overall soil dispersion risk of the site soils and to provide appropriate management principles in order to ensure that proposed earthworks do not cause land degradation, and to mitigate effects on the built environment from soil dispersion as a consequence of soil disturbance.

The report is divided into sections describing: the physical characteristics of the site; a review of detailed laboratory results, an assessment of the soil dispersion potential, and where required, subsequent management strategies for the construction phase of the development.

1.2 Scope of Study

The scope of the study included:

- The review of logging, sampling and laboratory analysis of samples recovered from ten (10) boreholes for the purposes of soil dispersion hazard testing;
- A review of the proposed development area by qualified GE staff; and
- The detailed interpretation and analysis of the data obtained and comment on relevant recommendations.

Furthermore, the investigation, field and laboratory testing and interpretation were carried out in general accordance with the following documents and standards:

- 'Implementation Guideline No. 28 Dispersive Soils Management' (ICC, 2016);
- Best Practice Erosion & Sediment Control - Books 1, 2 & 3 (IECA, 2018);
- Australian Soil & Land Survey Field Handbook (McDonald et. al., 1998);
- AS1289 Testing of Soils for Engineering Purposes; and
- Australian Soil Classification (Isbell, 2022).

1.3 Objectives

The specific objectives of the assessment were as follows:

- To undertake field survey and establish the soil types and characteristics within the investigation area;
- To define the overall soil dispersion hazard of the site soils using desktop, field and laboratory analysis; and
- To provide specific strategies for the management of dispersive soils during the construction phase of the development and for inclusion with bulk earthwork/engineering and ESC plans, where required.

1.4 DSMP Amendments

The DSMP is a flexible document that shall be modified in the event that site conditions change significantly from those considered within the DSMP and as site knowledge and site construction and engineering experience allows.

In the event that a monitoring program detects a notable failure to achieve the required DSMP objectives, the source of the failure shall be appropriately investigated, including engagement of a suitably-qualified professional (e.g. CPESC; RPEQ) where required, and the DSMP suitably modified to ensure incidents do not recur.

2. METHODOLOGY

As part of a broader geotechnical investigation by others, a total of ten (10) boreholes were drilled within the site area using solid flight auger in February 2025. Sampling was undertaken within each major soil horizon (i.e. texture change) encountered and bore logging undertaken in accordance with 'AS 1726 Geotechnical Site Investigations'. The site plan detailing the borehole locations is provided in Drawing No. GE25.019.D1.

Laboratory analysis was subsequently undertaken on representative samples in order to define soil dispersion potential and soil electro-chemistry in accordance with the following Australian Standards:

- Emerson Class Number in accordance with AS1289 3.8.1;
- pH value in accordance with AS1289 4.3.1; and
- Electrical Conductivity (1:5 soil to water suspension).

The overall soil testing regime is shown in Table 2.1 below:

Table 2.1 Soil Testing Regime

Testing Regime	Number of tests
Soil Profile Assessment	10 profiles
Emerson Class	18
Soil pH	18
Soil Electrical Conductivity (EC)	18
Exchangeable Sodium Percentage (ESP)	5
Agronomic Parameters	1

Qualified GE staff undertook Emerson Class, pH and Electrical Conductivity testing on representative samples.

On the basis of these results, a total of five (5) samples were dispatched to ALS Laboratories, Stafford, Brisbane for additional chemical analysis, including ESP and agronomic parameters. The laboratory certificates are contained in Appendix B.

3. SITE DESCRIPTION & PHYSICAL CHARACTERISTICS

3.1 General Overview

The site is currently undeveloped rural land with existing residential development located to the east. The proposed development disturbance area is approximately 55ha and shall feature extensive cut to fill bulk earthworks, the construction of an internal road network, the installation of services (e.g. stormwater; sewer; water) and three (3) dedicated stormwater management areas (e.g. bio-retention/detention basins).

3.2 Slopes & Drainage

In accordance with the *'Australian Soil & Land Survey Field Handbook (1998)'*, the site contains a gently to moderately inclined topography with the majority of slopes ranging between 3 - 15% across the development area and an estimated mean slope of approximately 8%. The majority of the site drains towards the northwest/west boundary. Areas along the eastern boundary that currently drain eastward shall be filled and graded towards the west.

3.3 Geology

Based on the Department of Mines 1:100,000 geological series maps, the site contains a uniform geology, detailed below (refer Plate 1):

- 'Gatton Sandstone' unit, comprising 'lithic and feldspathic labile sandstone' dating to the Jurassic Period.

Plate 1: Regional Geology



3.4 Site Inspection

A site inspection was undertaken by GE staff to examine the site soils and investigate areas of active erosion or evidence of dispersive soils along the eastern boundary. The site inspection revealed that the development area is predominantly characterized by a stable, non-eroded land surface with intact (non-dispersive) topsoil cover and moderate grass/vegetative surface cover.

An inspection of the eastern gully area provided a good opportunity to examine exposed subsoil behaviour. The ephemeral gully revealed extensive erosion and soil dispersive features, including undercutting, 'dribble pattern' and 'pitting/pocketing' (refer Plate 1).

Plate 1: Eastern (ephemeral) Gully Area – dispersive soil characteristics



3.5 Soil Profiles

For reference purposes, the *general* soil dispersion risk of the various soil orders contained within the Australian Soil Classification (ASC, 2016) is shown in Table 3.1 below.

Table 3.1 General Soil Dispersion Risk of ASC Soil Orders

ASC Soil Order	Soil Horizon	General Soil Dispersion Risk
Sodosol	A (topsoil)	Low
	B (subsoil)	Very High
Dermosol	A (topsoil)	Low
	B (subsoil)	Moderate
Hydrosol	A (topsoil)	Low - Moderate
	B (subsoil)	Moderate
Vertosol (sedimentary/alluvial)	A (topsoil)	Moderate
	B (subsoil)	Moderate - High
Vertosol (basalt)	A (topsoil)	Very Low
	B (subsoil)	Low
Kurosol	A (topsoil)	Very Low
	B (subsoil)	Low - Moderate
Chromosol	A (topsoil)	Very Low
	B (subsoil)	Low - Moderate
Kandosol / Tenosol / Rudosol / Podosol	A (topsoil)	Very Low
	B (subsoil)	Low

Based on the field and laboratory assessment, it is considered that the site contains Sodosols, Kurosols and Leptic Tenosols in accordance with the Australian Soil Classification (ASC, 2016).

A description of the characteristics of the soils identified on-site are given below and borelogs are included in Appendix A.

3.5.1 Sodosols grading to Kurosols

Sodosols are soils that also exhibit a clear or abrupt textural B horizon, however they exhibit a B2 horizon that is both sodic and not strongly acidic. Kurosols are soils that exhibit a clear or abrupt textural B horizon and exhibit a B2 horizon that is strongly acidic. The investigated Kurosols also revealed soil sodicity.

These soils were associated with boreholes BH1, BH3, STP2, STP5, BTP2, BTP5 and BTP8 and were generally characterised by a sandy loam A1 horizon overlying a light to medium clay B2 horizon.

3.5.2 Paralithic Leptic Tenosols

Tenosols are a diverse range of soils with minimal B horizon development. Paralithic Leptic Tenosols are underlain by weathered rock within 0.5m of the surface. These soils were associated with boreholes BH5, BH6 and BH7. The investigated Tenosols also revealed soil sodicity and grade towards Sodosols/Kurosols with increasing soil depth.

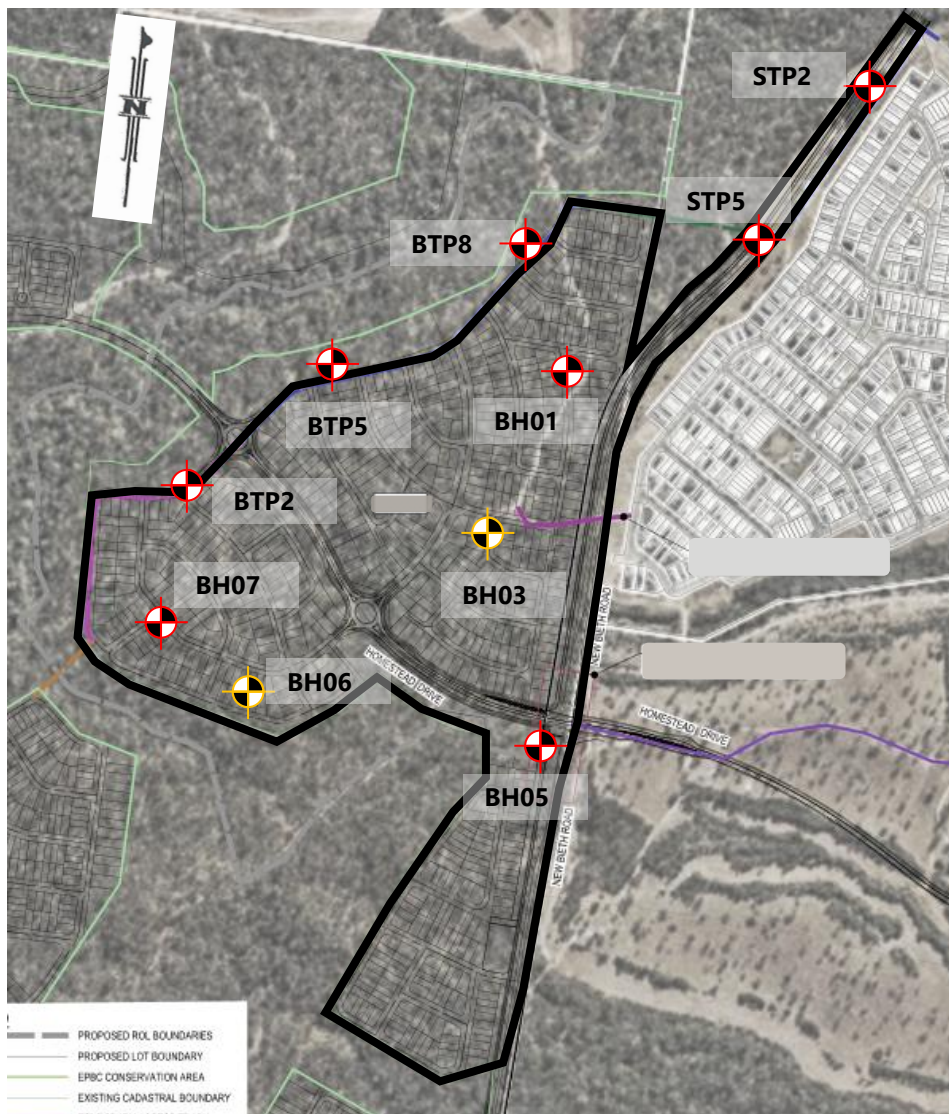
These soils were generally characterised by a sandy loam A1 horizon overlying a sandy clay loam B1/B2 horizon, underlain by very shallow sandstone rock.

4. LABORATORY RESULTS

Laboratory results undertaken in order to define soil dispersion potential are shown in the following table and discussed in the following sections. The laboratory certificates are attached in Appendix B. The site plan detailing borehole locations and pertinent laboratory results is provided in Drawing No. GE25.019.D1.

Table 4.1 Dispersion Hazard Test Results

Soil Type	Sample #	Emerson Class	pH	ECe (dS/m)	ESP (%)	Interpretation
A Horizon (topsoil)	STP5: 0.0m	7	6.2	1.0		
	BH01: 0.0m	7	5.5	0.4	2.4	Moderately Acidic pH
	BH03: 0.0m	7	5.7	0.7		Non-saline
	BH05: 0.0m	7	5.8	0.8		Non-Sodic
	BH06: 0.0m	7	5.6	0.8		Emerson Class: – Very Low Risk
	BTP2: 0.0m	7	5.7	0.6		
	BTP5: 0.0m	7	5.6	0.8		
	BTP8: 0.0m	7	5.9	0.7		Overall Very Low Dispersion Risk
B/C Horizon (subsurface materials)	STP2: 0.5m	1	5.3	1.8	26.7	
	STP5: 0.5m	2	5.5	1.7		Strongly Acidic to neutral pH
	BH01: 1.2m	2	6.0	2.5		
	BH03: 0.5m	3	6.2	1.3		Non-saline
	BH05: 0.5m	2	7.0	1.1	13.4	Strongly Sodic
	BH06: 1.2m	3	7.4	1.4		
	BH07: 1.2m	2	7.6	0.4	20.7	Emerson Class: – Moderate to Very High Risk
	BTP2: 1.2m	2	7.0	2.0		
	BTP5: 0.5m	2	7.2	2.2		
	BTP8: 1.2m	1	5.2	1.8	29.6	Overall High Dispersion Risk



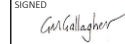
Key – Subsoils & Waterway Grab Samples

-  Emerson Class 1 or 2 – High to Very High Risk
-  Emerson Class 3 – Moderate Risk
-  Emerson Class ≥ 4 – Very Low to Low Risk



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TITLE Borehole & Sampling Locations		DRAWING NO. GE25.019.D1	
JOB LOCATION Undullah Tranche 1A		SCALE NTS	
CLIENT Charlie Resolved Pty Ltd	DATE 25.3.25	DRAWN GMG	SIGNED  GLEN GALLAGHER CPESC NO. 8346

4.1 Discussion

4.1.1 Emerson Class Tests

An Emerson number of 1 indicates a strongly dispersive soil, an Emerson number of 2 indicates a high risk of significant soil dispersion; an Emerson number of 3 indicates a moderate risk of significant soil dispersion; whilst an Emerson number ranging between 4 and 8 indicates a soil with low to negligible dispersion tendencies.

Emerson Class testing undertaken on 8 topsoil (i.e. A horizon) samples revealed Class 7 characteristics indicating a very low soil dispersion risk.

Emerson Class testing undertaken on 10 subsurface (B2/C horizon) samples revealed Class 1 - 3 characteristics, revealing a variable soil dispersion risk ranging between moderate and very high.

4.1.2 Soil pH

Soil pH is a secondary indicator in the estimation of soil dispersion hazard; where significantly alkaline pH values (e.g. pH >8.0) can indicate a higher risk of soil sodicity and subsequent soil dispersion. Conversely, strongly acidic samples (i.e. pH <5.5) can indicate high bio-available aluminum that can help counter-act soil dispersion tendencies of sodium ions in the soil.

The obtained topsoil (i.e. A horizon) pH values of 5.5 – 6.2 (median of 5.7) are generally moderately acidic, and do not indicate a higher risk of soil sodicity or significant benefit from bio-available aluminum levels.

The obtained subsurface (i.e. B/C horizon) pH values of 5.2 – 7.6 (median of 6.6) ranged from neutral to strongly acidic. These levels do not indicate a higher risk of soil sodicity, and exhibit a sporadic, mild benefit from bio-available aluminum levels.

4.1.3 Soil Salinity

Soil salinity reflects the relationship between landscape hydrology, geology, soil properties and vegetation. Soil salinity is also secondary indicator in the estimation of soil dispersion hazard. Soils with mildly saline values (or relatively higher values to comparison soils) can sometimes indicate higher levels of sodium and therefore can indicate a higher risk of soil sodicity and subsequent soil dispersion.

However, the actual soil dispersion risk is determined by the relative balance of sodium in relation to chloride levels within saline soils. Saline soils can often be sodic, but these soils will not show indicators of sodicity. The salt content of the soil prevents dispersion of soil particles in high enough concentrations. If this salt level falls below the requirement for soil stability even a small amount of sodium can produce adverse effects. A combination of high sodium levels and overall low salt will produce extremely poor physical conditions in soils associated with dispersive soils. Soils that exhibit an $EC_E < 4$ mS/cm are considered to be non-saline.

The soil salinity classes are shown in Table 4.2 below.

Table 4.2: Salinity classes of soils (after Richards, 1954)

Class		EC _e (dS/m)	Comments
Non-saline	None	<2	Salinity effects mostly negligible
	Slight	2 – 4	Yields of very sensitive crops may be affected
Saline	Moderate	4 – 8	Yields of many crops affected
	Very	8 – 16	Only tolerant crops yield satisfactorily
	High	> 16	Only a few very tolerant crops yield satisfactorily

The calculated EC_e (saturated) values for the sampled topsoil (A horizon) materials were 0.4 – 1.0 dS/m (median of 0.8 dS/m), indicating that the topsoil materials are non-saline.

The calculated EC_e (saturated) values for the sampled subsurface (B/C horizon) materials ranged between 0.4 – 2.5 dS/m (median of 1.8 dS/m), indicating that these materials are also non-saline.

4.1.4 Soil Sodidity (ESP)

Soil Sodidity is a measure of exchangeable sodium in relation to other exchangeable cations and is expressed as the Exchangeable Sodium Percentage (ESP). ESP is an important primary risk indicator in the identification of dispersive soils. The common problems that may be encountered with sodic soils are lower hydraulic conductivity (i.e. water logging), higher susceptibility to tunnel erosion and severe gully erosion, poor aeration and reduction in plant-available water capacity and poor leaching (i.e. build up of salts).

The tendency for soil dispersion usually increases with increasing ESP. Sodic soil layers (ESP ≥ 6) may disperse and strongly sodic soils (ESP ≥ 15) usually do. The Australian sodicity classifications are provided in Table 4.3 below:

Table 4.3: Sodidity classes of soils

Sodidity Classification	ESP (%)
Non-sodic	≤ 6
Sodic	6 – 15
Strongly sodic	> 15

Source: DPI (1993)

The ESP level of the topsoil (A horizon) sample was 2.4%, indicating non-sodic soils and a very low soil dispersion risk.

The ESP levels of three (3) subsurface (B/C horizon) samples ranged between 13.4% and 29.6% (median of 23.7%), indicating sodic to strongly sodic subsoils and a high to very high soil dispersion risk.

4.1.5 Topsoil Nutrient Results

The topsoil (agronomic) test results, interpretation and recommendations in relation to *optimum* plant growth for 'kikuyu pastures' (general grass) are detailed in Table 4.4 below:

Table 4.4: Agronomic Test Results

Parameter	Result	Guideline Level	Interpretation	Treatment Rate
pH (H ₂ O)	5.5 – 6.2	5.5 – 8.0	Marginal – Satisfactory. <i>No action required.</i>	
Calcium (meq/100g)	1.4	≥3.00	Low. Apply Ag. Lime.	
Magnesium (meq/100g)	1.2	≥0.80	Satisfactory. <i>No action required.</i>	
Ca: Mg Ratio	1.2	1.5 – 8	Low. Apply Ag. Lime.	Apply Ag. Lime (calcium carbonate) at 3.0 tonnes / 1000m³
CEC (meq/100g)	3.7	≥8	Low. Apply Ag. Lime.	
Aluminium (meq/100g)	0.2	<1	Satisfactory. <i>No action required.</i>	
Sodium (base %)	2.4	<6	Satisfactory. <i>No action Required.</i>	
EC (dS/m)	<0.1	<0.4	Satisfactory. <i>No action required.</i>	
NOx- Nitrogen (ppm)	<1	≥25	Very Low. Apply Nitrogen fertiliser	100 kg / 1000m³
Phosphorus - (Olsen)(ppm)	1.6	≥15	Very Low. Apply Phosphorus fertiliser	40 kg / 1000m³
Potassium (meq/100g)	0.4	≥0.6	Low. Apply Potassium fertiliser	50 kg / 1000m³

4.1.6 Topsoil Treatment Rates

The recommended minimum application rates are provided in Table 4.5 below.

Table 4.5: Recommended Amelioration Strategy (kikuyu pastures/ general grass growth)

Ameliorant		Minimum Treatment Rate
Ag. Lime (fine calcium carbonate)		3.0 tonnes per 1000m ³
NPK Fertiliser	Nitrogen (N)	100 kg per 1000m ³
	Phosphorus (P)	40 kg per 1000m ³
	Potassium (K)	50 kg per 1000m ³

An NPK fertilizer product should be chosen with the approximate NPK ratios similar to the recommendations provided and the overall rate of the product calculated to ensure the minimum levels of each element are attained.

N.B. Additional ameliorants or treatment rates may be requested and implemented by the Landscape Consultant to suit selected plant or grass species (e.g. WSUD areas). Further testing may be undertaken to constrain these ameliorant requirements.

4.1.7 Subsurface Treatment Rates

The recommended gypsum treatment rates for soil disturbances identified in Section 5 below (e.g. WSUD areas; service excavations) are shown in Table 4.6 below:

Table 4.6: Gypsum Treatment Rates

Soil	CEC (meq/100g)	ESP (%)	Gypsum Treatment Rate ¹
All Subsurface materials	7.5	19.2	2.7 kg per square metre (@ a 150mm equivalent treatment depth) (equiv. to 18 kg/m ³)

¹ Assumes Soil Bulk Density of 1.6 kg/m³ & Gypsum Purity of ≥80%

4.2 Overall Soil Dispersion Risk

On the basis of the site inspection, investigated soil profiles and detailed laboratory results, it is considered that the soil dispersion risk and subsequent management requirements for the proposed development can be defined as follows.

4.2.1 Topsoil Materials (0–150mm from Natural Surface) – Very Low Risk

It is considered that the topsoil materials exhibit an overall very low soil dispersion risk, however, shall require specific soil amelioration (ag. lime; fertilizers) in consultation with the Landscape Consultant to promote optimum re-vegetation at establishment and therefore also help mitigate soil dispersion risk of the underlying subsoils.

As per standard practice, all landscaping/stabilisation areas shall be monitored for suitable strike/cover to ensure compliance with the site ESCP requirements and LCC on-maintenance requirements.

4.2.2 Subsurface Materials –High Risk

It is considered that the subsurface materials (i.e. subsoils and crushed/ground rock materials) exhibit an overall high soil dispersion risk and therefore shall require specific soil amelioration and management practices in order to mitigate the soil dispersion risk.

To this end, subsurface materials within *specific and targeted* areas identified in Section 5 shall require dispersive soil amelioration, including gypsum treatment. Moreover, services shall include geofabric-wrapping in accordance with QUU standard drawings.

As per standard practice, all disturbed subsoil/subsurface materials shall require soil compaction to LCC geotechnical requirements and all subsoil/subsurface materials exposed shall be covered with hardstand or non-dispersive topsoil materials and appropriately revegetated in accordance with Landscape Design Drawings.

5. DISPERSIVE SOIL MANAGEMENT PLAN

Responsibility	Civil Contractor; Developer						
Operational Policy	- To mitigate the incidence of infrastructure damage and environmental harm resulting from tunnel and subsurface erosion. - To ensure the appropriate management of water quality in order to avoid impacts on the downstream environment.						
Performance Criteria	All areas of landscaping/rehabilitation shall attain suitable grass strike/cover to ensure compliance with the site ESCP requirements and ICC on-maintenance requirements. All disturbed materials requiring dispersive soil amelioration ('Zone1') shall meet the specified limits: <table><thead><tr><th>Material</th><th>Parameter</th><th>Criteria</th></tr></thead><tbody><tr><td>Subsurface Materials (≥150mm below natural NSL)</td><td>Soil Dispersion</td><td>Emerson Class No. 4 – 8; or Exchangeable Sodium Percentage ≤6 %</td></tr></tbody></table>	Material	Parameter	Criteria	Subsurface Materials (≥150mm below natural NSL)	Soil Dispersion	Emerson Class No. 4 – 8; or Exchangeable Sodium Percentage ≤6 %
Material	Parameter	Criteria					
Subsurface Materials (≥150mm below natural NSL)	Soil Dispersion	Emerson Class No. 4 – 8; or Exchangeable Sodium Percentage ≤6 %					
Implementation Strategy	<u>Topsoil Materials</u> - A high level of care shall be required during delineation of site topsoil and subsoil materials and also in order to ensure the soil texture of stripped topsoil materials is of suitable texture (i.e. clay content <35%). - Topsoil shall be stripped prior to bulk earthworks within the immediate construction stages and shall be stockpiled and shaped in a free draining condition to avoid long-term soil saturation. - All topsoils materials used in landscaping/stabilisation shall be suitably ameliorated (e.g. ag. lime and fertiliser) in consultation with a Landscaping Consultant to promote grass establishment, as required. <i>Indicative amelioration rates for general grass growth are provided in Table 4.5, however additional testing may be required and alternative strategies provided by the Landscaping Consultant, particularly for selected plant or grass species.</i> - All landscaping/stabilisation areas shall be visually monitored for suitable strike/cover to ensure compliance with the site ESCP requirements and LCC on-maintenance requirements.						

Subsurface Materials

General Management

1. All exposed subsoil/subsurface materials (i.e. >150mm depth from the natural surface) during earthwork activities shall be covered with hardstand, or non-dispersive topsoil materials to a minimum depth of 150mm and appropriately revegetated in accordance with Civil Engineering or Landscape Design Drawings (or similar).
2. All excavated subsoil/surface materials used for site fill shall be adequately compacted to the appropriate Geotechnical Specification - with a minimum 95% / 98% standard compaction requirement as applicable, and in accordance with AS3798 and subsequently verified to LCC specific geotechnical requirements.
3. All subsurface materials across the development area (i.e. >~150mm depth from the natural surface) shall be considered 'dispersive soils' and shall require the targeted treatment strategies (*WSUD areas; trench excavations*). Alternatively, a suitably qualified and experienced Environmental Consultant can be engaged to further delineate the location and/or treatment rates within the nominated areas. A detailed report including additional test results, sampling locations and site plan detailing delineations shall be required to justify any reduction/delineation of subsoil treatment areas.

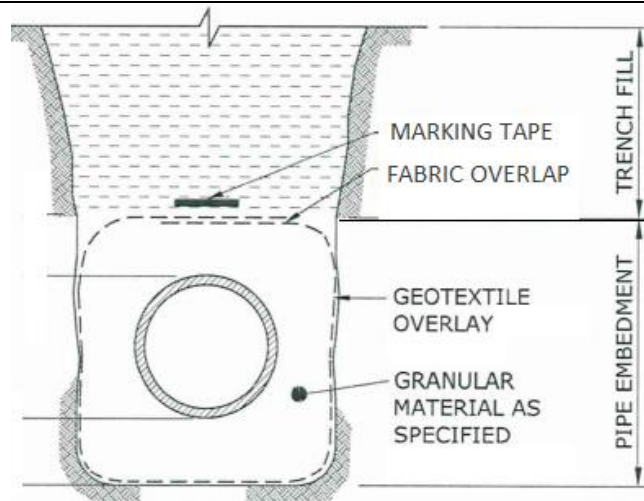
Import Materials

1. Any import soil materials (fill or topsoil) shall be verified non-dispersive soils, as confirmed and appropriately documented by the supplier.
2. In the absence of the above, all import soil materials shall be tested and verified by a suitably qualified and experienced Environmental Consultant. If soil amelioration is required for import materials, an addendum DSMP Report shall be prepared by a suitably qualified and experienced Environmental Consultant.

Trench Excavations

Trench excavations (Sewer; Water; Stormwater) undertaken by the Civil Contractor shall adopt fabric wrapping protocols as per QUU 'Type 4/D' requirements, summarised as follows:

- Geotextile overlay of the pipe embedment zone – against the trench floor and walls such that it fully encases the embedment, including a minimum 250mm overlap at all fabric joints:



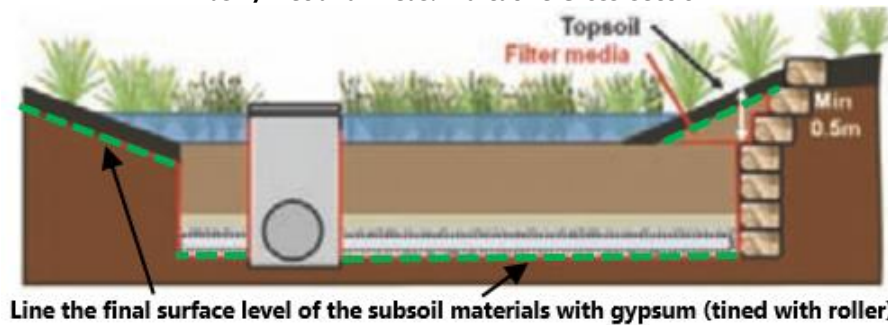
- No gypsum treatment is required.
 - The surface of the trench shall be covered with hardstand, non-dispersive topsoil or non-dispersible (or appropriately treated) soil materials to a minimum depth of 150mm cover and covered with permanent vegetation, rock or similar cover in accordance with Civil Engineering or Landscape Design Drawings.
2. All excavated and backfilled dispersive subsurface materials associated with service excavations shall be adequately compacted to an appropriate Geotechnical Specification - with the minimum 95% / 98% standard compaction requirement, as applicable, and in accordance with AS3798 and subsequently verified to LCC specific geotechnical requirements.
 3. A suitably qualified consultant may be engaged to provide additional advice or alternative management strategies for specific trench excavation areas prior to (or during) the Construction Phase.
 4. Moreover, for any section of pipe and surrounding bedding materials that are fully encapsulated by non-erodible rock (as confirmed by suitably qualified consultant) , geofabric-wrapping shall not be required for dispersive soil management.

Stormwater Detention/Bio-retention Basins, Stormwater Flow Paths (e.g. Swales; SW Outlets)

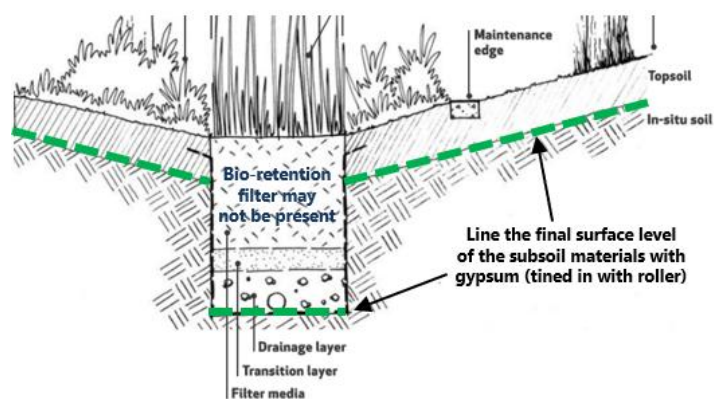
1. All water sensitive design (WSUD) (by others) shall consider the dispersive soil environment in accordance with applicable guidelines (e.g. geofabric liner over compacted surface for bio-retention systems).
2. All earthworks proposed within stormwater treatment and flow path areas (including all bio-basins, watercourses, swales, headwalls, outlets and batter chutes) shall be undertaken in accordance with the Engineering Design Drawings and Landscape Design Drawings and must include the following dispersive soil management techniques:

- All areas are covered/stabilised with a minimum 150mm of either non-dispersive topsoil and garden bed/vegetation/grass cover (rock may be incorporated), suitable geo-textile material and rock cover, erosion protection mat and vegetation/grass cover, or equivalent stabilisation/cover method;
- Prior to implementing the cover/stabilisation methods as outlined above, the final subsoil/subsurface level within the disturbed areas shall be lined with agricultural gypsum (NV >80%) at a rate of $\geq 2.7 \text{ kg/m}^2$ - gypsum to be tined with roller/grader, or similar wherever practicable- as noted in *dashed green* below. **N.B.** this treatment shall not be required in any area situated directly underneath HDPE **impermeable** liner, if utilised, or non-erodible rock confirmed by Geotechnical/Environmental Consultant.
- If fill materials are proposed, they shall be adequately compacted to an appropriate Geotechnical Specification - with a minimum 95% standard compaction requirement in accordance with AS3798 and subsequently verified to LCC specific geotechnical requirements.

Basin/Wetland Areas: Indicative Cross-section



Watercourse / Swale / Flow Path Areas: Indicative Cross-section



N.B. If passive irrigation systems are proposed, the Landscape Consultant shall seek advice from a suitably qualified consultant to address soil dispersion issues (e.g. gypsum treatments; suitable selection of soil textures of growing media).

Monitoring Requirements	Gypsum Source
	Gypsum used in amelioration must be 'Grade 1' i.e. must contain a minimum of 15.0% sulphur (S) and a minimum of 19.0% Calcium (Ca) ad must have a minimum neutralising value (NV) of 80%.
	Topsoil Materials
	All topsoil materials shall be ameliorated to promote revegetation/rehabilitation, with interpretation and any further recommendations for ameliorants (e.g. ag. lime and fertilizers) provided by the Landscape Consultant.

	All composite (bulk) samples shall comprise a minimum of three (3) sub-samples to help ensure representativeness of the tested materials and shall be taken to represent a minimum 150mm test depth equivalent. Dispersion Index testing (AS1289 3.8.2) may also be used if required in conjunction with the Emerson class/ESP test results, if deemed beneficial by the Consulting Engineer/Environmental Consultant. Ameliorated materials that do not meet the verification criteria shall be re-treated and re-verified until compliance has been achieved.
Reporting Requirements	All results, reports, photographs and other documentation regarding dispersive soil identification/treatment/amelioration shall be kept on record by the Contractor and available for inspection at all times. The Contractor's Site Manager shall maintain a log of gypsum treatment (including photographs) and shall ensure that soil records are kept up to date. Soil test results and gypsum treatment records shall be made available to the Superintendent, Certifier and Statutory Authorities upon request.
Incident Identification	Soil verification test results not meeting the specified criteria. Failure to adhere to the prescribed treatment methods or verification methods, as stated above. Evidence of sub-surface tunnelling/erosion.
Contingency Procedures	Review of soil dispersion control measures. The re-application of soil ameliorants in consultation with the Environmental Consultant.
ESCP Integration	The soil dispersion results presented in the DSMP shall be utilised/considered to develop the Erosion and Sediment Control Plan (ESCP), where appropriate.

6.DSMP CERTIFICATION

This DSMP assessment has been prepared with due reference to *Implementation Guideline No. 28 Dispersive Soils Management (ICC, 2016)* by Glen Gallagher, Environmental (Soil & Water) Scientist and Certified Professional in Erosion & Sediment Control (CPESC) No. 8346.

Please feel free to contact Gallagher Environmental on 0438 724 929 or glen@genviro.com.au for any queries or if further elaboration is required.

Yours faithfully,



Glen Gallagher BScApp(Env Sc)(Hons) MEIANZ CPESC #8346
Principal | Gallagher Environmental



APPENDIX A: BORE LOGS

UTM : 56J Easting (m) : 492547.24 Northing (m) : 6924439.26 Ground Elevation : 68.39 (m) Total Depth : 3.6 m BGL	Excavator : Zaxis 330 Excavator Supplier : ECS Civil Services Logged By : KD Reviewed By : DA Date : 18/02/2025	Job Number : 24-231 Client : Mirvac C Project : Geotechnical Investigation Monarch Glen Location : Wyatt Road, Undullah Loc Comment :
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Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.3	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, grey, dry.	MD			
		1	Residual		CI	w < PL	Sandy CLAY: medium plasticity, hard, brown mottled grey, medium grained sand, w < pl.	H			
		1.9									
		2									
		3	Rock		SST	D	Silty SAND: fine to coarse grained, very dense, brown, with cobbles and clay zones (extremely to moderately weathered sandstone).	VD			Ripper used from 2.7m
							BTP2 Terminated at 3.6m (not much progress)				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J	Excavator : Zaxis 330	Job Number : 24-231
Easting (m) : 492821.65	Excavator Supplier : ECS Civil Services	Client : Mirvac C
Northing (m) : 6924636.28	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 63.96 (m)	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 1.4 m BGL	Date : 18/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.3	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, grey, dry.	MD			
		0.8	Residual		CI	w < PL	Sandy CLAY: medium plasticity, hard, grey mottled brown black, fine to medium grained sand, w < pl.	H			
		1	Rock		SST	D	Silty SAND: fine to coarse grained, very dense, brown, with cobbles (extremely to moderately weathered sandstone).	VD			Ripper used from 1m
							BTP5 refusal at 1.4m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J Easting (m) : 493158.57 Northing (m) : 6924852.99 Ground Elevation : 62.59 (m) Total Depth : 2.6 m BGL	Excavator : Zaxis 330 Excavator Supplier : ECS Civil Services Logged By : KD Reviewed By : DA Date : 18/02/2025	Job Number : 24-231 Client : Mirvac C Project : Geotechnical Investigation Monarch Glen Location : Wyatt Road, Undullah Loc Comment :
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Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.3	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, grey, dry.	MD			
		1	Residual		CI	w < PL	Sandy CLAY: medium plasticity, stiff, brown mottled grey, fine to medium grained sand, w < pl.	St			
		1.2	Residual		CL-CI	w < PL	Sandy CLAY: low to medium plasticity, pale brown mottled grey, w < pl.				
		2	Rock		SST		Silty SAND: fine to coarse grained, very dense, brown, with cobbles (extremely to moderately weathered sandstone).	VD			ripper used at 2m
							BTP8 refusal at 2.6m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J	Excavator : Zaxis 330	Job Number : 24-231
Easting (m) : 27.78	Excavator Supplier : ECS Civil Services	Client : Mirvac C
Northing (m) : 153.23	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By :	Location : Wyatt Road, Undullah
Total Depth : 1.4 m BGL	Date : 19/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
1200mm GP Tooth Bucket			Topsoil		ML	w < PL	Sandy SILT: low plasticity, stiff to very stiff, pale grey, fine to medium grained sand, w < pl, (with rootlets).	St-VSt	D: DSMP		
		0.4	Residual		CL-CI	w < PL	Sandy CLAY: low to medium plasticity, very stiff to hard, pale brown, fine to medium grained sand, w < pl.	VSt-H	D: DSMP		
		0.8	Rock		SST	M	Gravelly to sandy CLAY: low to medium plasticity, hard, pale brown mottled pink, fine to medium grained sand, fine to coarse grained angular gravel, highly to extremely weathered, with cobbles <130mm.	H			
		1.2	Rock		SST	M	SANDSTONE: fine to coarse grained, pale grey, very low to low strength, moderately to slightly weathered.	VLS-LS	D: DSMP		
STP2 Terminated at 1.4m (slow progress)											

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM :	Excavator : Zaxis 330	Job Number : 24-231
Easting (m) : 0.00	Excavator Supplier : ECS Civil Services	Client : Mirvac C
Northing (m) : 0.00	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By :	Location : Wyatt Road, Undullah
Total Depth : 1.5 m BGL	Date : 19/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
1200mm GP Tooth Bucket ↑ ↓		0.35	Topsoil		ML	w < PL	Sandy SILT: low plasticity, stiff to very stiff, pale grey, fine to medium grained sand, w < pl, (with rootlets).	St-VSt	D: DSMP		
		0.9	Residual		CL-CI	w < PL	Sandy CLAY: low to medium plasticity, very stiff to hard, pale brown, mottled pink, fine to medium grained sand, w < pl.	VSt-H	D: DSMP		
		1	Rock		SST	M	Gravelly to sandy CLAY: low to medium plasticity, hard, pale brown, mottled pink, fine to coarse angular gravel, fine to coarse grained sand, extremely to highly weathered (with cobbles <130mm).	H	D: DSMP		
	Ripper	1.3	Rock		SST	M	SANDSTONE: fine to coarse grained, pale grey, very low to low strength, moderately to slightly weathered. Ripping at 1.3m, slow progress	VLS-LS			
							STP5 Terminated at 1.5m (refusal depth on MW-SW sandstone bedrock)				

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 90.90 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
										SPT	
		0.1	Topsoil		SM	D	Silty SAND: fine to medium grained, loose, grey, dry.	L			
		0.4	Residual		SC	D	Clayey SAND: fine to coarse grained, medium dense, pale brown, dry, low plasticity clay.	MD			
		1.6	Rock		SST		SANDSTONE: pale brown.				
Washbore		1.6					Commenced Coring at 1.6m			SPT Sample: 30/100mm, 0/mm, 0/mm (N=>50)	

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 90.90 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
				91												
				90	1											
							Commenced Coring at 1.6m									
NMLC	TCR = 100%	RQD = 74.58%		89	2		SANDSTONE: fine to coarse grained, brown mottled grey, low to medium strength.	HW-MW								Run 1
				88	3											

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff Vst - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 90.90 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
↑ NMLC ↓	TCR = 100%	RQD = 74.58%		87			SANDSTONE: fine to coarse grained, brown mottled grey, low to medium strength.	HW-MW							Run 1	J, 2°, UN, RO, CL, OP, J, 2°, PL, RO, CL, OP, BPI, PL, RO, STN, C,
	TCR = 100%	RQD = 96%			5		SANDSTONE: fine to medium grained, grey mottled brown, high strength.								Run 2	J, 2°, STP, RO, STN, OP,
	TCR = 100%	RQD = 76.41%			6			SW							Run 3	
				85	7											
				84												

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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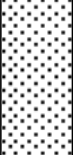
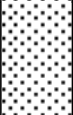
Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 90.90 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC	TCR = 100%	RQD = 76.41%		83 <												

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 81.40 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.3	Topsoil		SM	D	Silty SAND: fine to medium grained, loose to medium dense, pale brown, dry.	L-MD			
		0.4	Residual		SC	D	Clayey SAND: fine to coarse grained, medium dense, brown, dry, low to medium plasticity clay.	MD			
		1.1	Rock		SST	D	Silty SAND: fine to coarse grained, dense to very dense, pale brown.	D-VD			
		1.5	Rock		SST		SANDSTONE: fine to medium grained, brown mottled grey, medium strength.	MS			

Commenced Coring at 1.5m

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 81.40 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
				81												
				80	1											
							Commenced Coring at 1.5m									
NMLC	TCR = 100%	RQD = 50%		79	2		SANDSTONE: fine to medium grained, brown mottled grey, medium strength.									
				78	3		SANDSTONE: fine to medium grained, grey mottled brown, high strength.	SW								

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket	VE Very Easy(No Resistance)	SPT - Standard Penetration Test	B - Bulk disturbed sample	VS - Very soft
R Ripper	E Easy	PP - Hand/Pocket Penetrometer	D - Disturbed sample	S - Soft
HA Hand auger	F Firm	DCP - Dynamic Cone Penetrometer	ES - Environmental sample	F - Firm
PT Push tube	H Hard	PSP - Perth Sand Penetrometer	U - Thin wall tube "undisturbed"	St - Stiff
SON Sonic drilling	VH Very Hard(Refusal)	MC - Moisture Content		VSt - Very stiff
AH Air hammer		PBT - Plate Bearing Test		H - Hard
PS Percussion sampler		IMP - Borehole Impression Test		
AS Short spiral auger		PID - Photo Ionisation Detector		
AD/V Solid flight auger:V-Bit		VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		
AD/T Solid flight auger:TC-Bit				
HFA Hollow flight auger				
WB Washbore drilling				
RR Rock roller				

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 81.40 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
↑ NMLC <																

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 81.40 (m)	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
NMLC	TCR = 100%	RQD = 82.33%		73			SANDSTONE: fine to medium grained, grey mottled brown, high strength.	SW								
				72	9											
							BH07 Terminated at 10m									

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493208.54	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924655.70	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 75.13 (m)	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 21/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
										SPT	
		0.1	Topsoil		SM	D	Silty SAND: fine to medium grained, loose to medium dense, grey, dry.	L-MD			
			Residual		SC		Clayey SAND: fine to medium grained, medium dense, brown, low to medium plasticity clay.	MD			
		0.8									
		1	Rock		SST	D	Silty SAND: fine to coarse grained, dense to very dense, brown.	D-VD			
		1.6									
							Commenced Coring at 1.6m		SPT Sample: no sample recovered	30/90mm, 0/mm, 0/mm (N=>50)	

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

METHOD		PENETRATION		FIELD TESTS		SAMPLES		SOIL CONSISTENCY	
EX	Excavator bucket	VE	Very Easy(No Resistance)	SPT	- Standard Penetration Test	B	- Bulk disturbed sample	VS	- Very soft
R	Ripper	E	Easy	PP	- Hand/Pocket Penetrometer	D	- Disturbed sample	S	- Soft
HA	Hand auger	F	Firm	DCP	- Dynamic Cone Penetrometer	ES	- Environmental sample	F	- Firm
PT	Push tube	H	Hard	PSP	- Perth Sand Penetrometer	U	- Thin wall tube "undisturbed"	St	- Stiff
SON	Sonic drilling	VH	Very Hard(Refusal)	MC	- Moisture Content			VSt	- Very stiff
AH	Air hammer							H	- Hard
PS	Percussion sampler	WATER		PBT	- Plate Bearing Test	MOISTURE		RELATIVE DENSITY	
AS	Short spiral auger		Water Level on Date	IMP	- Borehole Impression Test	D	- Dry	VL	- Very loose
AD/V	Solid flight auger:V-Bit		Water inflow	PID	- Photo Ionisation Detector	M	- Moist	L	- Loose
AD/T	Solid flight auger:TC-Bit		Water outflow	VS	- Vane Shear; P=Peak, R=residual (unconnected kPa)	W	- Wet	MD	- Medium dense
HFA	Hollow flight auger					PL	- plastic limit	D	- Dense
WB	Washbore drilling					LL	- liquid limit	VD	- Very dense
RR	Rock roller					W	- Moisture content		

Qualtest

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493208.54	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924655.70	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 75.13 (m)	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 21/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness	
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS				EHS

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METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493208.54	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924655.70	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 75.13 (m)	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 21/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
NMLC	TCR = 100%	RQD = 93.33%		67			SANDSTONE: fine to medium grained, grey, high strength, with minor coal seams .									
				66	9			SW-F								
					10											
							BH01 Terminated at 10.05m									

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493137.45	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924566.34	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 80.94 (m)	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.15 m BGL	Date : 21/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, loose to medium dense, grey, dry.	L-MD			
		0.8	Residual		CI	w < PL	Sandy CLAY: medium plasticity, stiff to very stiff, brown, medium grained sand, w < pl.	St-VSt			
		1.1	Rock		SST		Silty SAND: fine to medium grained, dense, brown.	D			
		2	Rock		SST		SANDSTONE: fine to medium grained, grey mottled brown.				Auger refusal at 1.1

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

METHOD		PENETRATION		FIELD TESTS		SAMPLES		SOIL CONSISTENCY	
EX	Excavator bucket	VE	Very Easy(No Resistance)	SPT	- Standard Penetration Test	B	- Bulk disturbed sample	VS	- Very soft
R	Ripper	E	Easy	PP	- Hand/Pocket Penetrometer	D	- Disturbed sample	S	- Soft
HA	Hand auger	F	Firm	DCP	- Dynamic Cone Penetrometer	ES	- Environmental sample	F	- Firm
PT	Push tube	H	Hard	PSP	- Perth Sand Penetrometer	U	- Thin wall tube "undisturbed"	St	- Stiff
SON	Sonic drilling	VH	Very Hard(Refusal)	MC	- Moisture Content			VSt	- Very stiff
AH	Air hammer							H	- Hard
PS	Percussion sampler	WATER				MOISTURE			
AS	Short spiral auger			PBT	- Plate Bearing Test	D	- Dry		RELATIVE DENSITY
AD/V	Solid flight auger:V-Bit		Water Level on Date	IMP	- Borehole Impression Test	M	- Moist	VL	- Very loose
AD/T	Solid flight auger:TC-Bit		Water inflow	PID	- Photo Ionisation Detector	W	- Wet	L	- Loose
HFA	Hollow flight auger			VS	- Vane Shear; P=Peak, R=residual (unconnected kPa)	PL	- plastic limit	MD	- Medium dense
WB	Washbore drilling		Water outflow			LL	- liquid limit	D	- Dense
RR	Rock roller					W	- Moisture content	VD	- Very dense

Qualtest

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493137.45	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924566.34	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : 80.94 (m)	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.15 m BGL	Date : 21/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		9	Rock		SST		SANDSTONE: fine to medium grained, grey mottled brown.				
		10									
							BH02 Terminated at 10.15m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493060.30	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924354.20	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 24/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, dark grey, dry, with rootlets.	MD			
		0.6	Residual		SC	D	Clayey SAND: fine to medium grained, medium dense, grey, dry, low plasticity clay.	MD			
		0.9	Rock		SST	D	Silty SAND: fine to medium grained, very dense, grey, dry.	VD			
		1.1	Rock		SST	D	As above but fine to medium grained, brown grey, low to medium strength, auger refusal.	LS-MS			
							Commenced Coring at 1.1m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J
Easting (m) : 493060.30
Northing (m) : 6924354.20
Ground Elevation : Not Surveyed
Total Depth : 10.05 m BGL

Drill Rig : Hydropower Scout
Driller Supplier : Applied Geotech Drilling
Logged By : TS
Reviewed By : DA
Date : 24/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
					1		Commenced Coring at 1.1m									
NMLC	TCR = 100%	RQD = 87%			2		SANDSTONE: fine to medium grained, brown grey, low to medium strength.	MW-SW							Run 1	J, PL, RO, STN, C, J, 5°, UN, RO, CT, OP, J, PL, RO, CT, OP, SZ, IR, RO, CL, OP, IR, RO, STN, OP, J, UN, RO, CT, C, J, UN, RO, CL, C, J, IR, RO, CL, C, J, 5°, PL, RO, CL, OP, J, IR, RO, CL, OP, J, PL, RO, CL, OP, J, 15°, IR, RO, CL, OP, J, 15°, PL, RO, CL, OP,
					3											

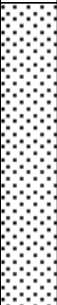
METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J
Easting (m) : 493060.30
Northing (m) : 6924354.20
Ground Elevation : Not Surveyed
Total Depth : 10.05 m BGL

Drill Rig : Hydropower Scout
Driller Supplier : Applied Geotech Drilling
Logged By : TS
Reviewed By : DA
Date : 24/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
↑ NMLC ↓	TCR = 100%	RQD = 91%			5		As above but brown mottled grey, medium strength.	MW-SW							Run 2	J, 8°, UN, RO, STN, OP, J, 5°, IR, RO, VN, C, Carbonaceous infill, 5°, IR, RO, Clay infill, 5°, PL, RO, CL, C,
	TCR = 100%	RQD = 91%			6		As above but mottled grey orange brown.	MW-SW							Run 3	J, 60°, CV, RO, CL, OP, J, 5°, PL, RO, CL, C, J, 10°, IR, RO, CL, OP, J, 20°, CV, RO, J, CV, RO, STN, OP, J, PL, RO, CL, C, Drillbreak?,

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff Vst - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493060.30	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924354.20	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 24/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC	TCR = 100%	RQD = 91%			9		As above but mottled grey orange brown.	MW-SW						30 100 300 1000 3000	Run 3	J, 40°, CV, RO, J, 45°, CV, RO, STN, C, J, PL, RO, VN, C, J, 45°, CV, RO, CL, C, J, PL, RO, CL, C, J, 15°, CV, RO, STN, C, J, 45°, CV, RO, STN, C, J, 45°, CV, RO, CL, C, J, PL, RO, CL, C, J, 5°, PL, RO, CT, OP,
					10		BH03 Terminate at 10.05m (Target Depth)									

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493146.40	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924086.80	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.07 m BGL	Date : 24/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, dark grey, dry, with rootlets.	MD			
		0.5	Residual		SC	D	Clayey SAND: fine to medium grained, medium dense, grey, dry, low plasticity clay.	MD			
		1	Rock		SST	D	Clayey SAND: fine to medium grained, trace fine to medium sized gravel, very dense, grey, dry, low plasticity clay, rock chips included .	VD			
		1.2	Rock		SST	D	As above but auger refusal.	VD			
							Commenced Coring at 1.2m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J
Easting (m) : 493146.40
Northing (m) : 6924086.80
Ground Elevation : Not Surveyed
Total Depth : 10.07 m BGL

Drill Rig : Hydropower Scout
Driller Supplier : Applied Geotech Drilling
Logged By : TS
Reviewed By : DA
Date : 24/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
					1		Commenced Coring at 1.2m									
↑ NMLC ↓	TCR = 100%	RQD = 43%			2		SANDSTONE: fine grained, light grey mottled brown, very low to low strength.	HW-MW								Run 1
	TCR = 100%	RQD = 44%			3		SANDSTONE: fine to medium grained, brown grey, low to medium strength.	HW-MW								Run 2

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER Water Level on Date Water inflow Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions



Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

[illegible]

METHOD		PENETRATION		FIELD TESTS		SAMPLES		SOIL CONSISTENCY	
EX	Excavator bucket	VE	Very Easy(No Resistance)	SPT	- Standard Penetration Test	B	- Bulk disturbed sample	VS	- Very soft
R	Ripper	E	Easy	PP	- Hand/Pocket Penetrometer	D	- Disturbed sample	S	- Soft
HA	Hand auger	F	Firm	DCP	- Dynamic Cone Penetrometer	ES	- Environmental sample	F	- Firm
PT	Push tube	H	Hard	PSP	- Perth Sand Penetrometer	U	- Thin wall tube "undisturbed"	St	- Stiff
SON	Sonic drilling	VH	Very Hard(Refusal)	MC	- Moisture Content			VSt	- Very stiff
AH	Air hammer							H	- Hard
PS	Percussion sampler	WATER		PBT	- Plate Bearing Test	MOISTURE		RELATIVE DENSITY	
AS	Short spiral auger		Water Level on Date	IMP	- Borehole Impression Test	D	- Dry	VL	- Very loose
AD/V	Solid flight auger:V-Bit		Water inflow	PID	- Photo Ionisation Detector	M	- Moist	L	- Loose
AD/T	Solid flight auger:TC-Bit		Water outflow	VS	- Vane Shear; P=Peak, R=residual (unconnected kPa)	W	- Wet	MD	- Medium dense
HFA	Hollow flight auger					PL	- plastic limit	D	- Dense
WB	Washbore drilling					LL	- liquid limit	VD	- Very dense
RR	Rock roller					W	- Moisture content		

Qualtest

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493146.40	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924086.80	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.07 m BGL	Date : 24/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC	TCR = 100%	RQD = 89%					SANDSTONE: fine to medium grained, grey mottled brown, low to medium strength.	MW							Run 3	XWS, IR, RO, STN, I, IR, RO, CL, OP, J, 15°, IR, RO, STN, OP, J, 10°, PL, RO, CL, C, J, 45°, PL, RO, CL, OP, J, PL, RO, CL, C, J, PL, RO, CL, C, J, 10°, PL, RO, CL, OP, J, 45°, PL, RO, CL, C,
		TCR = 100%	RQD = 71%		9			SANDSTONE: fine to medium grained, grey, medium to high strength.	MW-SW							
					10		BH05 Terminate at 10.07m (Target Depth)									

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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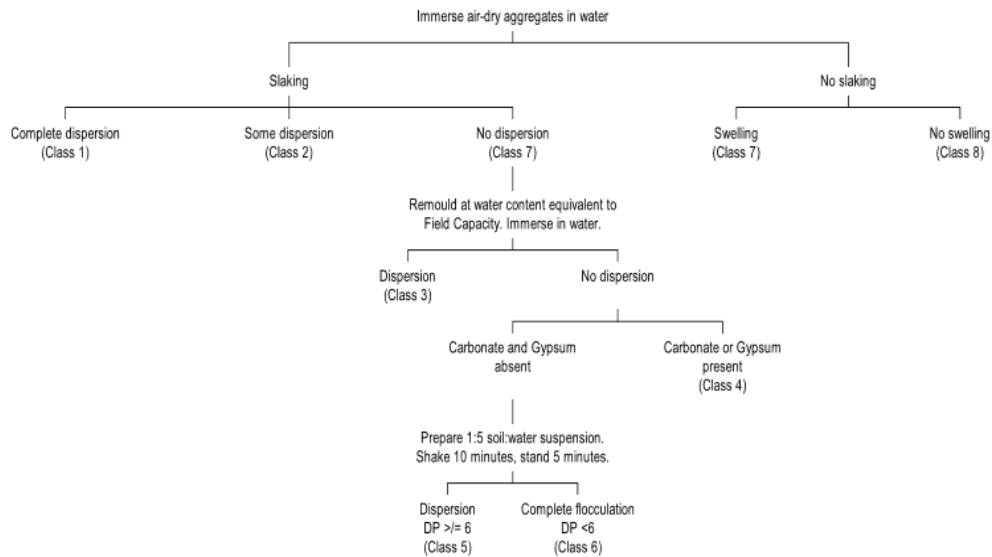
Refer to explanatory notes for details of abbreviations and basis of descriptions

APPENDIX B: LABORATORY RESULTS

Emerson Class Test Certificate

(Method: AS1289 3.8.1)

Figure 1. Determining the Emerson Class Number of Aggregates



Sample	Emerson Class
STP5: 0.0m	7
BH01: 0.0m	7
BH03: 0.0m	7
BH05: 0.0m	7
BH06: 0.0m	7
BTP2: 0.0m	7
BTP5: 0.0m	7
BTP8: 0.0m	7
STP2: 0.5m	1
STP5: 0.5m	2
BH01: 1.2m	2
BH03: 0.5m	3
BH05: 0.5m	2
BH06: 1.2m	3
BH07: 1.2m	2
BTP2: 1.2m	2
BTP5: 0.5m	2
BTP8: 1.2m	1

pH & Electrical Conductivity (EC) Test Certificate

(Soil Chemical Methods - Rayment & Lyons, 2010)

Sample	pH _{1:5}	EC _{1:5} (dS/m)	Texture Factor	Estimated Ece
STP5: 0.0m	6.2	0.07	14	1.0
BH01: 0.0m	5.5	0.03	14	0.4
BH03: 0.0m	5.7	0.05	14	0.7
BH05: 0.0m	5.8	0.06	14	0.8
BH06: 0.0m	5.6	0.06	14	0.8
BTP2: 0.0m	5.7	0.04	14	0.6
BTP5: 0.0m	5.6	0.06	14	0.8
BTP8: 0.0m	5.9	0.05	14	0.7
STP2: 0.5m	5.3	0.22	8	1.8
STP5: 0.5m	5.5	0.21	8	1.7
BH01: 1.2m	6.0	0.18	14	2.5
BH03: 0.5m	6.2	0.16	8	1.3
BH05: 0.5m	7.0	0.11	10	1.1
BH06: 1.2m	7.4	0.10	14	1.4
BH07: 1.2m	7.6	0.03	14	0.4
BTP2: 1.2m	7.0	0.25	8	2.0
BTP5: 0.5m	7.2	0.28	8	2.2
BTP8: 1.2m	5.2	0.22	8	1.8



CERTIFICATE OF ANALYSIS

Work Order

: **EB2507653**

Client

: **GALLAGHER ENVIRONMENTAL**

Contact

: **MR GLEN GALLAGHER**

Address

: **23 HOOKER STREET
WINDSOR 2756**

Telephone

: ----

Project

: **Undullah Tranche 1**

Order number

: **25/019**

C-O-C number

: ----

Sampler

: **GLEN GALLAGHER**

Site

: ----

Quote number

: **EN/333**

No. of samples received

: **7**

No. of samples analysed

: **7**

Page

: **1 of 4**

Laboratory

: **Environmental Division Brisbane**

Contact

: **Customer Services EB**

Address

: **2 Byth Street Stafford QLD Australia 4053**

Telephone

: **+61-7-3552-8685**

Date Samples Received

: **06-Mar-2025 16:05**

Date Analysis Commenced

: **10-Mar-2025**

Issue Date

: **14-Mar-2025 10:39**



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - "Testing"

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Soil Preparation, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

Δ = This result is computed from individual analyte detections at or above the level of reporting

∅ = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Magnesium/Potassium Ratio results for some samples as required Exchangeable Potassium results are less than the limit of reporting.
- ED007 (Exchangeable Cations): Unable to calculate Magnesium/Potassium Ratio result as required Exchangeable Potassium results are less than the limit of reporting.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		BH5 0.5-0.6m	BH7 1.2-1.3m				
		Sampling date / time		05-Mar-2025 00:00	05-Mar-2025 00:00				
Compound	CAS Number	LOR	Unit	EB2507653-006	EB2507653-007				
				Result	Result				
EA002: pH 1:5 (Soils)									
pH Value		0.1	pH Unit	7.0	7.6				
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C		1	µS/cm	105	28				
ED006: Exchangeable Cations on Alkaline Soils									
Ø Exchangeable Calcium		0.2	meq/100g		0.8				
Ø Exchangeable Magnesium		0.2	meq/100g		1.4				
Ø Exchangeable Potassium		0.2	meq/100g		<0.2				
Ø Exchangeable Sodium		0.2	meq/100g		0.6				
Ø Cation Exchange Capacity		0.2	meq/100g		2.8				
Ø Exchangeable Sodium Percent		0.2	%		20.7				
Ø Calcium/Magnesium Ratio		0.2	-		0.6				
ED007: Exchangeable Cations									
Exchangeable Calcium		0.1	meq/100g	6.1					
Exchangeable Magnesium		0.1	meq/100g	6.4					
Exchangeable Potassium		0.1	meq/100g	0.1					
Exchangeable Sodium		0.1	meq/100g	1.9					
Cation Exchange Capacity		0.1	meq/100g	14.6					
Exchangeable Sodium Percent		0.1	%	13.4					
Calcium/Magnesium Ratio		0.1	-	1.0					
Magnesium/Potassium Ratio		0.1	-	57.5					