GREEN

GEOTECHNICS

GEOTECHNICAL INVESTIGATION

FOR

NSW RFS

RFS COOMA, 9 POLO FLAT ROAD, POLO FLAT

REPORT GG10926.001

14 MARCH 2023

Geotechnical Investigation for a proposed RFS Control Centre at RFS Cooma, 9 Polo Flat Drive, Polo Flat

Prepared for

NSW RFS
C/- NBRS Architecture
Ground floor
4 Glen Street
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14 March 2023

Document Authorisation

Our Ref: GG10926.001

For and on behalf of Green Geotechnics

Matthew Green
Principal Engineering Geologist

Document Control

Revision	Description	Format	Date	Author	Distributed to
-	Final	PDF	14/03/2023	MG	NSW RFS C/- NBRS (Client)

Table of Contents

FIGURES

APPENDICIES

1. INTRODUCTION

This report presents the results of a Geotechnical Investigation carried out by Green Geotechnics Pty Limited for a proposed new RFS Control Centre to be constructed at RFS Cooma, 9 Polo Flat Drive, Cooma, NSW. The investigation was commissioned by NBRS Architecture on behalf of NSW RFS by return acceptance of Proposal PROP-2022-0518A, dated 23 December 2022.

We understand from the supplied architectural drawings that the development comprises construction of a new fire control centre with adjoining sheds, BBQ area, helipad, internal roads, and areas of parking. The development will be roughly at-grade with existing surface levels with minor excavations to a depth of less than 1 metre required for site preparation, foundation construction and landscaping. The pavement areas will be subject to heavy vehicle movements from appliances.

Structural loads have not been advised but we have assumed column loads in the moderate range will apply for this type of development.

The purpose of the investigation was to:

- assess the subsurface conditions over the site,
- provide a Site Classification to AS2870,
- provide a Site Classification to AS1170.4 (earthquake)
- provide recommendations regarding the appropriate foundation system for the site including design parameters,
- comment on safe batter slopes,
- provide retaining wall design parameters,
- provide recommendations for bulk and detailed earthworks,
- provide a pavement thickness design for the construction of flexible and rigid pavements, and
- provide an exposure classification in accordance with AS2159 and AS2870.

2. INVESTIGATION PROCEDURE

2.1 Fieldwork Details

The fieldwork was carried out on 29 February 2023 and comprised a detailed site walkover together with the drilling of nine (9) boreholes numbered BH1 to BH9. The borehole locations were nominated by the project structural engineer. The boreholes were drilled using rotary solid flight augers attached to a utility mounted Christie Engineering drilling rig owned and operated by Green Geotechnics.

The site location is shown in the attached Figure A. The borehole locations, as shown on Figure B, were determined by taped measurements from existing surface features overlain on available architectural drawings of the site. Photographs of the site indicating the borehole locations are shown on Figure C.

The strength of the soils encountered in the boreholes was assessed by undertaking Dynamic Cone Penetrometer (DCP) tests adjacent to each borehole. The strength of the weathered bedrock was estimated by observation of the auger penetration resistance when using a tungsten carbide drilling bit, together with examination of the recovered rock cuttings.

A total of eight (8) soil and rock samples were collected from the boreholes. All soil samples scheduled for chemical analysis were collected directly from the augers using hand tools and were transferred directly into new clean jars or sample bags. All jars and bags were filled to the rim to minimize head space. The samples were then placed into ice-filled chests and transferred to Australian Laboratory Services (ALS) for testing purposes. Samples scheduled for geotechnical analysis were collected from the augers using hand tools or by use of undisturbed tube sampling methods and were transferred into plastic bags or sealed containers prior to being transferred to Australian Soil & Concrete Testing (ASCT). Chain of Custody documentation was used to record and track the samples.

Groundwater observations were made in all boreholes during drilling, on completion of drilling and a short time after completion of drilling. No longer term monitoring of groundwater was carried out.

The fieldwork was completed in the full-time presence of our senior field geologist who set out the boreholes, nominated the sampling and testing, and prepared the borehole logs. The logs are attached to this report, together with a glossary of the terms and symbols used in the logs.

For further details of the investigation techniques adopted, reference should be made to the attached explanation notes.

Environmental and contamination testing of the soils was beyond the agreed scope of the works for Green Geotechnics.

2.2 Laboratory Testing

In order to assist with determining the Site Classification, undisturbed soil samples were obtained for shrink swell testing. To assist with determining the pavement thickness bulk samples of subgrade material were collected for soaked California Bearing Ratio (CBR) testing.

To assess the soils for their aggressiveness and levels of salinity, representative soil samples were tested to determine the following:

- pH,
- Sulphate Content (SO4),
- Chloride Content (CL), and
- Electrical Conductivity (EC).

The detailed test reports are provided in Appendix B and are discussed in Sections 4.2, 4.8 and 4.10 of this report.

3. RESULTS OF INVESTIGATION

3.1 Site Description

The proposed Cooma RFS control centre is located at the former Polo Flat Airfield at 9 Polo Flat Road, Polo Flat (Lot 14 in DP250029). The airfield is irregular in shape with an area of approximately 56 hectares.

The proposed RFS control centre is located in the north west corner of the former airfield, adjacent to the existing RFS facility at 11 Geebung Street. At the time of the fieldwork the site was vacant and comprised open grasslands which are part of the former airfield. The site is separated from the existing RFS facility by a metal chain link fence.

The ground surface over the footprint of the proposed facility falls gently to the south east with a fall of approximately 4 metres across the site from Reduced Level (RL) 816 metres Australian Height Datum (AHD) to RL 820 metres AHD.

To the north, south and east of the site are open grasslands from the former airfield together the remnants of the former asphalt airstrip. To the west of the site are a series of industrial sheds and buildings which are accessed via Geebung Street. The structures are single storey and primarily constructed of metal, concrete and brick.

3.2 Regional Geology & Subsurface Conditions

Reference to MinView by the State of New South Wales through Regional NSW 2021 illustrates the site is underlain by Quaternary Age clastic sediments comprising clays, silts, sands and gravel. Approximately 30 metres to the west of the site is a geological boundary with Cenozoic age igneous Dolerite bedrock associated with the Monaro Volcanics Group and approximately 350 metres to the east of the site is a geological boundary with Silurian Age Dacite bedrock associated with the Bredbo group of the Colinton Volcanics.

For the development of a site-specific geotechnical model, the observed subsurface conditions from the boreholes have been grouped into three (3) geotechnical units which are summarised as follows:

Unit 1 – Natural Silty Clays:

Natural firm becoming firm to stiff, stiff and very stiff silty clays were encountered from the surface to depths of 0.7 to 5.8 metres, being generally deepest over the eastern half of the site. The upper firm clays generally do not extend below depths of 0.4 to 0.6 metres. The clays were assessed to be medium to high plasticity becoming low plasticity with depth, and moist becoming dry and moist with depth. The clays increase in strength with depth.

Unit 2 – Natural Clayey Gravels (BH1 and BH9 only)

Natural clayey gravels (completely weathered Dolerite) were encountered below the upper clays in BH1 and BH3 and extend to depths of 1.0 to 1.1 metres. The gravels were assessed to be very stiff/dense.

Unit 3 – Weathered Dacite and Dolerite Bedrock:

Weathered Dacite and Dolerite bedrock underlies the site. The Dolerite is primarily encountered over the western portion of the site in BH1, BH3 and BH9 and has a relatively limited weathering profile, being unable to be penetrated below depths of 1.0 to 2.0 metres. The Dacite bedrock was encountered over the central and eastern portion of the site and was able to be penetrated to depths of up to 6 metres with corresponding strengths of very low and low strength.

For this assessment, the bedrock has been split into two units. Unit 3A materials represent the bedrock able to be easily penetrated with the auger (Class 5 rock), and Unit 3B materials represent the stronger bedrock with a lower rate of penetration as noted on the borehole logs (Class 4).

Groundwater seepage was not observed during auger drilling of the boreholes.

4. GEOTECHNICAL RECOMMENDATIONS

4.1 Primary Geotechnical Considerations

Based on the results of the assessment, we consider the following to be the primary geotechnical considerations for the development:

- Construction of pavements on variable subgrade materials, including localised pockets of near surface firm clays, and
- Foundation design for structural loads.

4.2 Site Classification to AS2870

To assist with determining the Site Classification, undisturbed soil samples were obtained for Shrink Swell Testing. The results of the testing are summarised below in Table 4.1.

TABLE 4.1 – Atterberg Limit Test Results

Borehole ID	Sample Depth	Shrink Swell Index ISS (%)
BH2	0.4 – 0.7m	0.8
BH5	0.6 – 0.85m	1.9

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Based on the subsurface conditions observed and results of the laboratory testing, and provided the recommendations provided in Section 4.4 of this report are adopted and the footings bear at least firm to stiff natural clays, the site may be reclassified ***Moderately Reactive (M).***

Foundation design and construction consistent with this classification shall be adopted as specified in the above referenced standard and in accordance with the following design details.

4.3 Site Classification to AS1170.4 (Earthquake)

The site sub-soil classification has been determined using AS1170.4-2007. The classification is based on the results of the borehole drilling. The depth of soil recorded in the subsurface profile exceeds 3 metres over the majority of the site, therefore the site is classified as a Shallow Soil Site (C_e). An earthquake hazard factor (Z) of 0.08 applies to sites within the Cooma area.

4.4 Foundation Design

Following site preparation and re-grading we expect the exposed materials at foundation level to comprise a combination of fill in areas which have been re-graded, and natural clays in areas which are at-grade or in cut. Footings may be founded in fill provided that the fill is placed as controlled engineered fill in accordance with the recommendations given in Section 4.9 of this report. Alternatively, all structural loads should be transferred to the underyling natural clays of at least firm to stiff consistency, or transferred to the underlying bedrock using piled foundations. Any topsoil, soft/firm clayey soils or uncontrolled fill materials should not be relied upon for foundation support.

Foundation design parameters for the various units are provided in Table 4.2 below:

TABLE 4.2 – Foundation Design Parameters

Material	Maximum Allowable (Serviceability) Values (kPa)			Typical E_{field} MPa	Modulus of subgrade reaction k_s (kPa/m)^
	End Bearing Pressure	Shaft Friction in compression#	Shaft Friction in tension*		
Uncontrolled Fill / Topsoil / Soft/Firm Clay	-	-	-	-	-
Controlled Fill and Firm to Stiff Clay	100	-	-	8	1.2×10^4
Stiff Clay	150	20	10	15	1.2×10^8
Very Stiff Clay	300	20	10	30	3.6×10^4
Class 5 Bedrock	700	70	35	75	8.4×10^4
Class 4 Bedrock	1000	100	75	100	1.2×10^5

* Uplift capacity of piles in tension loading should also be checked for inverted cone pull out mechanism.

clean socket of roughness category R2 or better is assumed

^The modulus of subgrade (ks) for a footing acting in the vertical direction is a function of various factors including depth and footing size. The following generalized relationship can be derived by making a few assumptions: ks = 120 x qa kPa/m (where qa = allowable bearing pressure)

The parameters for Class 4 bedrock provided in Table 4.2 apply to bored pile foundations. They should not be adopted for steel screw piles.

Settlements for pad footings or piled foundations in bedrock are anticipated to be about 1% of the minimum footing dimension, based on serviceability parameters as per Table 4.2. Settlements for pad footings in soils are anticipated to be up to about 15mm where loading does not exceed the maximum allowable values.

All shallow footings should be poured with minimal delay (i.e. preferably on the same day of excavation) or the base of the footing should be protected by a concrete blinding layer after cleaning of loose spoil and inspection.

The site is considered suitable for the use of conventional bored cast in-situ piles. Due to the shallow nature of the bedrock over the western half of the site the site is not considered suitable for the use of steel screw piles. Relatively large piling rigs fitted with rock drilling augers will however be required to penetrate the Dolerite bedrock encountered over the western half of site.

Based on the observations made during auger drilling, the sidewalls of bored piles are expected to remain stable during drilling. However, pile excavations should not be left open overnight. The possibility of some minor seepage needs to be considered when drilling bored piles and pouring concrete.

Bored pile footings should be drilled, cleaned, inspected and poured with minimal delay, on the same day. Water should be prevented from ponding in the base of footings as this will tend to soften the foundation material, resulting in further excavation and cleaning being required.

The initial stages of footing excavation/drilling, particularly if bored piles are adopted, should be inspected by a geotechnical engineer/engineering geologist to ascertain that the recommended foundation material has been reached and to check initial assumptions about foundation conditions and possible variations that may occur between borehole locations. The need for further inspections can be assessed following the initial visit.

4.5 Excavation Conditions

At the time of preparing this report detailed architectural drawings for the development were not available. However, based on the site slope we anticipate any excavations required for construction of the control centre would be limited in depth to no greater than 1.5 metres. Based on the results of the testing, bulk excavations to depths of up to 1.5 metres are expected to encounter clayey soils overlying Dacite and Dolerite bedrock. Excavators without assistance should be capable of excavating the soils and weathered bedrock to depths of up to 1.5 metres, however some ripping will likely be required during excavation of the Class 4 Dolerite over the western portion of the site. We do not anticipate the need to use hydraulic rock hammers during the works.

4.6 Safe Batter Slopes

In the short term, dry cut slopes should remain stable at an angle of 1 to 1. In the long term dry cut slopes formed at an angle of 2(H) to 1(V) should remain stable. Slopes cut at this angle would be subject to erosion unless protected by topsoil and diversion drains at the crest of the slopes. In order to use mowers to maintain cut slopes, an angle of 4(H) to 1(V) or flatter should be used.

4.7 Retaining Wall Design

When considering the design of any retaining walls, it will be necessary to allow for the loading from adjoining structures, any ground surface slope and the water table present.

A triangular stress distribution should be adopted for the design of a cantilevered retaining wall. The lateral earth pressure for a cantilevered wall should be determined as a proportion of the vertical stress, as given in the following formula:

$\sigma z = K\ z\ \gamma$, where σz = Horizontal pressure at depth z (kPa)

K = Earth pressure coefficient

z = Depth (m)

γ = Unit weight of soil or rock (kN/m^3)

Retaining walls may be designed using the parameters provided below in Table 4.3.

TABLE 4.3 – Retaining Wall Design Parameters

Material Unit	Unit Weight (kN/m^3)	Earth Pressure Coefficient		
		Active (K_a)	At Rest (K_O)	Passive (K_p)
1 & 2	18	0.4	0.6	2.5
3A	21	0.33	0.50	3.5
3B	22	0.3	0.45	4.5

The embedment of retaining walls can be used to achieve passive support. A triangular passive earth pressure distribution (increasing linearly with depth) may be assumed, starting from 0.5 m below excavation toe/base level.

Adequate drainage must be installed behind any retaining or below ground structures to prevent the build-up of hydrostatic forces.

4.8 Pavement Design & Construction

4.8.1 – Concrete Pavement Thickness Design

The laboratory testing carried out indicated the existing subgrade has a CBR value of 6%. The design traffic volume is difficult to determine for this type of development. In the absence of design traffic loadings, we have adopted a design traffic loading of 5×10^5 Commercial Vehicle Axle Group (CVAGs). Using the above data, the suggested pavement thickness is as follows:

TABLE 4.4 – Rigid Pavement Thickness Design

28 Day Concrete Strength (MPa)	Concrete Base Thickness (mm)	Subbase Thickness (mm)
32	170	100
40	150	100

4.8.1 – Flexible Pavement Thickness Design

The flexible pavement thicknesses have been determined using the procedures given in Australian Roads Research Board (ARRB) "Sealed Local Roads Manual." We have assumed a 95% confidence level that the pavement will perform satisfactorily during its design life. A design traffic loading of 3 x 10^5 ESAs is considered appropriate for the site provided the pavement is subjected to occasional heavy vehicle movements. For a subgrade CBR value of 6.0%, the suggested pavement thickness is a recommended minimum of 390 mm, made up as follows:

TABLE 4.5 – Flexible Pavement Thickness Design

Material Type	Minimum Thickness (mm)
AC	50
Base Course	150
Subbase	190
TOTAL	**390**

4.8.3 – Pavement Construction

The designs given above assume adequate provisions have been made for both surface and subsurface water.

The clayey site soils, which will make up the pavement subgrade are reactive. They will therefore be susceptible to shrinkage and swelling due to moisture content changes. If these subgrade soils are allowed to dry following compaction, it is probably that shrinkage will occur resulting in cracking. After placement of the pavement materials, the subgrade soils will moisten, resulting in swelling and partial loss of strength.

It is therefore recommended that the subgrade be covered as soon as possible after completion of compaction in order to minimise the potential for evaporation and shrinkage to occur.

The subgrade materials should be compacted to a minimum density ratio of 100% of the Standard maximum dry density. Compaction should be verified by proof rolling and in-situ density tests. Base and subbase course materials should be compacted and tested to a minimum density ratio of 98% of the Modified maximum dry density. The level of compaction should be verified by in-situ density testing.

4.9 Site Preparation and re-grading

The performance of the slabs and pavements cannot be guaranteed unless the following procedures are adopted during the site earthworks:

- Remove any vegetation, topsoil and uncontrolled fill present. The exposed subgrade should be inspected by a geotechnical engineer who may wish to proof roll the exposed subgrade with a heavy, non-vibrating roller to detect soft or wet areas. These areas should be excavated to competent material and then filled as detailed below.

- Fill the site to the underside of slab or pavement level, in layers not exceeding 200 mm loose thickness, compacted to achieve a density ratio in the range of 98% to 102% of the Standard maximum dry density, at a moisture content within the range of -2% to +2% of the optimum for the material adopted.

The onsite silty clays can become un-trafficable during periods of wet weather.

4.10 Exposure Classification to AS2870 & AS2159

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation and Tables 5.1 and 5.2 of AS2870-2011. In regard to the electrical conductivity, the laboratory test results have been multiplied by the appropriate factor to convert the results to EC_e.

The soils on the site consist of low permeability clays above the groundwater table. Therefore, the soil conditions B are considered appropriate. The test results are summarised in Table 4.6 below.

Table 4.6 – Exposure Classification Summary Table

Sample ID	Location	Depth (m)	pH	EC_e (dS/m)	Sulfate (ppm)	Chloride (ppm)	Exposure Classification AS2159		Exposure Classification AS2870
							Steel Piles	Concrete Piles	
S1	BH1	0.6	7.8	0.5	<10	<10	Non-Aggressive	Non-Aggressive	A1
S2	BH2	0.2	8.3	0.9	<10	<10	Non-Aggressive	Non-Aggressive	A1
S3	BH5	1.0	9.5	3.8	120	260	Non-Aggressive	Non-Aggressive	A1
S4	BH7	0.5	8.2	0.5	<10	<10	Non-Aggressive	Non-Aggressive	A1

5. FURTHER GEOTECHNICAL INPUT

The following summarises the scope of further geotechnical work recommended within this report. For specific details reference should be made to the relevant sections of this report.

- Geotechnical supervision and testing during bulk earthworks,
- Inspection of footing excavations to ascertain that the recommended foundation has been reached and to check initial assumptions regarding foundation conditions and possible variations that may occur.
- We also recommend that Green Geotechnics view the proposed earthworks and structural drawings in order to confirm they are within the guidelines of this report.

Nevertheless, it will be essential during excavation and construction works that progressive geotechnical inspections be commissioned to check initial assumptions about excavation and foundation conditions and possible variations that may occur between inspected and tested locations and to provide further relevant geotechnical advice.

6. GENERAL RECOMMENDATIONS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and Green Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, the subsurface conditions may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of Green Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

REPORT INFORMATION

Introduction

These notes have been provided to amplify Green Geotechnics report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Green Geotechnics reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several limitations, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. The borehole must be flushed, and any water must be extracted from the hole if further water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, GG will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, GG cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Green Geotechnics will be pleased to assist with investigations or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, GG requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Copyright

FIGURES

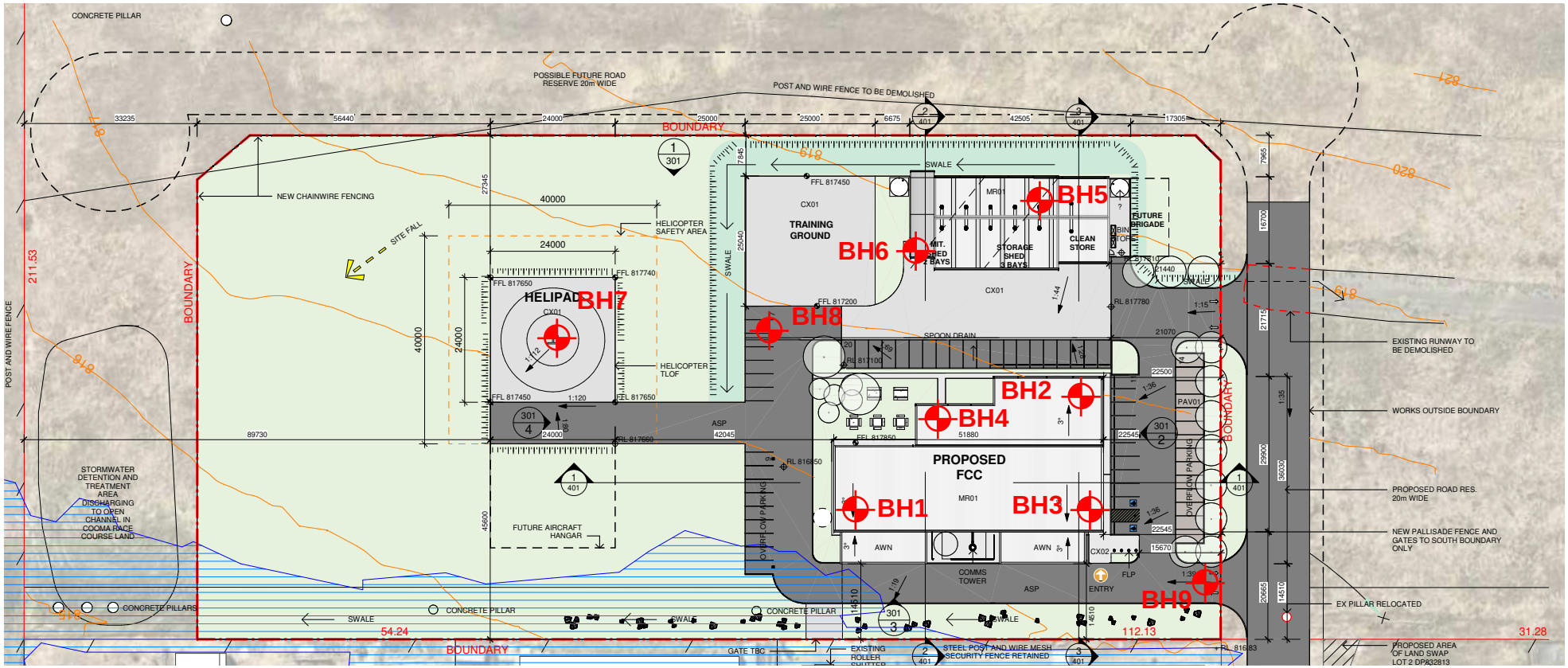
GREEN GEOTECHNICS	Project No: GG10926.001	Geotechnical Investigation RFS Cooma, 9 Polo Flat Road, Polo Flat **SITE LOCATION PLAN**	Figure No: GG10926.001A
	Client: NSW RFS		Drawn By: MG
	Date: 14 March 2023		Scale: Unknown

Legend:

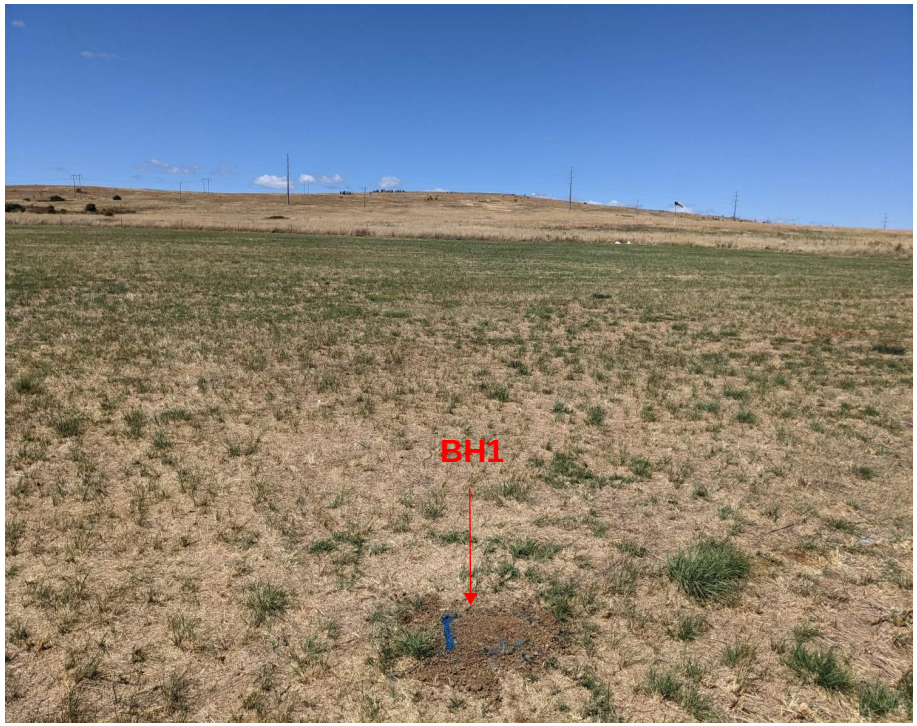
= Borehole

= DCP

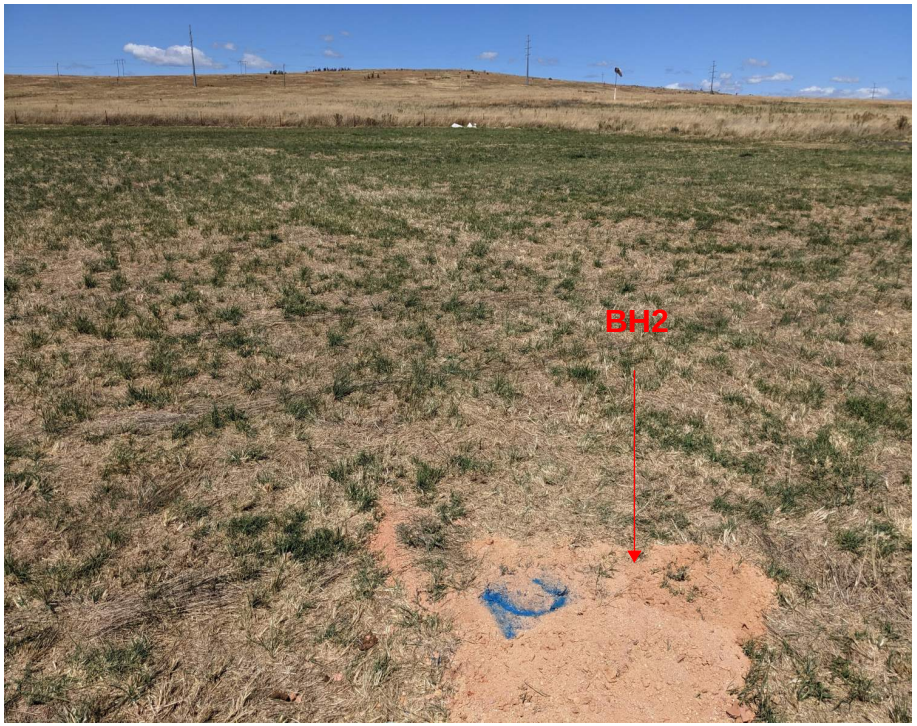
= Test Pit



GREEN GEOTECHNICS	Project No: GG10926.001	Geotechnical Investigation RFS Cooma, 9 Polo Flat Road, Polo Flat **TEST LOCATION PLAN**	Figure No: GG10926.001B
	Client: NSW RFS		Drawn By: MG
	Date: 14 March 2023		Scale: Unknown

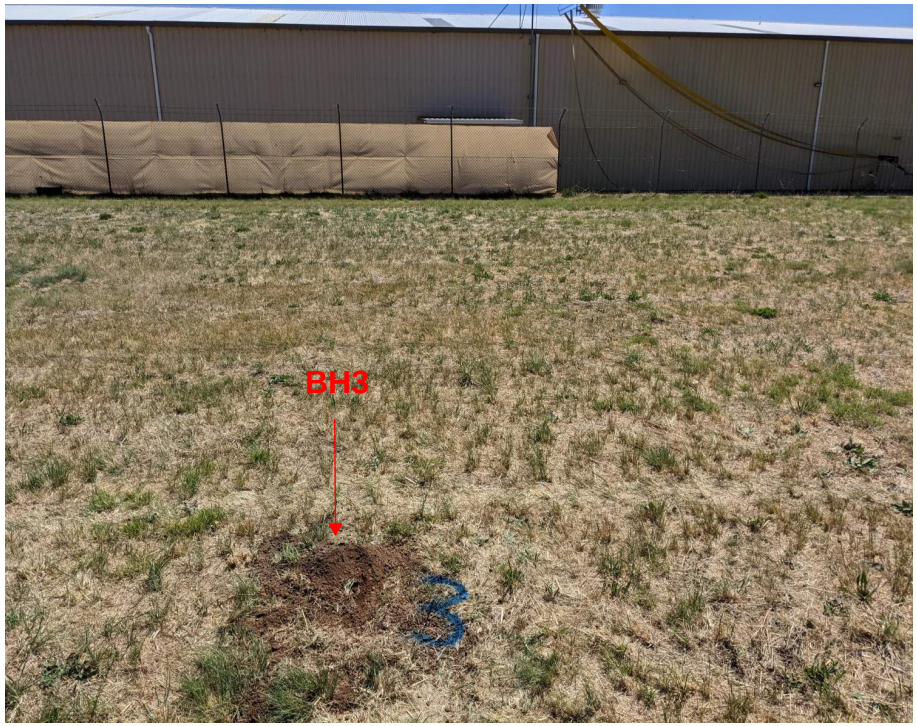


Position of BH1



Position of BH2

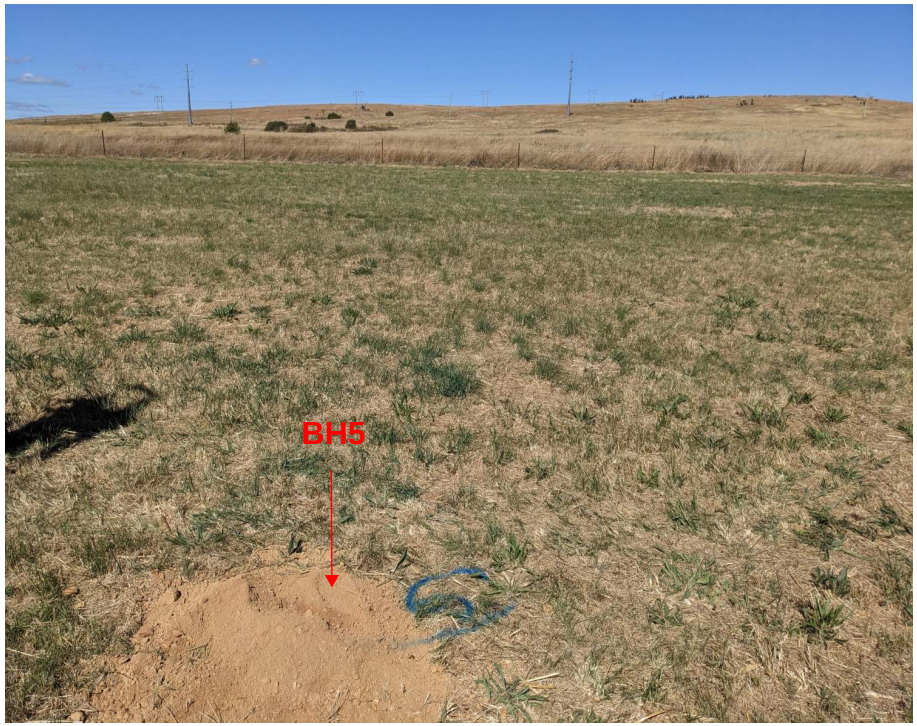
GREEN GEOTECHNICS	Project No: GG10926.001	Geotechnical Investigation RFS Cooma, 9 Polo Flat Road, Polo Flat **SITE PHOTOGRAPHS**	Page: 1 of 5
	Client: NSW RFS		
	Date: 14 March 2023		



Position of BH3

Position of BH4

GREEN GEOTECHNICS	Project No: GG10926.001	Geotechnical Investigation RFS Cooma, 9 Polo Flat Road, Polo Flat **SITE PHOTOGRAPHS**	Page: 2 of 5
	Client: NSW RFS		
	Date: 14 March 2023		



Position of BH5

Position of BH6

Position of BH7

Position of BH8

GREEN GEOTECHNICS	Project No: GG10926.001	Geotechnical Investigation RFS Cooma, 9 Polo Flat Road, Polo Flat **SITE PHOTOGRAPHS**	Page: 4 of 5
	Client: NSW RFS		
	Date: 14 March 2023		

Position of BH9

View of site

GREEN GEOTECHNICS	Project No: GG10926.001	Geotechnical Investigation RFS Cooma, 9 Polo Flat Road, Polo Flat **SITE PHOTOGRAPHS**	Page: 5 of 5
	Client: NSW RFS		
	Date: 14 March 2023		

APPENDIX A – BOREHOLE LOGS

GEOTECHNICAL LOG - NON CORED BOREHOLE

GREEN GEOTECHNICS

Project No: GG10926 | Surface RL: 817.0m AHD | Date Logged : 29/02/202

Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK

Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 1

Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown and orange brown, medium plasticity, trace of fine grained sand.	CI	FIRM TO STIFF	M-D
	S1 at 0.6m	1.0	Clayey GRAVEL: Dark grey with orange brown and dark brown.	GC	STIFF VERY STIFF	D
			DOLERITE: Dark grey with orange brown, fine grained, estimated very low strength (Class 5)			
		2.0	AUGER REFUSAL AT 1.5m ON WEATHERED DOLERITE BEDROCK (CLASS 4)			
		3.0				
		4.0				
		5.0				
		6.0				

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample

S - Chemical Sample | SPT - Standard Penetration Test

WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics

Equipment: Christie Utility

Hole Diameter (mm): 105mm

Angle from Vertical (^{o}): 0

Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 818.0m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 2
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown, medium plasticity, trace of fine grained sand.	CI	FIRM	M-D
	S2 at 0.2m					
	U50 0.4 to 0.7m		Silty CLAY: Dark brown and orange brown, medium to high plasticity, trace of fine grained sand.	CI-CH	FIRM TO STIFF	M
					STIFF	
			Silty CLAY: Red brown with yellow brown and light grey, medium plasticity.	CI	STIFF	M-D
		1.0				
					VERY STIFF	
		2.0				
			DACITE: Yellow brown with orange brown, purple and light grey, fine to medium grained, clay seams. Estimate very low strength (Class 5)			D
		3.0				
		4.0				
		5.0				
		6.0	BOREHOLE DISCONTINUED AT 6.0m ON WEATHERED DACITE (CLASS 5).			

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment:Christie Utility
Hole Diameter (mm): 105mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 817.5m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 3
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown and orange brown, medium plasticity, trace of fine grained sand.	CI	FIRM TO STIFF	D-M
					VERY STIFF	
		1.0	DOLERITE: Dark grey, fine to medium grained with orange brown speckles (vesicles), occasional clay seams, estimate very low strength (Class 5)			D
		2.0	AUGER REFUSAL AT 2.0m ON WEATHERED DOLERITE BEDROCK (CLASS 4).			
		3.0				
		4.0				
		5.0				
		6.0				

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 105mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 817.6m AHD | Date Logged : 29/02/202
Address: RFS Coomna, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 4
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown, medium plasticity, trace of fine grained sand.	CI	FIRM	M-D
			Silty CLAY: Dark brown and orange brown, medium to high plasticity, trace of fine grained sand.	CI-CH	FIRM TO STIFF	M
					STIFF	
			Silty CLAY: Yellow brown with red brown, light grey and purple, low plasticity.	CL	VERY STIFF	M-D
		1.0				
		2.0	DACITE: Orange brown with yellow brown, light grey and purple, clay seams, estimate very low strength (Class 5)			D
		3.0				
		4.0				
		5.0				
		6.0	BOREHOLE DISCONTINUED AT 6.0m ON WEATHERED DACITE (CLASS 5)			

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 105mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 819.0m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 5
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown, medium plasticity, trace of fine grained sand.	CI	FIRM	D-M
	U50 0.6 to 0.85m		Silty CLAY: Dark brown, grey with orange brown, medium to high plasticity, trace of fine grained sand.	CI-CH	FIRM TO STIFF STIFF	M
	S3 at 1.0m	1.0	Silty CLAY: Orange brown with yellow brown and light grey, low plasticity.	CL	VERY STIFF	M-D
		2.0	DACITE: Yellow brown with orange brown and light grey. Estimate very low strength (Class 5)			D
		3.0	AUGER REFUSAL AT 2.1m ON WEATHERED DACITE (CLASS 4).			
		4.0				
		5.0				
		6.0				

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 105mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 819.4m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 6
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown and orange brown, medium plasticity, trace of fine grained sand.	CI	FIRM TO STIFF	D-M
		1.0	Silty CLAY: Orange brown with light grey, yellow brown and light brown, medium plasticity.	CI	STIFF	D-M
		2.0	Gravelly Silty CLAY: Light grey with orange brown and yellow brown, low plasticity, some gravel.	CL	VERY STIFF	D
		3.0	Silty CLAY: Yellow brown with light grey and orange brown, low plasticity (Completely weathered Dacite).	CL	VERY STIFF	D
		4.0				
		5.0				
		6.0	DACITE: Light grey with yellow brown and orange brown, clay seams, trace of gravel (quartz angular piece) CLASS 5. BOREHOLE DISCONTINUED AT 6.0m ON WEATHERED DACITE.			D

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 105mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

GREEN GEOTECHNICS

Project No: GG10926 | Surface RL: 817.3m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 7
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown, medium plasticity, trace of fine grained sand.	CI	FIRM TO STIFF	D-M
	S4 at 0.5m		Silty CLAY: Dark brown and orange brown, medium to high plasticity, trace of fine grained sand.	CI-CH	FIRM TO STIFF	M
			Silty CLAY: Red brown with light grey, medium plasticity.	CI	STIFF	M-D
		1.0				
		2.0				
			Silty CLAY: Yellow brown with light grey and orange brown, low plasticity.	CI	VERY STIFF	M-D
		3.0				
		4.0				D
		5.0				
			SCHIST: Light grey with yellow brown and orange brown, clay seams, trace of gravel (quartz angular pieces). Estimate very low strenght (Class 5)			D
		6	BOREHOLE DISCONTINUED AT 6.0m ON WEATHERED SCHIST.			

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 105mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 817.8m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 8
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown, low plasticity, trace of fine grained sand.	CL	FIRM	M-D
	B1 0.2 to 1.2m		Silty CLAY: Orange brown with light grey and yellow brown, medium plasticity.	CI	FIRM TO STIFF	M-D
		1.0			STIFF	
			BOREHOLE DISCOTINUED AT 1.2m ON SILTY CLAY.			
		2.0				
		3.0				
		4.0				
		5.0				
		6.0				

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 200mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

GEOTECHNICAL LOG - NON CORED BOREHOLE

Project No: GG10926 | Surface RL: 817.3m AHD | Date Logged : 29/02/202
Address: RFS Cooma, 9 Polo Flat Road, Polo Flat | Logged By: JK
Client: NSW RFS | Checked By: MG

BOREHOLE NO.: BH 9
Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (M)	DESCRIPTION (Soil type, colour, grain size, plasticity, minor components, observations)	USC SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			Silty CLAY: Dark brown and orange brown, medium to high plasticity.	CI-CH	FIRM TO STIFF	D-M
	B2 0.2 to 0.6m				STIFF	
			Clayey GRAVEL: Dark grey.	GC	DENSE	D
		1.0	AUGER REFUSAL AT 1.0m ON WEATHERED DOLERITE BEDROCK.			
		2.0				
		3.0				
		4.0				
		5.0				
		6.0				

D - Disturbed sample | U - Undisturbed tube sample | B - Bulk sample
S - Chemical Sample | SPT - Standard Penetration Test
WT - Standing Water Table | SP - Water Seepage Level

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Green Geotechnics
Equipment: Christie Utility
Hole Diameter (mm): 200mm
Angle from Vertical (°): 0
Drill Bit: Spiral TC

Dynamic Cone Penetrometer Test Report

GREEN GEOTECHNICS

Project Number: GG10926

Site Address: RFS Cooma, 9 Polo Flat Road, Polo Flat

Test Date: 29/02/2023

Test Method: **AS 1289.6.3.2**

Technician: JK

Test No	BH1	BH2	BH3		BH1	BH2	BH3
Starting Level	Surface Level	Surface Level	Surface Level	Starting Level	N/A	N/A	N/A
Depth (m)	Penetration Resistance (blows / 150mm)			Depth (m)	Penetration Resistance (blows / 150mm)		
0.00 - 0.15	2	2	2	3.00 - 3.15			
0.15 - 0.30	4	2	3	3.15 - 3.30			
0.30 - 0.45	6	3	4	3.30 - 3.45			
0.45 - 0.60	12	4	3	3.45 - 3.60			
0.60 - 0.75	22	12	22	3.60 - 3.75			
0.75 - 0.90	Refusal	5	Refusal	3.75 - 3.90			
0.90 - 1.05		5		3.90 - 4.05			
1.05 - 1.20		22		4.05 - 4.20			
1.20 - 1.35		Refusal		4.20 - 4.35			
1.35 - 1.50				4.35 - 4.50			
1.50 - 1.65				4.50 - 4.65			
1.65 - 1.80				4.65 - 4.80			
1.80 - 1.95				4.80 - 4.95			
1.95 - 2.10				4.95 - 5.10			
2.10 - 2.25				5.10 - 5.25			
2.25 - 2.40				5.25 - 5.40			
2.40 - 2.55				5.40 - 5.55			
2.55 - 2.70				5.55 - 5.70			
2.70 - 2.85				5.70 - 5.85			
2.85 - 3.00				5.85 - 6.00			

Remarks: * Pre drilled prior to testing

Dynamic Cone Penetrometer Test Report

GREEN GEOTECHNICS

Project Number: GG10926

Site Address: RFS Cooma, 9 Polo Flat Road, Polo Flat

Test Date: 29/02/2023

Test Method: **AS 1289.6.3.2**

Technician: JK

Test No	BH4	BH5	BH6		BH4	BH5	BH6
Starting Level	Surface Level	Surface Level	Surface Level	Starting Level	N/A	N/A	3.00m
Depth (m)	Penetration Resistance (blows / 150mm)			Depth (m)	Penetration Resistance (blows / 150mm)		
0.00 - 0.15	2	2	3	3.00 - 3.15			*
0.15 - 0.30	3	3	2	3.15 - 3.30			*
0.30 - 0.45	3	3	4	3.30 - 3.45			*
0.45 - 0.60	5	4	6	3.45 - 3.60			*
0.60 - 0.75	6	5	8	3.60 - 3.75			*
0.75 - 0.90	10	6	8	3.75 - 3.90			*
0.90 - 1.05	12	10	7	3.90 - 4.05			*
1.05 - 1.20	14	12	10	4.05 - 4.20			8
1.20 - 1.35	22	22	9	4.20 - 4.35			19
1.35 - 1.50	Refusal	Refusal	11	4.35 - 4.50			12
1.50 - 1.65	*		8	4.50 - 4.65			22
1.65 - 1.80	*		9	4.65 - 4.80			Refusal
1.80 - 1.95	*		12	4.80 - 4.95			
1.95 - 2.10	*		16	4.95 - 5.10			
2.10 - 2.25	*		22	5.10 - 5.25			
2.25 - 2.40	14		Refusal	5.25 - 5.40			
2.40 - 2.55	18		*	5.40 - 5.55			
2.55 - 2.70	22		*	5.55 - 5.70			
2.70 - 2.85	Refusal		*	5.70 - 5.85			
2.85 - 3.00			*	5.85 - 6.00			

Remarks: * Pre drilled prior to testing

Dynamic Cone Penetrometer Test Report

GREEN GEOTECHNICS

Project Number: GG10926

Site Address: RFS Cooma, 9 Polo Flat Road, Polo Flat

Test Date: 29/02/2023

Test Method: **AS 1289.6.3.2**

Technician: JK

Test No	BH7	BH8	BH9		BH7	BH8	BH9
Starting Level	Surface Level	Surface Level	Surface Level	Starting Level	3.00m	N/A	N/A
Depth (m)	Penetration Resistance (blows / 150mm)			Depth (m)	Penetration Resistance (blows / 150mm)		
0.00 - 0.15	2	3	2	3.00 - 3.15	*		
0.15 - 0.30	3	2	4	3.15 - 3.30	*		
0.30 - 0.45	4	4	6	3.30 - 3.45	*		
0.45 - 0.60	3	8	22	3.45 - 3.60	*		
0.60 - 0.75	5	6	Refusal	3.60 - 3.75	*		
0.75 - 0.90	10	9		3.75 - 3.90	*		
0.90 - 1.05	6	10		3.90 - 4.05	10		
1.05 - 1.20	14	8		4.05 - 4.20	8		
1.20 - 1.35	9	Discontinued		4.20 - 4.35	14		
1.35 - 1.50	10			4.35 - 4.50	19		
1.50 - 1.65	11			4.50 - 4.65	22		
1.65 - 1.80	9			4.65 - 4.80	Refusal		
1.80 - 1.95	18			4.80 - 4.95			
1.95 - 2.10	22			4.95 - 5.10			
2.10 - 2.25	Refusal			5.10 - 5.25			
2.25 - 2.40	*			5.25 - 5.40			
2.40 - 2.55	*			5.40 - 5.55			
2.55 - 2.70	*			5.55 - 5.70			
2.70 - 2.85	*			5.70 - 5.85			
2.85 - 3.00	*			5.85 - 6.00			

Remarks: * Pre drilled prior to testing

SAMPLING & IN-SITU TESTING

GREEN GEOTECHNICS

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock. Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure. Undisturbed samples are taken by pushing a thin walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator.

Large Diameter Augers

Boreholes can be drilled using a large diameter auger, typically up to 300 mm or larger in diameter mounted on a standard drilling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration.

Diamond Core Rock Drilling

A continuous core sample of can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter (NMLC). The borehole is advanced using a water or mud flush to lubricate the bit and removed cuttings.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable, and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as: 15, 30/40 mm.

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.

- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

SOIL DESCRIPTIONS

GREEN GEOTECHNICS

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle Size (mm)
Boulder >200	Boulder >200
Cobble 63 - 200	Cobble 63 - 200
Gravel 2.36 - 63	Gravel 2.36 - 63
Sand 0.075 - 2.36	Sand 0.075 - 2.36
Silt 0.002 - 0.075	Silt 0.002 - 0.075
Clay <0.002	Clay <0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle Size (mm)
Coarse Gravel	20 – 63
Medium Gravel	6 – 20
Fine Sand	2.36 – 6
Coarse Sand	0.6 – 2.36
Medium Sand	0.2 – 0.6
Fine Sand	0.075 – 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion
And	Specify
Adjective	20 - 35%
Slightly	12 - 20%
With some	5 - 12%
With a trace of	0 - 5%

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained Shear Strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	ST	50 - 100
Very stiff	VST	100 - 200
Hard	H	200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (DCP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N Value	CPT qc value (MPa)
Very loose	VL	<4	<2
Loose	L	4 - 10	2 -5
Medium Dense	MD	10-30	5-15
Dense	D	30-50	15-25
Very Dense	VD	>50	>25

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

ROCK DESCRIPTIONS

GREEN GEOTECHNICS

Rock Strength

The Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $IS_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200

* Assumes a ration of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable.
Moderately weathered	MW	Staining and discolouration of rock substance has taken Place.
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh stained	FS	Rock substance unaffected by weathering but staining visible along defects.
Fresh	FR	No signs of decomposition or staining.

Degree of Fracturing

The following classification applies to the spacing of natural fractures in core samples (bedding plane partings, joints and other defects, excluding drilling breaks

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured Core	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Unbroken Core lengths mostly > 1000 mm

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	2 m

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling/handling, then the broken pieces are fitted back together and are not included in the calculation of RQD.

ABBREVIATIONS

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

Z	Water seep
V	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
S	Chemical sample
U50	Undisturbed tube sample (50mm)
W	Water sample
PP	Pocket Penetrometer (kPa)
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

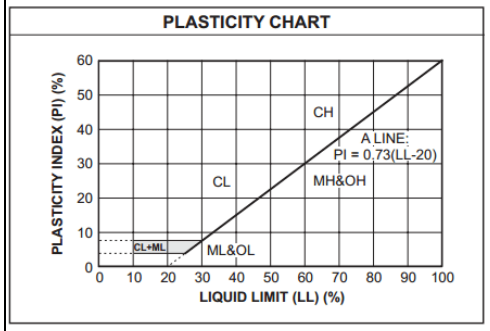
Other

fg	fragmented
bnd	band
qtz	quartz

UNIFIED SOIL CLASSIFICATION TABLE

GREEN GEOTECHNICS

Field Identification Procedures (Excluding particles larger than 75um and basing fractions on estimated weights)				Group Symbols	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils More than half of the material is large that 75um sieve size[b] — The 75um sieve size is about the particle visible to the naked eye	Gravels More than half of the coarse fraction is larger than a 4mm sieve	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name: indicative approximate percentages of sand and gravel; maximum size; angularity; surface condition, and hardness of the coarse grains; local of geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty Sand*, gravelly; about 20% hard, angular gravel particles 12mm maximum size; rounded and subangular sand grains, coarse to fine, about 15% non-plastic fines low dry strength; well compacted and moist in place; alluvial sand; *(SM)*	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75um sieve size) coarse grained soils are classified as follows Less than 5% GW, GP, SW, SP More than 12% GM, GC, SM, SC 5 to 12% Borderline cases requiring use of dual symbol $C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all graduation requirements for *GW* Atterberg limits below "A" line or *PI* less than 4 — Above "A" line with *PI* between 4 and 7 are borderline cases of requiring use of dual symbols Atterberg limits above "A" line with *PI* greater than 7
		Gravels with fines (appreciable amount of fines)	Predominantly one size or range of sizes with some intermediate sizes missing	*GP*	Poorly graded gravels, grave-sand mixtures, little or no fines		
			Nonplastic fines (for identification procedures see *ML* below)	*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures		
			Plastic fines (for identification procedures see *CL* below)	*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures		
	Sands More than half of the coarse fraction is smaller than a 4mm sieve	Clean sands (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*SW*	Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all graduation requirements for *SW* Atterberg limits below "A" line or *PI* less than 5 — Above "A" line with *PI* between 4 and 7 are borderline cases of requiring use of dual symbols Atterberg limits above "A" line with *PI* greater than 7
			Predominantly one size or range of sizes with some intermediate sizes missing	*SP*	Poorly graded sands, gravelly sands, little or no fines		
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)	*SM*	Silty sands, poorly graded sand-silt mixtures		
			Plastic fines (for identification procedures see *CL* below)	*SC*	Clayey sands, poorly graded sand-clay mixtures		
Find-grained soils More than half of the material is smaller than 75um sieve size	Identification Procedures of Fractions Smaller than 380 um Sieve Size						
	Silts and clays liquid limit less than 50	Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)			
		None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slit plasticity	Give typical name: indicative degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey Silt,* brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; *(ML)*
		Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts	
		High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils	



Plasticity Chart
For laboratory classification of fine-grained soils

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines

2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity

APPENDIX B

LABORATORY TEST RESULTS

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A.B.N. 92 328 384 368

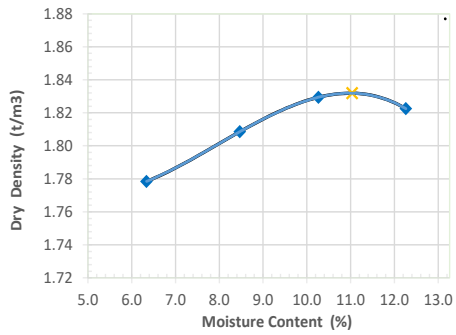
Report on AS CBR and MDD

Client:	Green Geotechnics Pty Ltd	Report No:	**241-307-CBR**
Client Address:	Po Box 3244, Rouse Hill, NSW, 2155	Report Date:	14/03/2023
Project:	Material Testing	Report Page:	Page 1 of 1
Works Component:	RFS Cooma, 9 Polo Flat Road, Polo Flat	Project No:	241
Material Used(Source):	Insitu	Test Request/Order:	**GG10926**
Material Description:	Silty Clay	Lot Number:	GG10926
Lot Boundaries:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 01/03/2023 to 14/03/2023	Control Line:	N/A

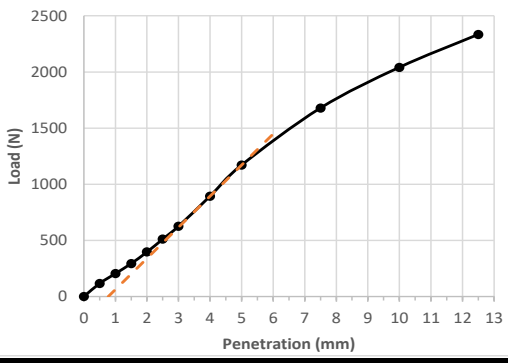
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
36581	**27/02/2023**	**N/A**	**N/A**	**BH8**	**0.2-1.2**

Parameters	Units	Test Results		Information
Pretreatment Regime	--	No Pretreatment		
Portion Retained on AS Sieve	%	2% on 19mm		Retained material excluded from CBR
Material Plasticity (Liquid Limit)	--	Sand / Granular		By Technician's Assessment
Sample Curing Time	hrs	MDD = 2 hrs	CBR = 145 hrs	
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.832		Standard compactive effort
Optimum Moisture Content (OMC)	%	11.0		
Field/Prep Moisture Content	%	Field %	Prep 10.5 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 10.7 %	LMR = 96.5%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.84 t/m3	LDR = 100.5%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.78 t/m3.
Specimen Swell	%	3.0		
Moisture Content - Top 30mm	%	19.3		After Penetration
Moisture Content - Remaining	%	17.3		After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

7

California Bearing Ratios

CBR $_{2.5}$ = 5.0

CBR $_{5.0}$ = 7

Including an Applied Correction of 0.8 mm

Sampling & Test Methods (Results relate only to the items sampled/tested)

AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS1289.2.1.1: (2005) Moisture Content of a Soil (Oven Drying)
AS1289.5.1.1: (2017)Dry Density/Moisture content relation of a soil (Standard)
AS1289.6.1.1: (2014)California Bearing Ratio of a soil (remoulded specimen)

Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Clout
Approved Signatory

**** NATA accreditation does not cover the performance of this service**

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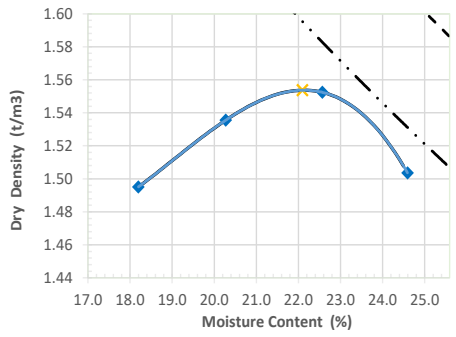
Report on AS CBR and MDD

Client:	Green Geotechnics Pty Ltd	Report No:	**241-308-CBR**
Client Address:	Po Box 3244, Rouse Hill, NSW, 2155	Report Date:	14/03/2023
Project:	Material Testing	Report Page:	Page 1 of 1
Works Component:	RFS Cooma, 9 Polo Flat Road, Polo Flat	Project No:	241
Material Used(Source):	Insitu	Test Request/Order:	**GG10926**
Material Description:	Silty Clay	Lot Number:	GG10926
Lot Boundaries:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 01/03/2023 to 14/03/2023	Control Line:	N/A

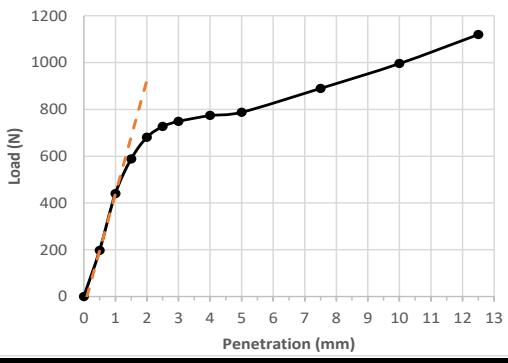
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
36582	**27/02/2023**	**N/A**	**N/A**	**BH9**	**0.2-0.6**

Parameters	Units	Test Results		Information
Pretreatment Regime	--	No Pretreatment		
Portion Retained on AS Sieve	%	0% on 19mm		Retained material excluded from CBR
Material Plasticity (Liquid Limit)	--	Low (Less than 35%)		By Technician's Assessment
Sample Curing Time	hrs	MDD = 126 hrs	CBR = 172 hrs	
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.554		Standard compactive effort
Optimum Moisture Content (OMC)	%	22.1		
Field/Prep Moisture Content	%	Field %	Prep 16.7 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 22.5 %	LMR = 102.0%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.55 t/m3	LDR = 99.5%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.52 t/m3.
Specimen Swell	%	2.0		
Moisture Content - Top 30mm	%	33.8		After Penetration
Moisture Content - Remaining	%	29.2		After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

6

California Bearing Ratios

CBR $_{2.5}$ = 6

CBR $_{5.0}$ = 4.0

Including an Applied Correction of 0.1 mm

Sampling & Test Methods (Results relate only to the items sampled/tested)

AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS1289.2.1.1: (2005) Moisture Content of a Soil (Oven Drying)
AS1289.5.1.1: (2017)Dry Density/Moisture content relation of a soil (Standard)
AS1289.6.1.1: (2014)California Bearing Ratio of a soil (remoulded specimen)

Report Remarks & Endorsement

NATA

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Issued By:

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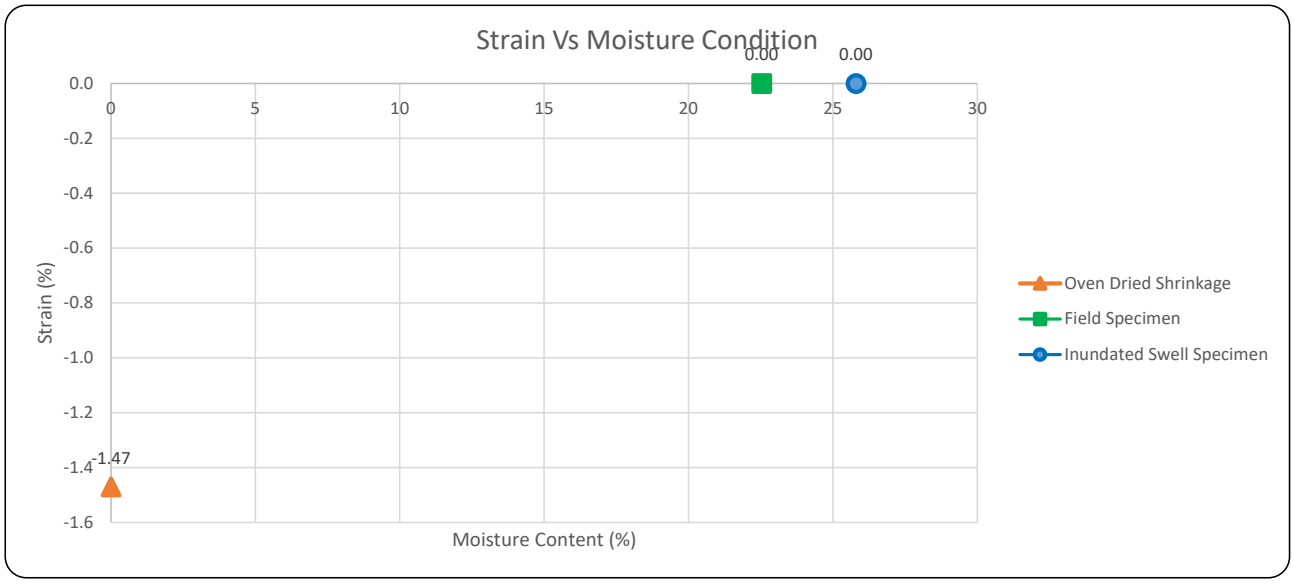
Report on Shrink / Swell Index of a Soil

Client:	ASCT Sydney South Laboratory	Report No:	**33-164-MQ**
Client Address:	Unit 10, 6 Gladstone Road, Castle Hill NSW 2154	Report Date:	6/03/2023
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Polo Flat, Cooma	Project No:	33
Material Used:	-	Test Request/Order:	GG10926
Material Description:	-	Lot Number:	-
Lab Test Date/s:	Testing commenced 02/03/2023 and was completed 03/03/2023.	ITP/PCP Number:	-
Lot Comments:	Sender Number-36579	Control Line:	BH02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
6938	**27/02/2023**	**-**	**-**	**BH02**	**0.4-0.7**

Parameters	Units	Test Results	Soil Description
Shrinkage - Field Moisture Content	%	22.2	CI, Silty CLAY
Swell - Field Moisture Content	%	22.8	
Swell - Inundated Moisture Content	%	25.8	
Inert Inclusions in the soil	%	0	
Extent of Soil Crumbling	-	None	
Extent of Soil Cracking	-	Minor	
Shrink-Swell Index	**%**	**0.8**	



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.7.1.1, Cl 4: (2003) Shrink Swell Index - Thin wall sampler (U50) AS 1289.7.1.1: (2003) Shrink Swell Index of a Soil	

NATA

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NATA Accreditation number: 20656

Issued By: P.Baltoski
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Approved Signatory

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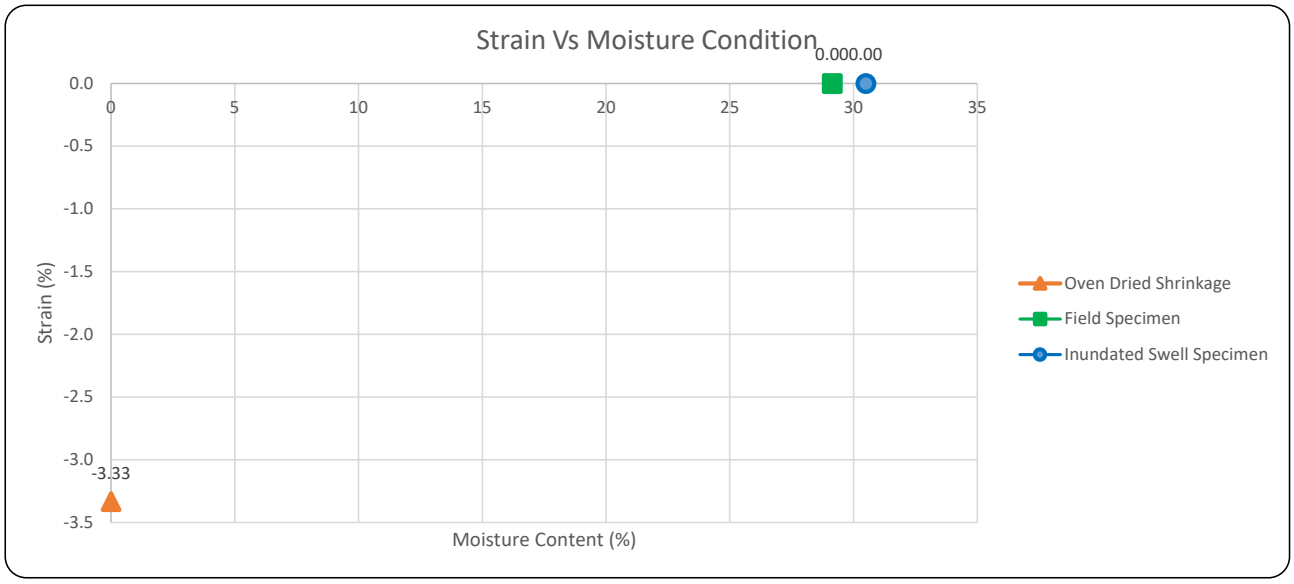
A.B.N. 34 635 062 609

Report on Shrink / Swell Index of a Soil

Client:	ASCT Sydney South Laboratory	Report No:	**33-165-MQ**
Client Address:	Unit 10, 6 Gladstone Road, Castle Hill NSW 2154	Report Date:	6/03/2023
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Polo Flat, Cooma	Project No:	33
Material Used:	-	Test Request/Order:	GG10926
Material Description:	-	Lot Number:	-
Lab Test Date/s:	Testing commenced 02/03/2023 and was completed 03/03/2023.	ITP/PCP Number:	-
Lot Comments:	Sender Number-36580	Control Line:	BH05

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
6939	**27/02/2023**	**-**	**-**	**BH05**	**0.6-0.85**

Parameters	Units	Test Results	Soil Description
Shrinkage - Field Moisture Content	%	29.2	CH,Silty CLAY
Swell - Field Moisture Content	%	29.1	
Swell - Inundated Moisture Content	%	30.5	
Inert Inclusions in the soil	%	0	
Extent of Soil Crumbling	-	None	
Extent of Soil Cracking	-	Minor	
Shrink-Swell Index	**%**	**1.9**	



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.7.1.1, Cl 4: (2003) Shrink Swell Index - Thin wall sampler (U50) AS 1289.7.1.1: (2003) Shrink Swell Index of a Soil	

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NATA Accreditation number: 20656

Issued By: P.Baltoski
P.Baltoski
Approved Signatory

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2306476**	Page	: 1 of 5
Client	: **GREEN GEOTECHNICS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR MATTHEW GREEN	Contact	: Customer Services ES
Address	: PO BOX 3244 ROUSE HILL 2155	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: GG10901 / GG10926 / GG10925	Date Samples Received	: 28-Feb-2023 08:00
Order number	: GG10901 / GG10926 / GG10925	Date Analysis Commenced	: 02-Mar-2023
C-O-C number	: ----	Issue Date	: 06-Mar-2023 15:03
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

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.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

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
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	GG10901/S1	GG10901/S2	GG10901/S3	GG10901/S4	GG10926/S1
			Sampling date / time	24-Feb-2023 00:00	24-Feb-2023 00:00	24-Feb-2023 00:00	24-Feb-2023 00:00	24-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2306476-001	ES2306476-002	ES2306476-003	ES2306476-004	ES2306476-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**8.5**	**8.0**	**8.8**	**8.0**	**7.8**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**235**	**209**	**360**	**322**	**40**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**12.3**	**15.8**	**16.2**	**15.5**	**10.3**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**160**	**70**	**50**	**70**	<10
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**70**	**340**	**400**	**720**	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	GG10926/S2	GG10926/S3	GG10926/S4	GG10925/S1	GG10925/S2
			Sampling date / time	24-Feb-2023 00:00	24-Feb-2023 00:00	24-Feb-2023 00:00	24-Feb-2023 00:00	24-Feb-2023 00:00
Compound	CAS Number	LOR	Unit	ES2306476-006	ES2306476-007	ES2306476-008	ES2306476-009	ES2306476-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**8.3**	**9.5**	**8.2**	**5.8**	**5.9**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**117**	**469**	**64**	**97**	**150**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**11.5**	**18.5**	**11.4**	**5.1**	**7.2**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	**120**	<10	**70**	**100**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	**260**	<10	**60**	**130**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	GG10925/S3	GG10925/S4	----	----	----
			Sampling date / time	24-Feb-2023 00:00	24-Feb-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2306476-011	ES2306476-012	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.2**	**5.6**	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**46**	**28**	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**16.1**	**11.0**	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**20**	**20**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	**30**	----	----	----