GOLDER
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REPORT

Geotechnical Investigation

CBH Group Konnongorring Rail Loading Facility

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1791739-070-R-Rev0

June 2023

Distribution List

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1.0 INTRODUCTION

This report presents the results of the geotechnical investigations undertaken by Golder Associates Pty Ltd (Golder) for the proposed Co-operative Bulk Handling Group Ltd (CBH) Rail Loading Facility at the receival facilities at Konnongorring. The scope of work was outlined in Golder proposal P1791739-052-L-Rev0, dated 9 June 2022, and authorised through CBH purchase order 4500512840, dated 13 June 2022.

This report includes the geotechnical investigations to assess foundation conditions for the proposed development and to support the pavement and rail formation design for the new rail loading facility and rail siding. The location of the site in relation to the surrounding area is shown on Figure 1, Location Plan.

2.0 PROPOSED DEVELOPMENT

The CBH receival facility at Konnongorring is an existing grain storage facility bounded by Northam-Pithara Road to the east and Konnongorring West Road to the north. We have been advised that the proposed development includes the construction of:

- A 52-wagon rail siding (1,080 m length of track).
- Two turn outs.
- New rail loading facility.
- A new 2 x 1,550 tonne Over Rail Bin (ORB) loading facility at the existing E-type storage facility, which will be demolished.

The layout of the existing facility and proposed expansion is shown on Figure 2, Site Plan.

3.0 OBJECTIVES

The objectives of the geotechnical investigation are to:

- Assess subsurface soil and groundwater conditions at the site (within the limits of the investigation).
- Assign a subgrade design California bearing ratio (CBR) value for pavement design.
- Provide a pavement thickness and surfacing design for the rail access track and the pavements around the ORB loading facility.
- Provide a site classification in accordance with AS 2870 (2011).
- Assess excavation conditions in areas of cut, including maximum permissible batter slopes and the suitability of cut for re-use as fill material.
- Provide advice on the suitability of *in situ* materials in areas of excavation for use in construction.
- Provide bearing capacity and settlement estimates for footings for proposed structures. This will require the supply of footing sizes and loads by the structural designer.
- Provide pile design parameters (if required).
- Provide the geotechnical reduction factor for pile design in accordance with AS 2159 (if required).
- Assess the earthquake site factor for the site in accordance with AS 1170.4 (2007).
- Provide advice on the aggressiveness of the soil to buried steel and concrete structures.
- Review ARC Infrastructure (ARC) specifications and requirements and assess and recommend *in situ* foundation preparation requirements in order to comply with ARC specifications and requirements.

- Assess the presence and expected quantity of unsuitable materials.
- Assess lime demand requirements should reactive soils be encountered.
- Provide a preliminary assessment of the likely presence of acid sulfate soils.
- Provide comment on other geotechnical factors that may influence construction or performance, including advice on compaction, pavement dry back requirements etc.

4.0 FIELDWORK

The geotechnical investigation was conducted between 1 September 2022 and 6 September 2022 comprised:

- Excavation of 15 test pits, extending to depths of between 0.2 m and 3.0 m. Test pit locations TP06 and TP08 were not excavated as the service locator was unable to locate nearby services. Test pit locations TP10 to TP12 were also not excavated as they coincided with pavement areas and the clearance spacing from the rail was less than the permitted.
- Dynamic cone penetrometer (DCP) testing adjacent to each test pit extending to depths of up to 1.0 m.
- Drilling of two boreholes, BH1 and BH2, using HQ3 diamond drilling techniques, extending to depths of 20 m. Standard penetration testing was conducted at 1.5 m depth intervals in granular soils.
- *In situ* permeability testing at three locations, IF1 and IF3, using the inverse auger method, extending to a depth of about 1.0 m.
- Earth electrical resistivity testing on two perpendicular traverses.
- Collection of geotechnical and acid sulfate soil samples within selected test pits and boreholes.

Test locations were positioned using a hand-held GPS, accurate to about ±5 m. A summary of the investigation locations is provided in the table below. The test locations are shown on Figure 2, Site Plan.

Table 1: Summary of Geotechnical Investigation Locations

Location ID	Easting (m MGA94)	Northing (m MGA94)	Measured Depth to Groundwater (m bgl)	Termination Depth (m bgl)	Termination Remark
BH01	478398	6564747	GNO	20.0	Target Depth
BH02	478391	6564759	6.6	20.0	Target Depth
TP01	478547	6564018	GNE	2.2	Refusal
TP02	478588	6564080	GNE	3.0	Target Depth
TP03	478617	6564158	GNE	3.0	Target Depth
TP04	478623	6564221	GNE	2.5	Refusal
TP05	478618	6564283	GNE	0.7	Refusal
TP07	478552	6564411	GNE	0.6	Refusal
TP09	478499	6564532	2.5	3.0	Target Depth
TP13	478343	6564832	GNE	0.6	Refusal
TP14	478239	6564820	GNE	1.2	Refusal
TP15	478155	6564785	GNE	2.1	Refusal
TP16	478127	6564853	GNE	1.2	Refusal
TP17	478185	6564875	GNE	0.2	Refusal
TP18	478239	6564916	GNE	0.8	Refusal
TP19	478108	6564933	GNE	2.5	Refusal
TP20	478178	6564969	GNE	0.7	Refusal
IF1	478499	6564532	-	0.85	Target Depth
IF2	478239	6564916	-	0.55	Refusal
IF3	478239	6564820	-	0.32	Refusal

Notes: GNE – Groundwater not encountered within test pit, GNO – Groundwater not observed at time of drilling/test pit excavation

The test pits were excavated using 8 tonnes rubber wheel backhoe owned and operated by WC & SJ Earthmoving. The test pit reports from the fieldwork program are presented in Appendix A, along with a list of the notes and abbreviations used on the reports. The method of soil description and simplified cementation classification system adopted is also included in Appendix A.

DCP testing was conducted adjacent to the test pits in accordance with AS 1289.6.3.2 and are provided on the test pit reports included in Appendix A.

The drilling was undertaken using a GDR650 truck mounted drill rig owned and operated by Ozdrill Pty Ltd. Drilling was undertaken using HQ3 techniques. Golder field personnel supervised the drilling and logged the soil and rock recovered during drilling. Borehole reports from the fieldwork program are presented in Appendix B, along with a list of the notes and abbreviations used on the reports. The method of soil description and simplified cementation classification system adopted is also included in Appendix B.

The *in-situ* infiltration test was advanced using a 75 mm diameter hand auger by Golder personnel. Infiltration testing was conducted at two separate locations using the "inverse auger method" outlined in Cocks (2007)[1]. Further discussion of the infiltration test results is provided in Section 9.11.

The electrical resistivity testing was undertaken using the Wenner 4-electrode method, along one orthogonal set of traverses in approximately north-south and east-west directions, at electrode spacings of 1 m, 2 m, 4 m, 8 m, 16 m, and 32 m. Further discussion of the electrical test results is provided in Section 9.12.

A geotechnical engineer from Golder positioned the test locations, logged the material encountered in the test pits and boreholes, collected samples for laboratory testing, and performed the DCP and infiltration testing.

5.0 LABORATORY TESTING

5.1 Geotechnical

Geotechnical samples recovered from the test pits and boreholes were submitted for geotechnical laboratory testing at Golder's NATA-accredited laboratory. The geotechnical laboratory testing comprised determination of the following soil properties:

Laboratory Test	No. Tests
Particle Size Distribution	11
Atterberg Limits and Linear Shrinkage	11
Dry Density – Moisture Content Relationship using Modified Compactive Effort	5
Soaked California Bearing Ratio	5
Point Load Test	6

Geotechnical laboratory test results are summarised in Table 2 and Table 3, and test certificates are provided in Appendix C.

[1] Cocks, G., Disposal of Stormwater Runoff by Soakage in Perth Western Australia, Journal and News of the Australian Geomechanics Society, Volume 42 Number 3, September 2007.

Table 2: Summary of Geotechnical Laboratory Test Results (Soil)

Location ID	Depth (m)	AS1726 Soil Description	Particle Size Distribution (Passing %)			MC (%)	LL (%)	PI (%)	LS (%)	OMC (%)	MMDD (t/m³)	CBR (%)	CBR Swell (%)
			Gravel	Sand	Fines								
Boreholes													
BH01	1.5	Sandy SILT	13.5	42.8	43.7	28.7	49.0	17.0	4.0	Not Tested			
BH01	6.0	Sandy SILT	0.2	43.7	56.1	21.6	51.0	20.0	5.5				
BH01	12	Sandy CLAY	0.4	57.6	42.0	18.9	47.0	25.0	5.0				
BH02	4.5	Sandy SILT	0.3	45.3	54.4	20.8	43.0	14.0	4.0				
BH02	10.5	Sandy SILT	2.8	42.2	55.0	21.4	45.0	15.0	3.0				
BH02	15	Clayey/Silty GRAVEL	47.2	25.4	27.4	12.1	34.0	10.0	2.5				
Test Pits													
TP03	0.3 – 0.6	Clayey SAND	14.9	61.7	23.4	10.4	23.0	11.0	2.5	8.5	2.07	20.0	Nil
TP05	0.3 – 0.6	Gravelly SAND	43.8	45.0	11.2	9.3	SIB	ND	-	8.5	2.10	20.0	Nil
TP09	1.0 – 1.5	Sandy GRAVEL	57.0	34.3	8.7	12.5	SIB	ND	-	9.0	2.04	45.0	Nil
TP15	1.3 – 1.5	Gravelly Silty SAND	35.3	50.9	13.8	12.5	SIB	ND	-	12.0	1.96	30.0	Nil
TP16	0.5 – 0.7	Clayey SAND	19.6	51.0	29.4	16.0	28.0	12.0	3.0	13.5	1.97	10.0	Nil

Notes: LL – Liquid Limit; PI – Plastic Index; LS – Linear Shrinkage; OMC – optimum moisture content, MMDD – maximum modified dry density, CBR – soaked California Bearing Ratio, Gravel – material passing a 63 mm sieve and retained on a 2.36 mm sieve; Sand – material passing a 2.36 mm sieve and retained on a 0.075 mm sieve; Fines – material passing a 0.075 mm sieve, ND – Not determined, SIB – Slip in bowl; ND – Not determined

Table 3: Summary of Geotechnical Laboratory Test Results (Rock)

Point Load Testing				
Location	Depth (m)	Test Type	$Is_{(50)}$	Inferred Strength
BH01	1.2 – 1.5	Diametral	0.083	Very Low
BH01	14.8 – 15.3	Axial	0.14	Low
BH01	15.6 – 16.0	Diametral	0.56	Medium
BH02	0.56 – 0.9	Axial	0.13	Low
BH02	1.3 – 1.6	Diametral	0.99	Medium
BH02	2.3 – 2.6	Axial	0.088	Very Low

5.2 Acid Sulfate Soil and Chemical Testing

All chemical and environmental laboratory testing was conducted by ALS Environmental, a NATA-accredited laboratory. Laboratory analytical results are presented in Appendix D and are summarised in Sections 5.2.1 and 5.2.2. Chain of Custody (COC) documentation is also included in Appendix D.

5.2.1 Acid Sulfate Soil

The intent of ASS field screening tests is to provide an initial evaluation of the potential (high, medium, and low) for each soil sample collected to be ASS. The following criteria are used to provide an indication of the potential existence of either actual ASS (AASS) or potential ASS (PASS):

- A pH_f of less than 4 suggests the presence of AASS.

The introduction of peroxide in the pH_{fox} test accelerates oxidation of sulfides in the soil resulting in the release of stored acidity and can provide an indication of the possible presence of PASS.

Three indicators are used together to indicate the probability of PASS presence:

- A pH_{fox} of less than 3
- An extreme or strong reaction strength
- A difference between pH_f and pH_{fox} of greater than 3.

A total of 16 samples were submitted to ALS Environmental for ASS field screening during the investigation. The field screening results are presented in Appendix D. None of the field screening samples indicated the present of AASS or PASS at the site. Based on the results of the ASS investigation, it is unlikely that ASS will be encountered at the site.

5.2.2 Chemical Testing

Laboratory testing to assess the aggressivity potential of three soil samples was carried out in the NATA-accredited laboratories of ALS Environmental and Analytical Reference Laboratory. The testing comprised determination of:

- pH.
- Sulfate content.
- Chloride content.

Laboratory test reports are presented in Appendix D for the soil samples. The results are summarised in Table 4. The results of the corrosivity testing assessment are based on Table 6.4.2(C) and 6.5.2(C) of AS 2159.2009, “Piling – Design and Installation” for concrete and steel structures.

Table 4: Summary of Aggressivity Laboratory Testing

Test Location	Sample Type	Sample Depth (m)	pH	Sulfate	Chloride	Exposure Classification	
				(mg/kg or mg/L)		Concrete (Table 6.4.2)	Steel (Table 6.5.2)
ASS01	Soil	0.5	6.0	20	< 10	Non-Aggressive	Non-Aggressive
ASS02	Soil	1.0	6.6	70	110	Non-Aggressive	Non-Aggressive
ASS04	Soil	0.5	6.3	40	10	Non-Aggressive	Non-Aggressive
ASS BH02	Soil	1.5	5.4	40	30	Non-Aggressive	Non-Aggressive

6.0 SITE CONDITIONS

6.1 Site Overview and Topography

The proposed rail loading facility is located to the east of the existing CBH Konnongorring site. The ground surface is generally flat with immature trees throughout the area.

The alignment of the proposed rail siding runs parallel and to the east of the existing rail track within the rail reserve. The bulk earthworks requirements for the rail are currently being assessed. Based on discussions with CBH, development within the northern paddock which was investigated during the program is currently not proposed. A drainage basin may be located in this area depending on the outcomes of the drainage design.

6.2 Subsurface Conditions

Based on the field investigation results, the subsurface conditions underlying the specific infrastructure for the proposed rail loading facility upgrade can be generalised as follows. The test locations which have been used to develop the generalised subsurface conditions at each of the specific infrastructure items are shown in brackets.

6.2.1 Rail Embankment (TP01 to TP05, TP07, TP09, and TP13)

The subsurface conditions encountered underlying the rail embankment can be summarised as follows:

- **Clayey SAND (SC) –** fine to coarse grained sand, low plasticity, yellow brown, trace gravel, extending to depths of between 0.7 m and 2.0 m, not encountered at TP4, TP5, TP7 or TP13, overlying;
- **Clayey GRAVEL/Sandy GRAVEL (GP-GC) –** yellow brown, fine to coarse grained gravel, sub-rounded to sub-angular, fine to medium grained sand, weakly to moderately cemented in parts, extending to the maximum depth investigated of 3.0 m.

Exceptions to the above generalised profile were encountered at the following locations:

- **Test Pits TP4 and TP5** which encountered **Gravelly SAND (SP),** yellow brown, fine to coarse grained sand, non-plastic fines, fine to coarse grained sub-rounded to sub-angular gravel, medium dense to dense, weakly cemented gravel in parts, extending from surface level to depths of between 0.7 m (refusal depth) and 2.0 m.
- **Test Pit TP7** which encountered **Sandy CLAY/Clayey SAND**, fine to coarse grained sand, yellow brown, moderately cemented in parts, extending from surface to the refusal depth of 0.6 m.
- **Test Pit TP13** which encountered **Sandy CLAY/Clayey SAND**, possibly fill or disturbed material, extending from surface to the refusal depth of 0.6 m.

6.2.2 Over Rail Bin (BH1 & BH2)

The subsurface conditions encountered underlying the ORB can be summarised as follows:

- **Sandy GRAVEL (GP) –** brown, fine to coarse grained, sub-rounded to sub-angular, fine to medium grained sand, with fines, extending to depths of between 0.45 m and 0.55 m, overlying
- **REFURRIGINISED GRANITE –** fine to coarse grained sand in an iron cemented matrix, pale grey with red, well cemented, layered, very low to medium strength, with interbedded Silty CLAY zones, extending to depths between 1.5 m and 3.45 m, overlying
- **Sandy SILT/Sandy CLAY (ML/CL-CH) –** residual soil, low to high plasticity clay, fine to coarse grained sand, white with yellow brown mottling in parts, very stiff to hard, with some zones of SAND (SP) and Clayey SAND (SC), extending to the depth of 14.8 m at BH1 and maximum depth investigated of 20.0 m at BH2, overlying
- **GRANITE –** medium to coarse grained, low to medium strength, white, flow banded, layered, extremely weathered to distinctly weathered, encountered at BH1 only and extending to depth investigated of 20.0 m.

6.2.3 Northern Area (TP14 to TP20)

The subsurface conditions encountered underlying the northern area can be summarised as follows:

- **Clayey GRAVEL/Clayey SAND (GC/SC) –** orange brown, yellow brown, fine to coarse grained gravel, sub-rounded to sub-angular, fine to coarse grained sand, weakly cemented gravel in parts, extending to depths of between 0.2 m and 1.3 m, overlying
- **Sandy CLAY (CI) –** orange brown, medium plasticity, stiff to hard, dry of plastic limit, extending to refusal depth of between 1.2 m and 2.5 m, not encountered at TP14 and TP15, overlying;
- **REFURRUGINISED GRANITE –** not encountered at all locations, medium to coarse grained, brown, yellow and orange, inferred high strength, causing refusal at depths of between 0.2 m and 0.8 m within test pits TP17, TP18 and TP20.

Exceptions to the above generalised profile were encountered at the following locations:

- **TP14 and TP15** which encountered **Silty SAND (SM) –** brown, fine to medium grained sand, moderately cemented gravel in parts, underlying the surficial Clayey GRAVEL (GC) layer at depths of between 0.6 m and 1.3 m.

Variations to the above generalised stratigraphy occur and the individual test pit and borehole logs provided in Appendix A and Appendix B should be referred to for further information.

6.3 Groundwater

During the test pit investigations, groundwater was encountered at one test pit location at the depth of 2.5 m. A groundwater well was installed within borehole BH02 following completion of drilling. At the time of the fieldwork, due to the low permeability of the ground, the groundwater level had not stabilised and therefore measurement of the static groundwater level was not possible.

A site visit to measure the groundwater levels was undertaken on 15 September 2022. The groundwater level was measured at 6.6 m depth in borehole BH02. Section 9.9 should be referred to for further information on groundwater levels.

7.0 PAVEMENT DESIGN

7.1 Design Method

The analysis for the Access Roads follows the empirical and mechanistic design methods contained in Austroads Guide to Pavement Technology Part 2 (2012, AGPT2). Mechanistic design of pavements was conducted with the program CIRCLY 6.0.

7.2 Design Traffic

7.2.1 Design Life

In accordance with CBH Design Specification TS-10A (CBH-ENG-CI-SST-0001, dated 13 October 2020), pavements have been designed for a life of 25 years.

Asphalt wearing surfaces for the Access Roads and hardstands have been assessed for a design life of 15 years.

7.2.2 Specification Requirements

The design traffic for access roads and hardstands has been assessed in accordance with Specification TS-10A as follows:

- Speed limit of 20 km/h
- 200 vehicles per day during peak season (90 days)
- 10 vehicles per day during remainder of the year (275 days)
- 100% heavy vehicles
- Annual traffic growth rate of 1%.

An axle equivalency factor of 11.54 equivalent standard axles (ESAs) per heavy vehicle was assumed, based on available MRWA information for rural highways and assuming all heavy vehicles are Austroads Class 12.

The design traffic volume was assessed as follows:

- 6.8×10^6 ESAs for a 25-year design life
- 3.9×10^6 ESAs for a 15-year design life.

The following ratios of standard axle repetitions (SARs) to ESAs were used for road licensed vehicles in the CIRCLY analysis:

- 1.26 for asphalt fatigue
- 2.31 for permanent deformation of the subgrade.

7.2.3 Hardstand and Access Road

A hardstand and access road is required around the hoppers and rail siding. CBH Design Specification TS-10A (CBH-ENG-CI-SST-0001, dated 13 January 2022) does not provide guidance on the typical loads that will be applied to the hardstand area around the proposed rail facility. However, TS-10A does indicate that unless specified the access road traffic movements should be used in design. We have therefore assumed that the loading that will be applied to the pavement will be same an Access Road.

7.3 Subgrade Design CBR

7.3.1 Access Roads and Hardstands

The alignment of the access roads and hardstand areas has not been finalised at this stage. For the access road design, we have utilised the subsurface conditions encountered within test pit TP07, TP09, BH01, BH02 and TP13 to develop the subgrade conditions. Based on the results of the test pits undertaken on the approaches to the ORBs the subsurface conditions generally comprise hard Sandy SILT/Sandy CLAY, dense Clayey SAND or Refurruginised GRANITE. On the basis of the subsurface conditions encountered and in consideration of the provision of sealed pavements, which reduces the likelihood of soaked conditions occurring below pavements, the following subgrade design CBRs have been adopted for design:

- 7% in areas underlain by insitu soils.
- 12% in areas underlain by at least 300 mm thickness of sandy or gravelly fill (minimum CBR of 12%).

It should be noted that the subgrade design CBR will depend on the material actually encountered at subgrade level, which depends on the depth of cut or fill (and fill material properties in the area). Delineation of subgrade design CBR zones will need to be reviewed following confirmation of the earthworks levels.

7.3.2 Rail Formation

Based on the results of the investigations along the rail line, the subgrade conditions comprise Clayey SAND and Gravelly SAND, overlying gravelly soils. The soaked CBRs recorded values of between 20.0% and 45.0% along the rail line alignment, with no swell recorded. The soaked CBR values for the Clayey SAND appear to be relatively high for the material description however the samples contained a gravel component which has likely increased the CBR measured in the laboratory. To allow for variability in the site conditions and based on our experience soaked CBR of 10% is considered appropriate for design of the rail formation.

7.4 Pavement Materials

Assumed flexible pavement and subgrade material properties are summarised in Table 5.

Table 5: Summary of Material Assumptions – Flexible Pavements

Material	Vertical Modulus of Elasticity (MPa) at 29°C	Poisson's Ratio (ν)	Degree of Anisotropy
Granular Pavements			
Asphalt (14 mm DGA, traffic speed at 10 km/h)	1,340	0.40	1.0
Basecourse	450	0.35	2.0
Sub-base	250	0.35	2.0
Subgrade (clayey soil)	50 (10 × CBR)	0.40	2.0
Subgrade (sandy or gravelly soil, or lime stabilised clayey soil)(1)	120 (10 × CBR)	0.40	2.0

Notes: DGA – dense graded asphalt
(1) Design properties of lime stabilised soil must be confirmed prior to construction. Refer Section 7.3.1.

It should be noted that due to the relatively heavy loads and high tyre pressures, the basecourse modulus required to reduce the risk of asphalt fatigue is high. Depending on the material used for pavement construction, cement stabilisation may be required. Further advice on the suitability of pavement construction materials should be sought once a material source is identified.

7.5 Pavement Design (Access Road and Hardstand Areas)

We have provided designs for the Access Roads and hardstands using Class 320 binder within the asphalt as performance of well-constructed MRWA intersection mix with Class 320 binder has generally been good in the cooler regions of Western Australia. However, given the significant number of heavy vehicles, low traffic speeds and number of turning movements A15E polymer modified binder should be considered to improve rut resistance. Dense graded asphalt with A15E provides good rut resistance, particularly in the early life of the asphalt when the binder is relatively soft.

Pavement requirements are summarised in Table 6.

Table 6: Granular Pavement Design

Layer	Pavement Thickness Requirements (mm)
Subgrade Design CBR 7% (Founded on Insitu Ground)	
14 mm intersection mix asphalt with C320 binder(1)	40
Prime, 10/5 mm emulsion seal(2), tack coat	Nominal thickness
Basecourse	190
Sub-base	200
Subgrade Design CBR 12% (Minimum 300 mm thickness imported Sandy and Gravelly Subgrade)	
14 mm intersection mix asphalt with C320 binder(1)	40
Prime, 10/5 mm emulsion seal(2), tack coat	Nominal thickness
Basecourse	150
Sub-base	165

Notes: (1) A15E binder could be considered to improve rut resistance.
(2) A 10 mm single coat seal with S35E binder may also be suitable if due care is taken during construction.
A tack coat is required on all seals prior to asphalting
No allowance for construction tolerance is included in the above pavement designs

The asphalt wearing surface may develop defects prior to achieving the required design life due to factors that are not considered in current industry-standard pavement design methods, such as environmental cracking or oxidation of the binder. Thin layers of dense graded asphalt typically have a life of approximately 15 years, although longer lives have been observed where construction quality is high, good maintenance practices are implemented and conditions are favourable.

7.6 Sealing

It is essential that a prime and sprayed seal be applied prior to the asphalt wearing course to waterproof the pavement.

Preliminary seal application rates are presented in Table 7. The preliminary rates will need to be adjusted to suit the aggregate used and site conditions.

Cut-back prime should be allowed to cure for a minimum period of three days of warm, dry weather prior to application of the seal.

Table 7: Preliminary Bituminous Surfacing Preliminary Application Rates

Treatment Type	Binder Type	Aggregate Size	BAR/EAR (L/m^2 at 15°C)	ASR (m^2/m^3)
Prime	40/60 Bitumen (C170)/ Medium curing cutter	Not Applicable	0.6 (total application rate)	Not Applicable
Double coat 10/5 mm emulsion seal (below asphalt)	CRS 170/60	10 mm	0.9	140
		5 mm	1.1	180-220
Single coat 10 mm seal (below asphalt)	S35E[(1)]	10 mm	1.4	150

Notes: BAR – binder application rate (S35E), ASR – aggregate spread rate, EAR – emulsion application rate (CRS170/60)
[(1)] S35E is not recommended if the pavement temperature is below 35°C at the time of sealing. Emulsion (CRS170/60) is recommended in this instance

Two options for sprayed seals below asphalt have been provided: a 10/5 mm double coat emulsion seal or a 10 mm single coat S35E seal. The 10/5 mm double coat seal is recommended to reduce the risk of damage by construction plant. There is increased risk of damage to the single coat seals occurring during construction, which may affect waterproofing and reduce the life of the pavement.

All damage to the seal must be repaired to maintain waterproofing prior to asphalting.

7.7 Pavement Joints

Care must be taken to ensure the waterproofing characteristics of the surfacing are maintained during the life of the facility. Appropriate longitudinal grades must be provided on the top of subgrade to allow any water that may enter the pavement to drain.

Where joints between pavements occur, it is recommended that standard Main Roads Western Australia (MRWA) Joint details are adopted. Relevant transverse joint details are provided in Appendix E. Special attention needs to be provided to compaction at the joint tie-ins. Rollers should overlap the joint to ensure that good compaction is achieved at the interface.

8.0 RAIL SPECIFIC DISUCSISON

8.1 Site Won Material Evaluation

The bulk earthworks for the rail formation has not been determined at this stage. Once earthworks levels are available, evaluation of the suitability of areas of cut for use as fill can be undertaken. Arc Infrastructure Rail Earthworks Specification W880 400 014 (Specification) includes the following definitions for Subgrade and Common Fill:

- Fill Type 2 – Subgrade: earthworks layer overlying the Common Fill and underlying the Sub Ballast Capping.
- Fill Type 3 – Common Fill: new bulk earthworks underlying the Subgrade.

The specification outlines the required material property limits for Fill Type 2 – Subgrade and Fill Type 3 – Common Fill.

The laboratory test results for the entire project which have been evaluated against the ARC infrastructure Specification are summarised in Table 8. It should be noted that the test results are for the insitu subgrade conditions and should be reviewed against the proposed bulk earthworks levels once available.

Table 8: Summary of Laboratory Test Results and Arc Infrastructure Rail Earthworks Specification

Arc Infrastructure Rail Earthworks Specification W880 400 014			Test Pit Location	TP03	TP05	TP09	TP15	TP16
Sieve Size (mm)	Fill Type 2 Subgrade Limits	Fill Type 3 Common Fill Limits	Depth (m)	0.3 – 0.6	0.3 – 0.6	1.0 – 1.5	1.3 – 1.5	0.5 – 0.7
			AS 1726 Soil Description	Clayey SAND	Gravelly SAND	Sandy GRAVEL	Silty SAND	Clayey SAND
	Percent Passing (%)		Sieve Size (mm)	Percent Passing (%)				
75	-	100	75	100	100	100	100	100
19	90 – 100	-	19	100	100	100	99	100
13.2	78 – 100	-	13.2	98	94	83	93	95
9.5	-	40 – 100	9.5	95	87	68	81	90
4.75	45 – 100	20 – 100	4.75	89	66	49	69	83
2.36	32 – 75	17 – 100	2.36	85	56	43	65	80
0.6	20 – 48	8 – 25	0.6	64	39	28	50	63
0.3 (1)	15 – 36	-	0.3 (1)	53	29	22	37	52
0.075 (2)	-	2 – 25	0.075 (2)	23	11	9	14	29
Other Property Limits			Other Properties					
MC (%)	5 – 15	5 – 30	MC (%)	10.4	9.3	12.5	12.5	16.0
LL (%)	≤ 30	≤ 35	LL (%)	23	SIB	SIB	SIB	28
PI (%)	≤ 12	≤ 17	PI (%)	11	ND	ND	ND	12
MMDD (%)	≥ 2,000	≥ 1,850	MMDD (%)	2.07	2.10	2.04	1.96	1.97
CBR (%)	≥ 20	≥ 12	CBR (%)	20	20	45	30	10

Notes: LL – Liquid Limit, PI – Plasticity Index, MC – Moisture Content, MMDD – Maximum Modified Dry Density, CBR – California Bearing Ratio, ND – Not Determined, SIB – Slip in Bowl
(1) Limit applies to Subgrade only.
(2) Limit applies to Common Fill only.

Does not comply with Arc Specifications.
Comply with Arc Specifications.
Comply with the Common Fill Specification only.
Comply with the Subgrade Fill Specification only.

Based on Table 8, the in-situ subgrade conditions do not comply with all the Arc Infrastructure Specification requirements for Common Fill. The subgrade conditions at test pit locations TP05 and TP09 comply with the requirements for Subgrade. The gravelly subgrade conditions present over parts of the rail alignment are considered suitable to support the rail formation, provided suitable site preparation techniques are undertaken in accordance with the ARC Specifications.

8.2 Subgrade

Based on review of the test results, a cover of select subgrade overlying the common fill material is recommended to provide support of the rail formation and to accommodate the estimated shrink swell movements associated with seasonal changes in moisture content. The ARC Rail Earthworks Specification provides typical cross sections for various earthworks scenarios. The following two criteria should be considered when choosing an appropriate thickness of the selected subgrade:

- **Strength**: Assessed using the effective CBR at the base of the sub-ballast capping.
- **Shrink-swell movement at the base of the sub-ballast capping**: The expected surface movements in accordance with AS 2870-2011 “Residential Slabs and Footings” should be used to assess potential movements at the rail if clayey site-won material is used as Common Fill.

Figure 1 of the ARC Rail Earthworks Specification indicates that a minimum thickness of 900 mm of subgrade material is required over the common fill material. Based in our experience, a cover of 900 mm is unlikely to be required to provide suitable support for the rail formation (depending on the CBR assumed in the rail formation design). Further evaluation of the required cover can be undertaken once earthworks levels are available.

8.3 Recommendations

Golder has been involved with numerous projects constructed on marginal soils, where typically a defined thickness of non-reactive fill cover has been provided below subgrade level and with particular attention to drainage. From our experience, the risk of using marginal soils as embankment fill can be managed successfully with the appropriate controls. A relaxation of the Arc Infrastructure Specification requirements for Common Fill is unlikely to significantly increase project risk. The requirement to use marginal materials within the embankments can be assessed once earthworks levels are known.

9.0 GEOTECHNICAL DISCUSSION

The results of the investigation indicate that the site is geotechnically suitable for development provided that our recommendations are incorporated into the design and construction of the project.

9.1 Geohazards

The geohazards identified at this site include:

- The potential variability in founding conditions below the infrastructure due to variation in the underlying natural soil. Suitable site preparation procedures are required to create uniform founding conditions.
- The presence of well cemented layers and rock at shallow depth across the site.
- Near-surface clay, which may result in seasonal volume changes. The clayey soil is considered moderately reactive, and the footing is likely to be relatively stiff, it will be important to reduce moisture variations in the natural soil. This may be achieved by use of relatively low permeability, inert fill of suitable thickness, and use of capping material over clayey soils.
- Perched or confined groundwater during wet periods – requiring removal from excavations if present.

9.2 Fixed Rail Loading Facility Foundation Design and Site Preparation Requirements

Based on subsurface conditions, shallow pad and strip footings are considered appropriate to support structures at the site.

Ultimate and allowable bearing pressures for shallow footings have been assessed under the assumption that the site preparation procedures in Section 9.2.3 will be carried out and the specified level of compaction is achieved below the base of each footing.

The maximum allowable working (serviceability) bearing pressures have been given with a minimum factor of safety of 3 or reduced further for larger footings to limit settlements to an acceptable level.

9.2.1 Pad and Strip Footing Design

Table 9 presents bearing capacities for a range of footing sizes for pad footings and strip footings respectively. The table provides allowable pressures for embedment depths of 0.5 m and 1.0 m. It must be noted that the bearing pressures provided assume that no wind or water erosion occurs around the footing to reduce the embedment depth. Protection of the surface is required to ensure erosion does not occur.

The design assumes that the shallow foundations are founded on very stiff sandy silt with a minimum undrained shear strength of 100 kPa. This must be verified during construction using dynamic cone penetrometer testing to 0.9 m depth (or shallower refusal).

Table 9: Preliminary Footing Design Parameters

Minimum Embedment Depth (m)	Minimum Plan Dimension (m)	Maximum Allowable Working Bearing Pressure (kPa)	Estimated Settlement at Maximum Allowable Working Bearing Pressure (mm)
Pad Footings			
0.5	0.5	150	<5
	1.0	170	<5
	1.5	190	5-10
	2.0	200	5-10
	2.5	200	10-15
1.0	0.5	165	<5
	1.0	185	<5
	1.5	200	5-10
	2.0	200	5-10
	2.5	200	10-15
Strip Footings			
0.5	0.5	130	<5
	1.0	150	5-10
	1.5	170	10-15
	2.0	180	15-20
1.0	0.5	150	<5
	1.0	170	5-10
	1.5	180	10-15
	2.0	180	15-20

Bearing capacities for footings of intermediate plan dimensions to those tabulated can be interpolated. Footings that have a plan dimension either smaller or larger than those covered by the table above will need to be considered individually, along with other embedment depths. Footings carrying significant eccentric loading, such as below retaining walls, need to be assessed separately.

Settlement of the structures will depend upon several factors including the applied pressures, footing size, and base preparation. The preliminary estimates of settlement provided in Table 9 assume that the site preparation measures detailed previously have been completed. The estimated settlements are for the working bearing pressure values shown. Differential settlements of up to about 50% of the total estimated settlement values may occur. Up to about 70% of the total settlement is expected to occur during construction and initial loading.

9.2.2 Raft Footing Design

We have been advised that the preferred option is to support the proposed structures on raft foundations. Once the foundation details are known further information can be provided on estimated settlements under the proposed loads.

9.2.3 Site Preparation below Structures

The following site preparation procedures are required beneath structures founded on shallow foundations (pad, strip, and raft footings):

- Remove trees and vegetation, including grubbing out roots and stumps.
- Strip any topsoil, uncontrolled fill, all organic material, roots and other unsuitable or deleterious material from the site. These materials should be stockpiled separately or removed from site and are not suitable for re-use as structural fill. Topsoil should be stockpiled separately from deleterious materials.
- Excavate to the required depth. If suitable sandy or gravelly materials are removed during this process, they can be stockpiled for later re-use as structural fill or removed from site if not required. Assessment of the suitability of these materials must be conducted prior to reuse.
- Proof-compact the footing base to identify soft or weak areas.
- The geotechnical investigation indicates that the footings are likely to be founded on very stiff clayey/silty soil or Refurruginised Granite. Any soft or loose areas encountered at footing formation level must be removed and replaced with lean mix concrete/concrete blinding. Clayey/silty material that is allowed to become wet must be treated as unsuitable and removed from below foundations and replaced with approved structural fill or lean mix concrete.
- The footing bases must be assessed by a geotechnical engineer prior to placement of blinding concrete. The contractor must undertake DCP testing and shear vane testing to confirm that a minimum undrained shear strength of 100 kPa is achieved to a minimum depth of 0.9 m. The DCP and shear vane results must be reviewed by a geotechnical engineer prior to placement of blinding concrete.
- The soil at the base of the footing excavation must not be disturbed during excavation and must not be allowed to soften due to pooling of groundwater, rainwater, or surface water inflow. To avoid these situations occurring, it is recommended that a flat blade bucket be used to finish the base of the excavation and the base of the excavation be surfaced with lean mix concrete immediately following excavation, and geotechnical assessment and DCP/shear vane testing. If the clayey/silty soil at the base of the excavation is disturbed (e.g. accidentally over-excavated) or allowed to become wet and soften, the disturbed or softened soil must be removed until competent, *in situ* soil is encountered, and replaced with approved structural fill or lean mix concrete.

The occurrence of unsuitable materials not detected during the ground investigation cannot be dismissed. Any deleterious material must be removed from beneath footings and replaced with approved structural fill or lean mix concrete.

9.2.4 Approved Fill

Approved fill should comprise imported clayey gravel. The intent of using clayey gravel is to reduce infiltration of water into the soil around the footing, and therefore the potential for wetting of the foundation material post construction. The clayey gravel is intended to be relatively easy to work, but with at least about 15% to 20% low plasticity fines to provide a relatively low permeability barrier to infiltration.

Use of more permeable materials as fill is not recommended around footings and may increase the risk of poor performance.

9.2.5 Compaction

Clayey gravel fill must be moisture conditioned and compacted to achieve a minimum dry density ratio of 95% (as determined using Modified Compactive Effort) in accordance with AS 1289 5.2.1. A nuclear densometer should be used for compaction control.

Fill should be placed and compacted in horizontal layers not greater than 0.3 m loose thickness. Loose layers of less than 0.3 m thickness may need to be used if adequate compaction cannot be demonstrated.

9.2.6 Drainage

The area around the footings must be graded to direct water away from the structure so that water does not pond close to the footings. Consideration should also be given to surfacing the area around the footings with a spray seal, asphalt, or concrete to reduce moisture variation within the soil.

9.3 Site Classification

We have assessed the classification for the site in accordance with AS 2870-2011 “Residential Slabs and Footings”. AS 2870-2011 defines site classification on the basis of a characteristic surface movement associated with the seasonal moisture changes in expansive soils. It does not specifically deal with movements associated with settlement. It should be noted that the AS 2870-2011 site classification is limited to residential and some light industrial structures.

The definitions of the various site classifications in AS 2870-2011 and the surface movements to which they relate are presented in Table 10.

Table 10: Site Classification

Class	Foundation Type	Characteristic Surface Movement y_s (mm)
A	Most sand or rock sites with little or no ground movement from moisture changes.	-
S	Slightly reactive clay sites with only slight ground movement from moisture changes.	0 to 20
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes.	20 to 40
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes.	40 to 60
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes.	60 to 75
E	Extremely reactive clay sites, which can experience extreme ground movement from moisture change.	>75

Based on our investigation, the site is underlain by low to medium plasticity clayey/silty soils overlying recemented Granite rock or gravelly soils. Therefore, in its current state, we consider that the site may be classified as “Class S” in accordance with AS 2870-2011.

9.4 General Earthworks and Pavements Site Preparation Requirements

Perched groundwater is expected to occur following significant rainfall events. It is recommended that the drainage be installed prior to bulk earthworks, particularly if construction is planned during the wetter parts of the year. A deep cut-off drain that diverts surface water around the site is recommended to be installed prior to construction. Failure to provide adequate drainage prior to construction increases the risk of material becoming unsuitable due to moisture, and also increases the risk of moisture-related construction issues, such as reduced stability of excavations and poor site trafficability.

It should be noted that perched groundwater may take significant time to drain following installation of the cut-off drains, depending on the amount of moisture present at the time and weather conditions.

The following site preparation measures are required below pavements and other areas not covered by the site preparation requirements in Section 0:

- Install perimeter site drainage.
- Strip any topsoil, uncontrolled fill, all organic material, roots and other unsuitable or deleterious material from the site. These materials should be stockpiled separately and are not suitable for re-use as structural fill. Topsoil should be stockpiled separately from deleterious materials.
- Excavate to the required elevation and compact the exposed surface with suitable compaction equipment to achieve as a minimum the level of compaction outlined in Section 9.10 to the required depth. Over-excavation and re-compaction in layers may be required where the required level of compaction cannot be achieved. Any soft or weak areas must be removed and replaced with approved structural fill.
- Construct the pavement and allow to dry back.
- Apply a prime, seal and asphalt wearing surface.

Site preparation during drier periods is recommended to limit difficulties with earthworks and trafficking across areas of clayey soil. Difficulties with earthworks during wet periods are particularly prevalent where clayey soils are present at or near to the surface. Where present, clayey soils can be difficult to work and may become unsuitable material if allowed to get wet. On-site drainage must be implemented to intersect any subsurface flow and surface runoff that may perch on the site.

9.5 Excavation Conditions

Based on the results of the investigation, shallow well cemented soils (Refurruginised Granite and Iron cemented clayey soils) are present across the site which caused refusal to the backhoe at depths of between 0.2 m and 2.5 m during the investigation. Three test pits were advanced to the target depth of 3.0 m which indicates a degree of variability in the cementation observed within the Refurruginised Granite. Very low to low strength, well cemented Refurruginised Granite was encountered at borehole BH1 at a depth of 0.45 m (1.05 m thickness) and at borehole BH02 at 0.56 m depth (1.05 m thickness).

Well cemented/indurated zones were also encountered at the top of the clayey soil at some test locations (refer to the test pit reports, and the excavation resistance notes). The use of a rock breaker or large dozer (*e.g.,* Caterpillar D8 or D9) with a single ripping Tyne to remove localised zones of shallow rock and cemented zones should be allowed for in earthworks estimates. Higher excavation resistances in clayey soils are likely during the drier summer months.

The presence of materials that may interfere with excavations such as fill, old foundations, large tree roots or deleterious materials should also be considered, and allowance made in earthworks quantities.

Excavations in sandy or variable soils are particularly prone to instability unless support is provided. Care must be exercised in such excavations and appropriate safety measures adopted where necessary. As a guide, a short-term slope angle for excavations above groundwater of 1V:1.5H (Vertical: Horizontal) is recommended for the subsurface soils encountered on site, provided that structures, footings, or other loaded areas are not present at or near the crest of slopes. Where buildings, structures or other loaded areas are present at or near the crest of slopes, individual assessment of suitable slope angles or retention will be required.

Long-term batter slopes must not be steeper than 1V:2H. It should be noted that some erosion is expected at this slope angle and flatter slopes may be required to manage erosion. Alternative batter slope treatments, such as vegetation, could also be considered to manage erosion.

9.6 Fill Material

Fill must comply with the material requirements as stated in AS 3798-2007, “Guidelines on Earthworks for Commercial and Residential Developments”.

Based on the results of the field investigation, the *in-situ* soils in the upper 1 m to 2 m at the site are relatively variable and comprise sand, gravelly sand, sandy gravel, clayey gravel, clayey sand, silty sand and sandy clay. These materials are generally considered suitable for re-use as fill; however, the requirements of the pavement design and site classification must also be considered. It must be noted that the clayey sand and sandy clay may have poor workability properties and a lower CBR compared with a more sandy or gravelly soil with lower clay content. It is essential the earthworks contractor has experience with using clayey soil as fill. Close attention to moisture conditioning, thorough mixing and the use of pad foot rollers is recommended to facilitate achievement of the specification requirements.

A maximum liquid limit of 50% is recommended for clayey soils being used as fill. High plasticity clayey soils with a liquid limit above 50% are not suitable for re-use as fill material due to their poor workability and higher potential for shrink-swell movements. Based on the laboratory test results the majority of the material encountered on site is likely to be suitable for use as fill. It is recommended material with lower liquid limit or clay content be used where practicable. Alternatively, lime stabilisation of fill materials may be considered to reduce plasticity and improve workability. The use of clayey soils as fill during wet periods is not recommended.

9.7 Retaining Structures

Retaining structures should be designed in accordance with AS 4678 – 2002 “Earth-Retaining Structures”. Design of temporary and permanent retention systems will need to take into account the following factors as a minimum:

- Surcharge loads from adjacent structures.
- Wall movement induced by excavations.
- Ground movements induced by excavation.
- An allowance for over excavation.

Where retaining structures are required at the site, the parameters listed in Table 11 are considered appropriate. Granular backfill for retaining walls must comprise free draining granular material complying with APPENDIX E – E1 of CBH’s Specification.

Table 11: Soil parameters for Earth Retaining Structures

Soil Type	Angle of Internal Friction, Φ (˚)	Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p	At Rest Coefficient of Earth Pressure, K_0	Bulk Density (kN/m^3)
Compacted Granular Fill	36	0.26	3.9	0.41	19

Earth pressure coefficients are provided for conditions of zero friction between the wall and the soil. The retaining wall designed should make an independent assessment of the parameters appropriate to the construction method to be used, including alternative values of wall friction. A horizontal ground surface behind the wall has been assumed.

Retaining walls can move and rotate under imposed soil loading resulting in settlement behind the wall. This must be considered during the design and construction of the retaining walls in order that the rail loading facility is not adversely affected. Account must be taken of the effect of both temporary and permanent works on the rail loading facility.

Compaction plant can augment the lateral earth pressure acting on retaining walls. Only hand operated compaction equipment is recommended within 2 m of any retaining walls to minimise lateral pressures.

9.8 Erosion

The drainage designer will need to consider the erosion resistance of the *in-situ* material, and site-won and imported fill when conducting the drainage design. Flow velocities may need to be limited to manage the risk of erosion. Where this is not practical, alternative treatments such as rock pitching or lined drainage channels may be required.

9.9 Groundwater Levels

As discussed in Section 6.3, the groundwater table was observed at test pit TP09 and borehole BH02 at the depth of 284.3 m and 281.1 m, respectively. Based on the results of the investigation, unless piled foundations are proposed, groundwater is expected to be below the proposed footing level and thus is unlikely to be encountered during construction. However, due to the presence of shallow clayey soils, perched water at the site following wet periods could occur.

9.10 Subgrade Compaction

Approved fill material and *in situ* soils must be moisture-conditioned and compacted using suitable compaction equipment to achieve the minimum compaction requirements outlined below:

- For clayey soils (clayey sand) and other granular materials with a fines content of more than 5%, a dry density ratio of at least 92% using Modified compaction is required in accordance with AS 1289 5.2.1.
- For sandy or gravelly soils containing gravel or cobbles, a dry density ratio of at least 95% using Modified compaction is required in accordance with AS 1289 5.2.1-2003.

Fill should be placed in horizontal layers of not greater than 0.3 m loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

9.11 Infiltration

Infiltration testing was carried out within hand auger boreholes IF1 to IF3 as indicated on Figure 2. The infiltration test results are summarised in Table 12.

Table 12: Infiltration Test Results

Test	Test Depth (m)	Material	Infiltration Rate (m/day)
IF1	0.85	Clayey SAND	1.4
IF2	0.52	Clayey GRAVEL	1.3
IF3	0.32	Clayey SAND	0.2

The results of the testing indicate the site has a low permeability from a stormwater disposal perspective.

The design of any stormwater infiltration system should allow for reductions in the soil permeability arising from:

- A significantly reduced infiltration rate during winter months when the groundwater level is shallower, which will reduce the rate of infiltration.
- Clogging of soils with fine particles through ongoing infiltration.
- Densification of *in situ* soils from compaction during construction.

9.12 Earth Electrical Resistivity Testing

The electrical resistivity testing was undertaken using the Wenner 4-electrode method, along two orthogonal traverses in approximately north-south and east-west directions. As per Section 4.0, the electrodes were set at spacings of 1 m, 2 m, 4 m, 8 m, 16 m, and 32 m. However, due to limited spacing at ER2 in the east-west direction, the electrical resistivity testing was performed up to a spacing of 8 m.

The results of the earth electrical resistivity testing completed for this investigation are presented in Table 13.

Table 13: Earth Electrical Resistivity Test Results

Electrode Spacing 'a' (m)	Electrical Resistance 'R' (ohms)		Apparent Resistivity (ohm. m)	
	West to East	South to North	West to East	South to North
Location – Paddock (ER1)				
1.0	10.37	15.46	65	98
2.0	8.62	8.52	108	107
4.0	2.09	2.26	53.	57.0
8.0	0.89	1.00	45	50
16	-	0.26	-	26
32	-	0.13	-	26
Location – Crop (ER2)				
1.0	90.10	28.30	569	179
2.0	34.10	22.53	429	283
4.0	14.50	7.13	364	179
8.0	2.94	4.69	148	236
16	1.32	3.04	132	306
32	0.66	0.16	133	326

9.13 Earthquake Site Subsoil Class

The methods of assessing earthquake risk classification and consequential design implications are outlined in Australian Standard AS 1170.4 (2007) *Structural design actions Part 4: Earthquake actions in Australia*. The standard uses several factors in assessing an earthquake design category for a particular structure at a given site.

From Table 4.1 of AS 1170.4 (2007), a site sub-soil of Class C_e (shallow soil site) is applicable for this site. The hazard factor (Z) for the site presented on Figure 3.2(D) of AS 1170.4 (2007) is 0.09.

9.14 Acid Sulfate Soils

Based on the results of the ASS investigation and the geology observed at the site, it is unlikely that ASS will be encountered at the site.

10.0 SPECIFICATIONS AND CONSTRUCTION

10.1 Pavement Materials

We expect that natural gravel will be used for the basecourse and sub-base. Based on previous discussions with CBH, the sourcing of suitable pavement materials is typically problematic at CBH sites. Material used for pavement construction should meet the requirements of CBH Group Technical Specification TS-10B – Earthworks, Bitumen and Drainage Works. It should also be noted that the requirements outlined in CBH Specification TS-10B for sub-base are more onerous than the requirements outlined in Main Roads Specification 501 – Pavements. MRWA has also developed specification requirements for basecourse material in the Great Southern region which slightly relaxes some of the grading and plasticity requirements to suit the natural gravels in this area. Consideration should be given to adopting the MRWA Specification requirements within the CBH Specification.

It is noted that the available material may not meet the requirements of CBH Construction Specification TS-10B. If this occurs the proposed construction materials must be assessed by a geotechnical engineer to assess suitability for use.

Natural gravels used for construction of the pavement should be durable and not break down under construction equipment.

10.2 Pavement Compaction

CBH Specification limits for compaction of pavement materials are reproduced in Table 14.

Table 14: Compaction Requirements

Component	Density Specification Limit Minimum Characteristic Value (%)*
Natural Gravel Basecourse	98
Natural Gravel Sub-base	98[(1)]

Notes: *Modified Compactive Effort
[(1)] A reduction to 96% modified dry density ratio is considered acceptable

Compaction requirements may need to be reassessed once construction materials have been identified. If crushed rock basecourse is proposed, an increase in compaction to 99% Modified dry density ratio is recommended.

10.3 Dryback Requirements

Pavement materials should be placed and compacted within ±2% of the optimum moisture content for the material. However, compacted pavement materials are weaker when at optimum moisture content in comparison to a drier state. If construction of the overlying pavement continues before the underlying pavement layers dry back, premature failure may occur.

Dryback of pavement layers must continue until the moisture content throughout the full depth of the layer is less than the values specified in Table 15. Dryback must be complete prior to construction of overlying pavement layers or application of the prime, seal and wearing surface.

Table 15: Dryback Requirements

Component	Minimum Dryback Requirement (%MOMC)
Crushed Rock Basecourse	60
Natural Gravel Basecourse	70
Natural Gravel Sub-base	85
Subgrade (upper 300 mm)	85

Notes: MOMC – modified optimum moisture content

Cement modified material should be cured with light, regular watering for a period of seven days to allow adequate hydration of the cement. Following hydration, the material should be dried back to the required moisture ratio.

10.4 Pavement Drainage

Performance of granular pavements is highly sensitive to the in-service moisture content. It is essential that adequate crossfall and drainage is provided to remove water from pavements. As previously noted, due to the clayey nature of the site it is recommended that the perimeter drainage be installed prior to bulk earthworks to reduce the risk of surface water or perched groundwater affecting the strength of the moisture sensitive soils. The pavement design assumes that the subgrade and pavement does not wet up following achieving dry back. Drains need to maintain their functionality during the life of the facility.

10.5 Asphalt Wearing Surface

A nominal 40 mm thickness of 14 mm intersection mix asphalt with Class 320 binder is considered suitable for the pavements at the site. However, A15E polymer modified binder may be preferred as it improves rut resistance compared with unmodified binder.

It is recommended that MRWA Specification 504 be used as a basis for asphalt mix design. It is also recommended that approved asphalt mixes registered by MRWA be used if practicable.

11.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled – “Important Information Relating to this Report”, which is included in APPENDIX F of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder has under the contract between it and its client.

Your attention is drawn to the limitations of the pavement design method adopted. In this regard the following should be noted:

1) The pavement design life has been calculated for the provided design traffic based on the assumed material design parameters as presented in this report.

2) The design does not address future changes in axle loads. Future increases in axle loads (and overload) may lead to premature failure.

3) The specified method of design only considers asphalt fatigue and subgrade rutting when calculating design life.

4) Asphalt can fail for a number of other reasons, such as normal oxidation hardening, rutting, shoving and ravelling, for which design methodologies that allow design for a specific number of years do not exist.

5) Actual pavement life will be influenced by the quality of the materials actually used and the quality of construction.

6) Some cracking, ravelling, and rutting of the asphalt is expected during the pavement life and it is normal practice that routine maintenance and rehabilitation measures will be required to ensure that the pavement will realise its expected life.

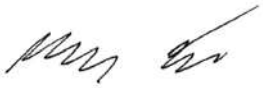
7) Adequate drainage, and a waterproof surfacing above the granular pavement material is required. The ingress of water in the pavement decreases its shear/rutting resistance. The design assumes that the pavement will be kept in a dry condition. Golder cannot accept the risks associated with the omission of an impermeable wearing course.

8) It has been assumed that granular sub-base and basecourse materials will be unbound (fatigue of cemented layers has not been considered in the analysis).

9) The life expectancy of a spray seal is dependent upon conditions such as weather, traffic, binder type and grade, aggregate size, and type. Typical service life of a double coat seal, according to Austroads Guide to Pavement Technology Part 3, varies between eight and 12 years before the wearing surface may reach intervention levels or the minimum required performance measures.

Signature Page

Golder Associates Pty Ltd



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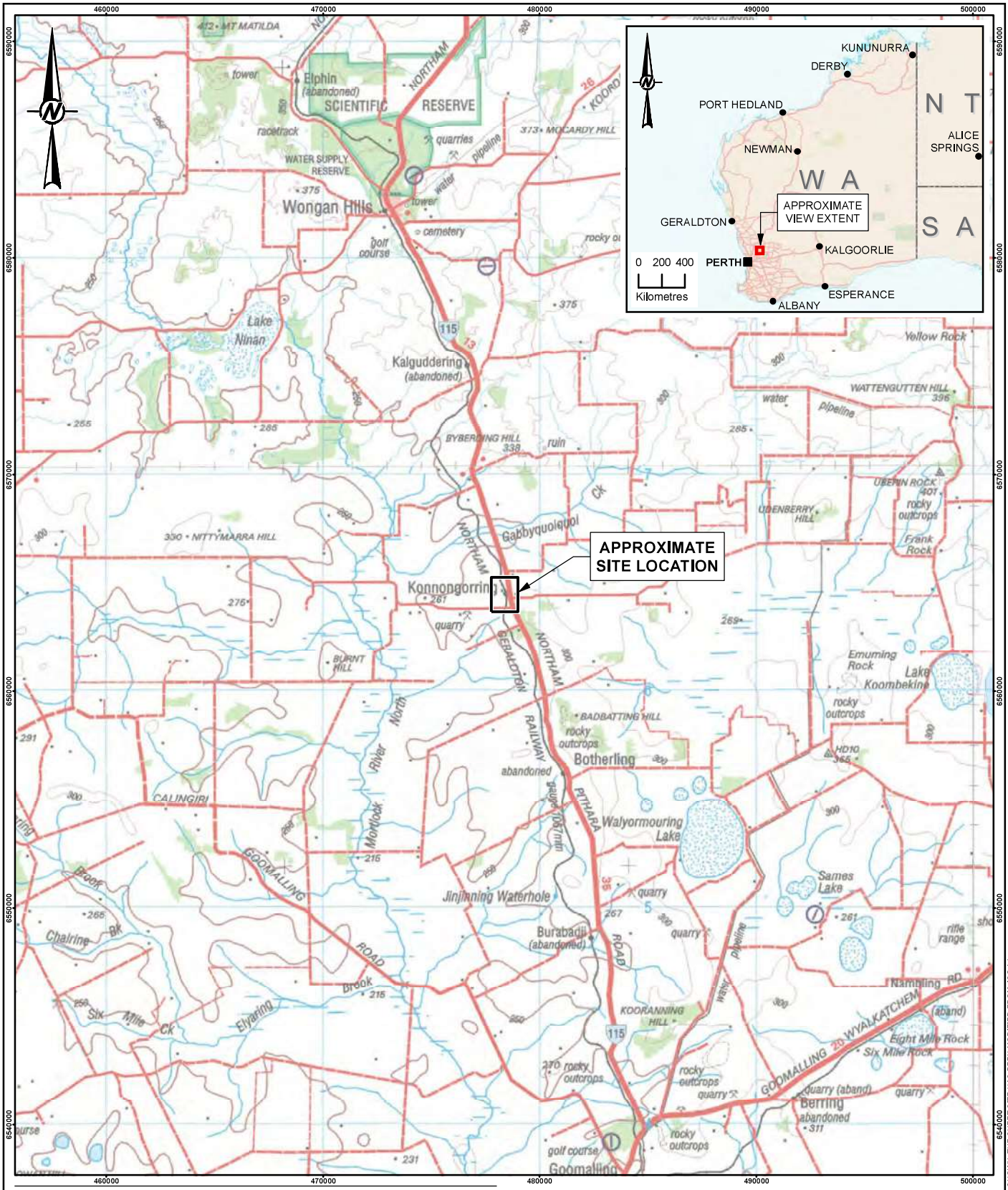


0 5,000 10,000

1:250,000 METRES

NOTE:
1. COORDINATE SYSTEM: GDA2020 MGA ZONE 50

REFERENCES:
1. IMAGE SOURCED FROM GEOSCIENCE AUSTRALIA 1:250,000 TOPOGRAPHIC MAPPING.

CLIENT
CBH GROUP

PROJECT
KONNONGORRING RAIL SIDING

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022.10.20
DESIGNED	TC
PREPARED	JRP
REVIEWED	DMS
APPROVED	DMS

TITLE
LOCATION PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
1791739	070 R	0	1

PATH: B:\CBH_Group\Konnongorring\99_PROJECTS\1791739 - Konnongorring Receival Facility\02_PRODUCTION\MXD\070-R\Rev0\1791739-070-R-F001-Rev0.mxd PRINTED ON: 2022-10-20 AT: 10:48:41 AM

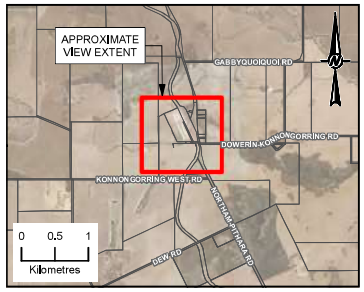
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A4

25mm

0

LEGEND

- TEST PIT LOCATION
- TEST PIT LOCATION (COULD NOT PERFORM DUE TO UNCERTAINTY OF UNDERGROUND SERVICES)
- BOREHOLE LOCATION
- INFILTRATION TEST LOCATION
- ACID SULFATE SOIL TEST LOCATION
- ELECTRICAL RESISTIVITY TEST LOCATION
- CADASTRE



0 80 160

1:4,000 METRES

NOTE:
1. COORDINATE SYSTEM: GDA2020 MGA ZONE 50

REFERENCES:
1. SITE LAYOUT OVERLAY PROVIDED BY CLIENT (PDF FORMAT). DRAWING NO. 358-ENG-CI-DDR-0002 REV. 0 DATED 28/01/2020.
2. CADASTRE AND AERIAL IMAGERY BASED ON INFORMATION PROVIDED BY AND WITH THE PERMISSION OF THE WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2022). AERIAL IMAGERY DATED JANUARY 2012.

CLIENT
CBH GROUP

PROJECT
KONNONGORRING RAIL SIDING

TITLE
SITE PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2022-10-20
DESIGNED	TC
PREPARED	JRP
REVIEWED	DMS
APPROVED	DMS

PROJECT NO.	CONTROL	REV.	FIGURE
1791739	070 R	0	2

APPENDIX A

Borehole Reports

GOLDER
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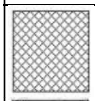
METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

SYMBOLS


FILL


GRAVEL (GW, GP, GM or GC)


SAND (SW, SP, SM or SC)


SILT (ML or MH)


CLAY (CL, CI or CH)


ORGANIC SOILS (OL, OH or Pt)


COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

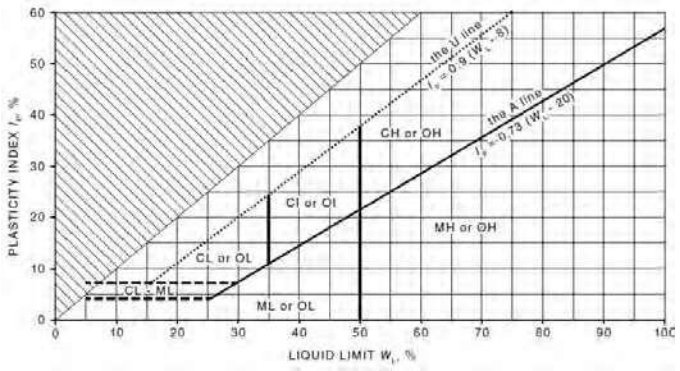
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726-2017. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Soil Group	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	19 to 63 mm
	Medium	6.7 to 19 mm
	Fine	2.36 to 6.7 mm
SAND	Coarse	0.6 to 2.36 mm
	Medium	0.21 to 0.6 mm
	Fine	0.075 to 0.21 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays and silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in dry condition and may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sand and gravels tend to cohere.

Moisture condition for fine grained soils is described relative to the plastic limit or liquid limit as specified in AS1726-2017.

CONSISTENCY AND DENSITY

Fine Grained Soils

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa
Fr	Friable	-

Coarse Grained Soils

Symbol	Term	Density Index (%)	SPN "N" *
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

* SPT correlations are not stated in AS1726-2017, and may be subject to corrections for overburden pressure and equipment type.

CEMENTATION

Weakly Cemented	The soil may be easily disaggregated by hand in air or water.
Moderately Cemented	Effort is required to disaggregate the soil by hand in air or water.

GOLDER
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EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

ADH	Hollow auger drilling	EX	Excavator	PQ3	Diamond core - 83 mm
ADT	Auger drilling with tc-bit	HA	Hand auger	PT	Push tube sampling
ADV	Auger drilling with v-bit	HAND	Excavated by hand methods	RAB	Rotary air blast
AIRCORE	Aircore	HMLC	Diamond core - 63 mm	RC	Reverse circulation
AT	Air track	HQ3	Diamond core - 61 mm	RD	Rotary Drilling
BH	Backhoe bucket	JET	Jetting	RT	Rock roller
CT	Cable tool rig	MZ	Mazier tube sampling	SONIC	Sonic drilling
DTC	Diatube coring	NDD	Non-destructive digging	SPT	Standard penetration testing
EE	Existing excavation	NMLC	Diamond core - 52 mm	U	Undisturbed tube sampling
EPT	Extruded push tube	NQ3	Diamond core - 45 mm	WB	Washbore drilling

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED — The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

GROUNDWATER NOT ENCOUNTERED — The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80 mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure test
DCP	Dynamic cone penetration test
CPT	Cone penetration test
CPTu	Cone penetration test with pore pressure (u) measurement

RANKING OF VISUALLY OBSERVABLE CONTAMINATION AND ODOUR (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)	RQD = Rock Quality Designation (%)	SCR = Solid Core Recovery (%)	F = Fracture Frequency
$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Axial lengths of core} > 100\,\text{mm}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Length of cyclindrical core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\text{No. of defects}}{\text{Length of zone (m)}}$

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

GOLDER
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STRENGTH

Symbol	Term	UCS (MPa)	Field Guide
VL	Very Low	0.6 to 2	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	2 to 6	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	6 to 20	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	20 to 60	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	60 to 200	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>200	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Material with strength less than 'Very Low' shall be described using soil characteristics. The presence of an original rock structure, fabric or texture should be noted, if relevant.

ROCK MATERIAL WEATHERING

Symbol		Term	Field Guide
RS		Residual Soil	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
XW		Extremely Weathered	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
DW	HW	Highly Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
	MW	Moderately Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change of strength from fresh rock.
SW		Slightly Weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
FR		Fresh	Rock shows no sign of decomposition of individual minerals or colour changes.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type	
P	Parting
X	Foliation
L	Cleavage
C	Contact
J	Joint
SSu	Sheared Surface
SS	Sheared Seam
SZ	Sheared Zone
CS	Crushed Seam
IS	Infilled Seam
EWS	Extremely Weathered Seam
V	Vein

Coating or Infilling	
Cn	Clean
Sn	Stain
Ve	Veneer
Ct	Coating
In	Infill

Planarity	
Pl	Planar
Cv	Curved
Un	Undulating
St	Stepped
Ir	Irregular

Roughness	
VRo	Very Rough
Ro	Rough
Sm	Smooth
Po	Polished
Sl	Slickensided

Vertical Boreholes – The dip (inclination from horizontal) of the defect is given.

Inclined Boreholes – The inclination is measured as the acute angle between the core axis and the vertical direction.

REPORT OF TEST PIT: TP01

GOLDER
MEMBER OF WSP

CLIENT:	CBH Group	COORDS: 478547.0 m 6564018.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
LOCATION:	Konnongorring	PIT DEPTH: 2.20 m	CONTRACTOR: WC & SJ Earthmoving
JOB NO:	PS128388	BUCKET TYPE:	LOGGED: CK DATE: 1/9/22
			CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SC	Clayey SAND fine to coarse grained, low plasticity, yellow brown, trace fine to medium grained gravel	M	D	Seat
			0.5								MD	
			1.0								L - MD	
			1.5	1.30					with gravel, sandy clayey gravel in parts		MD	
	H		2.0	2.00				GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, pale grey, with fine to medium grained sand		VD	
			2.5						TEST PIT DISCONTINUED @ 2.20 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.0									

0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01f RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP01

		COORDS: 478547.0 m 6564018.0 m MGA94 Zone 50 50		SHEET: 1 OF 1	
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD		MACHINE: JCB 3CX Backhoe	
PROJECT:	Konnongorring Receival Facility			CONTRACTOR: WC & SJ Earthmoving	
LOCATION:	Konnongorring	PIT DEPTH: 2.20 m		LOGGED: CK	DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:		CHECKED: DMS	DATE: 20/10/22

TP01 - 1

TP01 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP02

CLIENT:	CBH Group	COORDS: 478588.0 m 6564080.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
LOCATION:	Konnongorring	PIT DEPTH: 3.00 m	CONTRACTOR: WC & SJ Earthmoving
JOB NO:	PS128388	BUCKET TYPE:	LOGGED: CK DATE: 1/9/22
			CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SC	Clayey SAND fine to coarse grained, low plasticity, yellow brown, trace fine to medium grained gravel	M	D	Seat
			0.5									
			1.0									
				1.20				GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, yellow brown, with fine to medium grained sand		MD	
			1.5									
			2.0									
			2.5									
			3.0						TEST PIT DISCONTINUED @ 3.00 m TARGET DEPTH GROUNDWATER NOT ENCOUNTERED BACKFILLED			

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

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GAP gINT FN. F01f RL3

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP02

		COORDS: 478588.0 m 6564080.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 3.00 m	LOGGED: CK DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP02 - 1

TP02 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

REPORT OF TEST PIT: TP03

GOLDER
MEMBER OF WSP

CLIENT:	CBH Group	COORDS: 478617.0 m 6564158.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
LOCATION:	Konnongorring	PIT DEPTH: 3.00 m	CONTRACTOR: WC & SJ Earthmoving
JOB NO:	PS128388	BUCKET TYPE:	LOGGED: TC DATE: 1/9/22
			CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0		BDS 0.30-0.60 m Rec = 300/300 mm 3x bags			SC	Clayey SAND fine to coarse grained, low plasticity, yellow brown, trace fine to medium grained gravel	M	MD	Seat
			1.0	1.00				GC / GP	Clayey GRAVEL /Sandy GRAVEL fine to coarse grained, sub-rounded to sub-angular, yellow brown, fine to coarse grained sand			
			3.0						TEST PIT DISCONTINUED @ 3.00 m TARGET DEPTH GROUNDWATER NOT ENCOUNTERED BACKFILLED			

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

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GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP03

		COORDS: 478617.0 m 6564158.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 3.00 m	LOGGED: TC DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP03 - 1

TP03 - 2

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GAP gINT FN. F27 RL1

REPORT OF TEST PIT: TP04

GOLDER
MEMBER OF WSP

CLIENT:	CBH Group	COORDS: 478623.0 m 6564221.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
LOCATION:	Konnongorring	PIT DEPTH: 2.50 m	CONTRACTOR: WC & SJ Earthmoving
JOB NO:	PS128388	BUCKET TYPE:	LOGGED: TC DATE: 1/9/22
			CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SP-SM	Gravelly SAND fine to coarse grained, non-plastic fines, yellow brown, fine to coarse grained sub-rounded to sub-angular gravel, with silt, weakly cemented gravel in parts	M	MD	Seat
			0.5									
			1.0								D	
			1.5									
			2.0	2.00				CL / SC	Sandy CLAY /Clayey GRAVEL low plasticity, orange yellow brown, fine to coarse grained sand, weakly to moderately cemented in parts		D - H	
	H		2.5						TEST PIT DISCONTINUED @ 2.50 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.0									

0 5 10 15 20 25

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GAP gINT FN. F01f RL3

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP04

		COORDS: 478623.0 m 6564221.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 2.50 m	LOGGED: TC DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP04 - 1

TP04 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27
RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP05

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478618.0 m 6564283.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 0.70 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: TC DATE: 1/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	0 5 10 15 20 25
BH	H		0.0		BDS 0.30-0.60 m Rec = 300/300 mm 3x bags			SP-SM	Gravelly SAND fine to coarse grained, non-plastic fines, yellow brown, fine to coarse grained sub-rounded to sub-angular gravel, with silt, weakly cemented gravel in parts	D	VD	
			0.5									
									TEST PIT DISCONTINUED @ 0.70 m REFUSAL ON VERY DENSE GRAVEL GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									

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GAP gINT FN. F01f RL3

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP05

		COORDS: 478618.0 m 6564283.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 0.70 m	LOGGED: TC DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP05 - 1

TP05 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP07

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478552.0 m 6564411.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 0.60 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 1/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	H		0.0					SC / CL-CI	Clayey SAND /Sandy CLAY fine to coarse grained, yellow brown, moderately cemented in parts	M	H	Seat (HB)
			0.5						TEST PIT DISCONTINUED @ 0.60 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01f RL3

GAP 10.0.6 LIB.GLB Log GAP NON-CORED FULL PAGE KONNO RAIL SIDING.GPJ <<DrawingFile>> 20/10/2022 16:03 10.02.00.04 Datgel Tools

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP07

		COORDS: 478552.0 m 6564411.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 0.60 m	LOGGED: CK DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP07 - 1

TP07 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP09

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478499.0 m 6564532.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 3.00 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: TC DATE: 1/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M	▽	0.0					SC	Clayey SAND fine to coarse grained, yellow brown		D	Seat
			0.5								MD	
				0.70				GP-GM	Sandy GRAVEL /Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, non-plastic fines, yellow brown, fine to coarse grained sand, with silt			
			1.0		BDS 1.00-1.50 m Rec = 500/500 mm 3x bags					M		
			1.5								D	
			2.0									
		▽	2.5							W		
			3.0						TEST PIT DISCONTINUED @ 3.00 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 2.50 m DEPTH BACKFILLED			

REPORT OF TEST PIT PHOTOGRAPHS: TP09

		COORDS: 478499.0 m 6564532.0 m MGA94 Zone 50 50		SHEET: 1 OF 1	
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD		MACHINE: JCB 3CX Backhoe	
PROJECT:	Konnongorring Receival Facility			CONTRACTOR: WC & SJ Earthmoving	
LOCATION:	Konnongorring	PIT DEPTH: 3.00 m		LOGGED: TC	DATE: 1/9/22
JOB NO:	PS128388	BUCKET TYPE:		CHECKED: DMS	DATE: 20/10/22

TP09 - 1

TP09 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27
RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP13

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478343.0 m 6564832.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 0.60 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 1/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					CL-CI / SC	Sandy CLAY /Clayey SAND low to medium plasticity, brown, fine to coarse grained sand, approximately 30-40% fines (possibly fill)	M	VSt - H	Seat (HB)
	H		0.5									
									TEST PIT DISCONTINUED @ 0.60 m REFUSAL ON ROCK GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP14

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478239.0 m 6564820.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 2/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, brown, trace sand		L	Seat
			0.5	0.60				SM	Silty SAND brown, moderately cemented gravel in parts	M	MD	
	H		1.0								VD	
									TEST PIT DISCONTINUED @ 1.20 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01f RL3

GAP 10.0.6 LIB.GLB Log GAP NON-CORED FULL PAGE KONNO RAIL SIDING.GPJ <<DrawingFile>> 20/10/2022 16:03 10.02.00.04 Datgel Tools

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP14

		COORDS: 478239.0 m 6564820.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 1.20 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP14 - 1

TP14 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP15

CLIENT:	CBH Group	COORDS: 478155.0 m 6564785.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
LOCATION:	Konnongorring	PIT DEPTH: 2.10 m	CONTRACTOR: WC & SJ Earthmoving
JOB NO:	PS128388	BUCKET TYPE:	LOGGED: CK DATE: 2/9/22
			CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					GC	Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, yellow brown, trace sand	M	MD	Seat 20+
			1.0	1.30	BDS 1.30-1.50 m Rec = 200/200 mm 2x bags			SM	Silty SAND brown, moderately cemented gravel in parts			
	H		2.0								VD	
			2.5						TEST PIT DISCONTINUED @ 2.10 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01f RL3

GAP 10.0.6 LIB.GLB Log GAP NON-CORED FULL PAGE KONNO RAIL SIDING.GPJ <<DrawingFile>> 20/10/2022 16:03 10.02.00.04 Datgel Tools

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP15

		COORDS: 478155.0 m 6564785.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 2.10 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP15 - 1

TP15 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP16

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478127.0 m 6564853.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 2/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SC	Clayey SAND low plasticity, orange brown, fine to medium grained clay, weakly to moderately cemented gravel in parts	M	MD	Seat
			0.5		BDS 0.50-0.70 m Rec = 200/200 mm 2x bags						D	20+
	H		1.0									
									TEST PIT DISCONTINUED @ 1.20 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP16

		COORDS: 478127.0 m 6564853.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 1.20 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP16 - 1

TP16 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP17

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478185.0 m 6564875.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 0.20 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 2/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm 0 5 10 15 20 25
BH	H		0.0					SC	Clayey SAND fine to medium grained, orange brown and brown, weakly cemented in parts, approximately 20% of fines	M	VD	Seat (HB)
									TEST PIT DISCONTINUED @ 0.20 m REFUSAL ON ROCK GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			0.5									
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01f RL3

GAP 10.0.6 LIB.GLB Log GAP NON-CORED FULL PAGE KONNO RAIL SIDING.GPJ <<DrawingFile>> 20/10/2022 16:03 10.02.00.04 Datgel Tools

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP17

		COORDS: 478185.0 m 6564875.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 0.20 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP17 - 1

TP17 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP18

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478239.0 m 6564916.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 0.80 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 2/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SC	Clayey SAND fine to medium grained, orange brown and brown, weakly cemented in parts, approximately 20% fines	M	L	Seat
				0.40				CI	Sandy CLAY medium plasticity, orange brown, fine to medium grained sand, weakly cemented in parts, approximately 40-50% fines		H	20+
	H		0.5									
									TEST PIT DISCONTINUED @ 0.80 m REFUSAL ON ROCK GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP18

		COORDS: 478239.0 m 6564916.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 0.80 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP18 - 1

TP18 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP19

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478108.0 m 6564933.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 2/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SC	Clayey SAND fine to medium grained, orange brown, low to medium plasticity clay, weakly cemented in parts, approximately 20-30% fines	M	MD	Seat
			0.5									
				0.70				CI / SC	Sandy CLAY /Clayey SAND medium plasticity, orange brown, fine to coarse grained sand, weakly cemented in parts, approximately 30-40% fines			(HB)
			1.0									
			1.5	1.50					pale yellow brown		VSt	
	H										H	
			2.0									
			2.5						TEST PIT DISCONTINUED @ 2.50 m REFUSAL ON HARD CLAY GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01f RL3

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP19

		COORDS: 478108.0 m 6564933.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 2.50 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP19 - 1

TP19 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT: TP20

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478178.0 m 6564969.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
PIT DEPTH: 0.70 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: JCB 3CX Backhoe
CONTRACTOR: WC & SJ Earthmoving
LOGGED: CK DATE: 2/9/22
CHECKED: DMS DATE: 20/10/22

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M		0.0					SC	Clayey SAND fine to medium grained, orange brown and brown, weakly cemented in parts, approximately 20% fines	M	MD	Seat
				0.40								
	H		0.5					CI	Sandy CLAY medium plasticity, orange brown, fine to medium grained sand, weakly cemented in parts, approximately 40-50% fines		H	(HB)
									TEST PIT DISCONTINUED @ 0.70 m REFUSAL ON ROCK GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

GOLDER
MEMBER OF WSP

REPORT OF TEST PIT PHOTOGRAPHS: TP20

		COORDS: 478178.0 m 6564969.0 m MGA94 Zone 50 50	SHEET: 1 OF 1
CLIENT:	CBH Group	SURFACE RL: DATUM: AHD	MACHINE: JCB 3CX Backhoe
PROJECT:	Konnongorring Receival Facility		CONTRACTOR: WC & SJ Earthmoving
LOCATION:	Konnongorring	PIT DEPTH: 0.70 m	LOGGED: CK DATE: 2/9/22
JOB NO:	PS128388	BUCKET TYPE:	CHECKED: DMS DATE: 20/10/22

TP20 - 1

TP20 - 2

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F27 RL1

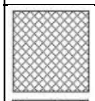
APPENDIX B

Test Pit Reports

GOLDER
MEMBER OF WSP

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

SYMBOLS


FILL


GRAVEL (GW, GP, GM or GC)


SAND (SW, SP, SM or SC)


SILT (ML or MH)


CLAY (CL, CI or CH)


ORGANIC SOILS (OL, OH or Pt)


COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

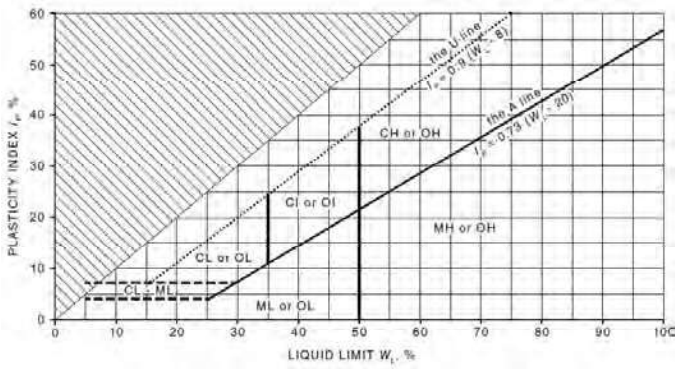
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726-2017. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Soil Group	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	19 to 63 mm
	Medium	6.7 to 19 mm
	Fine	2.36 to 6.7 mm
SAND	Coarse	0.6 to 2.36 mm
	Medium	0.21 to 0.6 mm
	Fine	0.075 to 0.21 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays and silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in dry condition and may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sand and gravels tend to cohere.

Moisture condition for fine grained soils is described relative to the plastic limit or liquid limit as specified in AS1726-2017.

CONSISTENCY AND DENSITY

Fine Grained Soils

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa
Fr	Friable	-

Coarse Grained Soils

Symbol	Term	Density Index (%)	SPN "N" *
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

* SPT correlations are not stated in AS1726-2017, and may be subject to corrections for overburden pressure and equipment type.

CEMENTATION

Weakly Cemented	The soil may be easily disaggregated by hand in air or water.
Moderately Cemented	Effort is required to disaggregate the soil by hand in air or water.

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EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

ADH	Hollow auger drilling	EX	Excavator	PQ3	Diamond core - 83 mm
ADT	Auger drilling with tc-bit	HA	Hand auger	PT	Push tube sampling
ADV	Auger drilling with v-bit	HAND	Excavated by hand methods	RAB	Rotary air blast
AIRCORE	Aircore	HMLC	Diamond core - 63 mm	RC	Reverse circulation
AT	Air track	HQ3	Diamond core - 61 mm	RD	Rotary Drilling
BH	Backhoe bucket	JET	Jetting	RT	Rock roller
CT	Cable tool rig	MZ	Mazier tube sampling	SONIC	Sonic drilling
DTC	Diatube coring	NDD	Non-destructive digging	SPT	Standard penetration testing
EE	Existing excavation	NMLC	Diamond core - 52 mm	U	Undisturbed tube sampling
EPT	Extruded push tube	NQ3	Diamond core - 45 mm	WB	Washbore drilling

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED — The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

GROUNDWATER NOT ENCOUNTERED — The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80 mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure test
DCP	Dynamic cone penetration test
CPT	Cone penetration test
CPTu	Cone penetration test with pore pressure (u) measurement

RANKING OF VISUALLY OBSERVABLE CONTAMINATION AND ODOUR (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)	RQD = Rock Quality Designation (%)	SCR = Solid Core Recovery (%)	F = Fracture Frequency
$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Axial lengths of core} > 100\,\text{mm}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Length of cyclindrical core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\text{No. of defects}}{\text{Length of zone (m)}}$

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

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STRENGTH

Symbol	Term	UCS (MPa)	Field Guide
VL	Very Low	0.6 to 2	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	2 to 6	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	6 to 20	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	20 to 60	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	60 to 200	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>200	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Material with strength less than 'Very Low' shall be described using soil characteristics. The presence of an original rock structure, fabric or texture should be noted, if relevant.

ROCK MATERIAL WEATHERING

Symbol		Term	Field Guide
RS		Residual Soil	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
XW		Extremely Weathered	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
DW	HW	Highly Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
	MW	Moderately Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change of strength from fresh rock.
SW		Slightly Weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
FR		Fresh	Rock shows no sign of decomposition of individual minerals or colour changes.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type	
P	Parting
X	Foliation
L	Cleavage
C	Contact
J	Joint
SSu	Sheared Surface
SS	Sheared Seam
SZ	Sheared Zone
CS	Crushed Seam
IS	Infilled Seam
EWS	Extremely Weathered Seam
V	Vein

Coating or Infilling	
Cn	Clean
Sn	Stain
Ve	Veneer
Ct	Coating
In	Infill

Planarity	
Pl	Planar
Cv	Curved
Un	Undulating
St	Stepped
Ir	Irregular

Roughness	
VRo	Very Rough
Ro	Rough
Sm	Smooth
Po	Polished
Sl	Slickensided

Vertical Boreholes – The dip (inclination from horizontal) of the defect is given.
Inclined Boreholes – The inclination is measured as the acute angle between the core axis and the vertical direction.

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REPORT OF BOREHOLE: BH01

SHEET: 1 OF 2

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478398.0 m 6564747.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 20.00 m

DRILL RIG: GDR650
CONTRACTOR: Ozdrill
LOGGED: CK DATE: 6/9/22
CHECKED: DMS DATE: 20/10/22

Drilling						Field Material Description					Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH UCS MPa (VL 0.6, L 2.0, M 6.0, H 20, VH 60, EH 200)	LABORATORY STRENGTH (MPa)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm) (10, 30, 100, 300, 1000, 3000)
HQ3	GWNO			0			Sandy GRAVEL (GP) fine to coarse grained, sub-rounded to sub-angular, brown, fine to medium grained sand, with fines					
					0.45							
		100	50 (100)	1			REFURRUGINISED GRANITE fine to coarse grained, pale grey with red, quartz sand in an iron cemented matrix, iron staining up to 40-60mm thickness, well cemented			PLI(D)=0.08		
					1.50							
				2			Sandy SILT / Sandy CLAY (CL-ML) white, fine to coarse grained sand, trace fine to medium grained gravel, hard				Rec = 180/370 mm SPT 1.50-1.87 m; 25, 30, 22/70mm N>52	
				3							Rec = 240/450 mm SPT 3.00-3.45 m; 10, 13, 18 N=31	
					3.50		Core Loss between 3.5 m and 4 m					
				4	4.00		Sandy SILT / Sandy CLAY (CH-MH) white, fine to coarse grained sand, very stiff to hard				Rec = 340/450 mm SPT 4.50-4.95 m; 7, 12, 21 N=33	
				5								
				6							Rec = 280/450 mm SPT 6.00-6.45 m; 6, 10, 16 N=26	
				7								
				8							Rec = 300/450 mm SPT 7.50-7.95 m; 6, 8, 14 N=22	
				9							Rec = 380/450 mm SPT 9.00-9.45 m; 6, 11, 19 N=30	
				10								

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F02a
RL3

GOLDER
MEMBER OF WSP

REPORT OF BOREHOLE: BH01

SHEET: 2 OF 2

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478398.0 m 6564747.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 20.00 m

DRILL RIG: GDR650
CONTRACTOR: Ozdrill
LOGGED: CK DATE: 6/9/22
CHECKED: DMS DATE: 20/10/22

Drilling						Field Material Description					Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH UCS MPa (VL 0.6, L 2.0, M 6.0, H 20, VH 60, EH 200)	LABORATORY STRENGTH (MPa)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm) (10, 30, 100, 300, 1000, 3000)
HQ3	GWNO			10			Sandy SILT / Sandy CLAY (CH-MH) white, fine to coarse grained sand, very stiff to hard				Rec = 240/450 mm SPT 10.50-10.95 m; 10, 19, 23 N=42	
					11.00							
				11			Sandy CLAY (CI) medium plasticity, white mottled yellow brown, fine to coarse grained sand, hard					
				12							Rec = 240/450 mm SPT 12.00-12.45 m; 12, 20, 36 N=56	
					12.45							
							Core Loss between 12.45 m and 13.39 m					
				13								
					13.39							
							Sandy CLAY (CI) medium plasticity, white, fine to medium grained sand, hard				Rec = 210/330 mm SPT 13.50-13.83 m; 13, 30, 8/30mm N>38	
					14.00							
				14			fine to coarse grained					
					14.80							
						+ +	GRANITE fine to medium grained, flow banded, layered, white	XW		PLI(A)=0.14	SPT 15.00-15.05 m; 6/50mm HB N=R	
				15		+ +						
		100	95 (100)			+ +				PLI(D)=0.56		
				16		+ +		DW				
					16.65	+ +						
						+ +	iron staining at 16.76 m					
		100	100 (100)	17		+ +						
					17.40	+ +						
						+ +	iron staining at 17.4 m, and 17.6 m to 17.95 m					
				18		+ +		HW				
		100	100 (100)			+ +						
					19.00	+ +						
				19		+ +	iron staining from 19 m to 20 m					
		100	85 (215)			+ +	END OF BOREHOLE @ 20.00 m TARGET DEPTH GROUNDWATER NOT OBSERVED BACKFILLED					
				20	20.00	+ +						

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GAP gINT FN. F02a
RL3

GAP 10.0.6 LIB.GLB Log GAP CORED BOREHOLE KONNO RAIL SIDING.GPJ <<DrawingFile>> 20/10/2022 16:56 10.02.00.04 Datgel Tools

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REPORT OF CORE PHOTOGRAPHS: BH01

SHEET: 1 OF 2

CLIENT:	CBH Group	COORDS: 478398.0 m 6564747.0 m MGA94 Zone 50 50	DRILL RIG: GDR650		
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	CONTRACTOR: Ozdrill		
LOCATION:	Konnongorring	INCLINATION: -90°	LOGGED: CK	DATE:	6/9/22
JOB NO:	PS128388	HOLE DEPTH: 20.00 m	CHECKED: DMS	DATE:	20/10/22

BH01 - 0.00 - 5.00 m

BH01 - 5.00 - 10.00 m

GOLDER
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REPORT OF CORE PHOTOGRAPHS: BH01

SHEET: 2 OF 2

CLIENT:	CBH Group	COORDS: 478398.0 m 6564747.0 m MGA94 Zone 50 50	DRILL RIG: GDR650		
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	CONTRACTOR: Ozdrill		
LOCATION:	Konnongorring	INCLINATION: -90°	LOGGED: CK	DATE:	6/9/22
JOB NO:	PS128388	HOLE DEPTH: 20.00 m	CHECKED: DMS	DATE:	20/10/22

BH01 - 10.00 - 15.00 m

BH01 - 15.00 - 20.00 m

REPORT OF BOREHOLE: BH02

GOLDER
MEMBER OF WSP

SHEET: 1 OF 2

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478391.0 m 6564759.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 20.00 m

DRILL RIG: GDR650
CONTRACTOR: Ozdrill
LOGGED: CK DATE: 7/9/22
CHECKED: DMS DATE: 20/10/22

Drilling						Field Material Description					Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH UCS MPa (VL 0.6, L 2.0, M 6.0, H 20, VH 60, EH 200)	LABORATORY STRENGTH (MPa)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm) (10, 30, 100, 300, 1000, 3000)
HQ3	GWNO			0	0.56		Sandy GRAVEL (GP) fine to coarse grained, sub-rounded to sub-angular, brown, fine to medium grained sand, with fines					
		100	100 (100)	1	1.61		REFURRUGINISED GRANITE fine to coarse grained, pale grey with red, quartz sand in an iron cemented matrix, iron staining up to 40-60mm thickness, well cemented			PLI(A)=0.13 PLI(D)=0.99		
					2.00		Core Loss between 1.61 m and 2 m				Rec = 210/150 mm SPT 1.50-1.65 m; 20/150mm HB N=R	
				2	2.25		Silty CLAY (CH) high plasticity, white, with fine to medium grained sand, hard					
		100	100 (100)				REFURRUGINISED GRANITE fine to coarse grained, white, iron staining in parts, well cemented			PLI(A)=0.09		
		100	90 (100)	3	3.45						Rec = 200/450 mm SPT 3.00-3.45 m; 11, 18, 26 N=44	
					4.35		Core Loss between 3.45 m and 4.35 m					
				4	5.83		Sandy SILT / Sandy CLAY (CL-ML) white, fine to coarse grained sand, trace fine to medium grained gravel, very stiff				Rec = 250/450 mm SPT 4.50-4.95 m; 8, 15, 13 N=28	
				5	6.00		Core Loss between 5.83 m and 6 m					
				6	6.45		Sandy SILT / Sandy CLAY (CL-ML) white, fine to coarse grained sand, hard				Rec = 240/450 mm SPT 6.00-6.45 m; 11, 17, 28 N=45	
					7.00		Core Loss between 6.45 m and 7 m					
				7	8.00		Sandy SILT / Sandy CLAY (CL-ML) white mottled yellow brown, fine to coarse grained sand, hard				Rec = 270/450 mm SPT 7.50-7.95 m; 11, 19, 28 N=47	
				8	8.71		Core Loss between 8 m and 8.71 m					
				9	9.45		Sandy SILT / Sandy CLAY (CL-ML) white mottled yellow brown, fine to coarse grained sand, hard				Rec = 230/410 mm SPT 9.00-9.41 m; 11, 14, 22/110mm N>36	
					10.00		Core Loss between 9.45 m and 10 m					
				10								

REPORT OF BOREHOLE: BH02

SHEET: 2 OF 2

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478391.0 m 6564759.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 20.00 m

DRILL RIG: GDR650
CONTRACTOR: Ozdrill
LOGGED: CK DATE: 7/9/22
CHECKED: DMS DATE: 20/10/22

Drilling						Field Material Description					Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH UCS MPa (VL 0.6, L 2.5, M 5.0, H 20, VH 60, EH 200)	LABORATORY STRENGTH (MPa)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm) (10, 30, 100, 300, 1000, 3000)
HQ3	GWNO			10			Sandy SILT / Sandy CLAY (CL-ML) white mottled yellow brown, fine to coarse grained sand, hard				Rec = 260/350 mm SPT 10.50-10.85 m; 12, 20, 10/50mm N>30	
				11	11.56							
					11.73		presence of fine to coarse quartz fragments					
							pink staining of 50mm thick				Rec = 230/450 mm SPT 12.00-12.45 m; 11, 15, 21 N=36	
				12	12.45		Core Loss between 12.45 m and 13.1 m					
				13	13.10		Sandy CLAY (CI) medium plasticity, white, fine to coarse grained sand, hard				Rec = 260/375 mm SPT 13.50-13.88 m; 13, 24, 16/75mm N>40	
				14	14.20		presence of fine to coarse quartz fragments					
				15	15.45		Core Loss between 15.45 m and 16 m				Rec = 140/100 mm SPT 15.00-15.10 m; 17/100mm HB N=R	
				16	16.00		SAND (SP) fine to coarse grained, pale grey, very dense					
					16.50		Sandy CLAY (CI-CH) medium to high plasticity, white, fine to medium grained sand, hard, approximately 30-40% fines, trace fine to coarse quartz gravel fragments				Rec = 220/200 mm SPT 16.50-16.70 m; 23, 14/50mm HB N>14	
				17	17.00		Core Loss between 17 m and 17.7 m					
					17.70		Sandy CLAY (CL) low plasticity, white, fine to medium grained sand, hard, approximately 30-40% fines, presence of fine to coarse quartz fragments				Rec = 300/450 mm SPT 18.00-18.45 m; 15, 23, 40 N=63	
				18	18.45		Core Loss between 18.45 m and 19 m					
				19	19.00		Sandy CLAY (CL) low plasticity, white, fine to medium grained sand, hard, approximately 30-40% fines, presence of fine to coarse quartz fragments					
					19.32							
					19.50		Core Loss between 19.32 m and 19.5 m				Rec = 200/300 mm SPT 19.50-19.80 m; 12, 33/150mm HB N>33	
				20	20.00		Sandy CLAY (CL-CI) low plasticity, white, fine to medium grained sand,					

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GAP gINT FN. F02a
RL3

GOLDER
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REPORT OF BOREHOLE: BH02

SHEET: 3 OF 2

CLIENT: CBH Group
PROJECT: Konnongorring Receival Facility
LOCATION: Konnongorring
JOB NO: PS128388

COORDS: 478391.0 m 6564759.0 m MGA94 Zone 50 50
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 20.00 m

DRILL RIG: GDR650
CONTRACTOR: Ozdrill
LOGGED: CK DATE: 7/9/22
CHECKED: DMS DATE: 20/10/22

Drilling						Field Material Description					Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH UCS MPa (VL 0.6, L 2.0, M 6.0, H 20, VH 60, EH 200)	LABORATORY STRENGTH (MPa)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm) (10, 30, 100, 300, 1000, 3000)
				20			hard, approximately 30-40% fines					
							END OF BOREHOLE @ 20.00 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 6.60 m DEPTH STANDPIPE INSTALLED					
				21								
				22								
				23								
				24								
				25								
				26								
				27								
				28								
				29								
				30								

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F02a
RL3

GOLDER
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REPORT OF CORE PHOTOGRAPHS: BH02

SHEET: 1 OF 2

CLIENT:	CBH Group	COORDS: 478391.0 m 6564759.0 m MGA94 Zone 50 50	DRILL RIG: GDR650		
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	CONTRACTOR: Ozdrill		
LOCATION:	Konnongorring	INCLINATION: -90°	LOGGED: CK	DATE:	7/9/22
JOB NO:	PS128388	HOLE DEPTH: 20.00 m	CHECKED: DMS	DATE:	20/10/22

BH02 - 0.00 - 5.00 m

BH02 - 5.00 - 10.00 m

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REPORT OF CORE PHOTOGRAPHS: BH02

SHEET: 2 OF 2

CLIENT:	CBH Group	COORDS: 478391.0 m 6564759.0 m MGA94 Zone 50 50	DRILL RIG: GDR650		
PROJECT:	Konnongorring Receival Facility	SURFACE RL: DATUM: AHD	CONTRACTOR: Ozdrill		
LOCATION:	Konnongorring	INCLINATION: -90°	LOGGED: CK	DATE:	7/9/22
JOB NO:	PS128388	HOLE DEPTH: 20.00 m	CHECKED: DMS	DATE:	20/10/22

BH02 - 10.00 - 15.00 m

BH02 - 15.00 - 20.00 m

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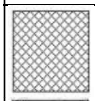
METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

SYMBOLS


FILL


GRAVEL (GW, GP, GM or GC)


SAND (SW, SP, SM or SC)


SILT (ML or MH)


CLAY (CL, CI or CH)


ORGANIC SOILS (OL, OH or Pt)


COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

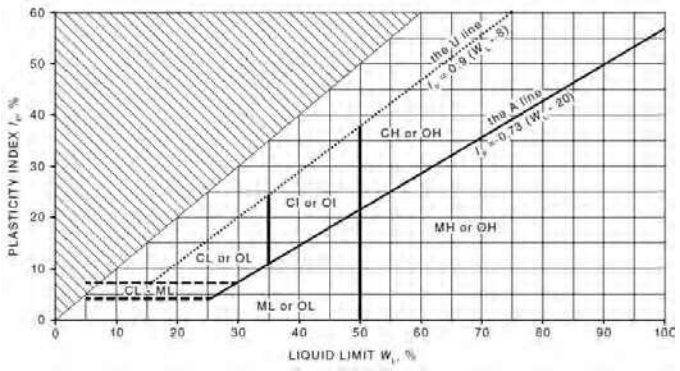
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726-2017. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Soil Group	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	19 to 63 mm
	Medium	6.7 to 19 mm
	Fine	2.36 to 6.7 mm
SAND	Coarse	0.6 to 2.36 mm
	Medium	0.21 to 0.6 mm
	Fine	0.075 to 0.21 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays and silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in dry condition and may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sand and gravels tend to cohere.

Moisture condition for fine grained soils is described relative to the plastic limit or liquid limit as specified in AS1726-2017.

CONSISTENCY AND DENSITY

Fine Grained Soils

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa
Fr	Friable	-

Coarse Grained Soils

Symbol	Term	Density Index (%)	SPN "N" *
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

* SPT correlations are not stated in AS1726-2017, and may be subject to corrections for overburden pressure and equipment type.

CEMENTATION

Weakly Cemented	The soil may be easily disaggregated by hand in air or water.
Moderately Cemented	Effort is required to disaggregate the soil by hand in air or water.

GOLDER
MEMBER OF WSP

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

ADH	Hollow auger drilling	EX	Excavator	PQ3	Diamond core - 83 mm
ADT	Auger drilling with tc-bit	HA	Hand auger	PT	Push tube sampling
ADV	Auger drilling with v-bit	HAND	Excavated by hand methods	RAB	Rotary air blast
AIRCORE	Aircore	HMLC	Diamond core - 63 mm	RC	Reverse circulation
AT	Air track	HQ3	Diamond core - 61 mm	RD	Rotary Drilling
BH	Backhoe bucket	JET	Jetting	RT	Rock roller
CT	Cable tool rig	MZ	Mazier tube sampling	SONIC	Sonic drilling
DTC	Diatube coring	NDD	Non-destructive digging	SPT	Standard penetration testing
EE	Existing excavation	NMLC	Diamond core - 52 mm	U	Undisturbed tube sampling
EPT	Extruded push tube	NQ3	Diamond core - 45 mm	WB	Washbore drilling

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED — The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

GROUNDWATER NOT ENCOUNTERED — The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80 mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure test
DCP	Dynamic cone penetration test
CPT	Cone penetration test
CPTu	Cone penetration test with pore pressure (u) measurement

RANKING OF VISUALLY OBSERVABLE CONTAMINATION AND ODOUR (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)	RQD = Rock Quality Designation (%)	SCR = Solid Core Recovery (%)	F = Fracture Frequency
$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Axial lengths of core} > 100\,\text{mm}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Length of cyclindrical core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\text{No. of defects}}{\text{Length of zone (m)}}$

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

GOLDER
MEMBER OF WSP

STRENGTH

Symbol	Term	UCS (MPa)	Field Guide
VL	Very Low	0.6 to 2	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	2 to 6	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	6 to 20	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	20 to 60	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	60 to 200	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>200	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Material with strength less than 'Very Low' shall be described using soil characteristics. The presence of an original rock structure, fabric or texture should be noted, if relevant.

ROCK MATERIAL WEATHERING

Symbol		Term	Field Guide
RS		Residual Soil	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
XW		Extremely Weathered	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
DW	HW	Highly Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
	MW	Moderately Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change of strength from fresh rock.
SW		Slightly Weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
FR		Fresh	Rock shows no sign of decomposition of individual minerals or colour changes.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type	
P	Parting
X	Foliation
L	Cleavage
C	Contact
J	Joint
SSu	Sheared Surface
SS	Sheared Seam
SZ	Sheared Zone
CS	Crushed Seam
IS	Infilled Seam
EWS	Extremely Weathered Seam
V	Vein

Coating or Infilling	
Cn	Clean
Sn	Stain
Ve	Veneer
Ct	Coating
In	Infill

Planarity	
Pl	Planar
Cv	Curved
Un	Undulating
St	Stepped
Ir	Irregular

Roughness	
VRo	Very Rough
Ro	Rough
Sm	Smooth
Po	Polished
Sl	Slickensided

Vertical Boreholes – The dip (inclination from horizontal) of the defect is given.

Inclined Boreholes – The inclination is measured as the acute angle between the core axis and the vertical direction.

APPENDIX C

Geotechnical Laboratory Certificates

Soils testing - Determination of the California Bearing Ratio of a soil

Standard laboratory method for a remoulded specimen (Soaked)

AS 1289.6.1.1-2014

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209160**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	**0.30 - 0.60**
Project name:	Konnongorring Receival Facility	**TP03**		**Client sample ref.:**	
Project reference:		**Loc. ref.:**			
Sample description:	(SC) Clayey SAND, fine to coarse grained, brown, low plasticity, trace of fine to medium gravel.			**Sampled by:**	**Tested as received**
				Sampled type:	**Bulk**

SPECIMEN PREPARATION - SUMMARY OF COMPACTION AND MOISTURE CONTENT TEST RESULTS

Initial moisture content:	**9.3% As rcvd.**
Compaction method:	AS1289.5.2.1-2017 Modified
Maximum dry density (t/m^3):	**2.07**
Optimum moisture content:	**8.5%**
Oversize material (>19mm):	-
Compaction moisture content:	**8.7%**

Note on compaction:

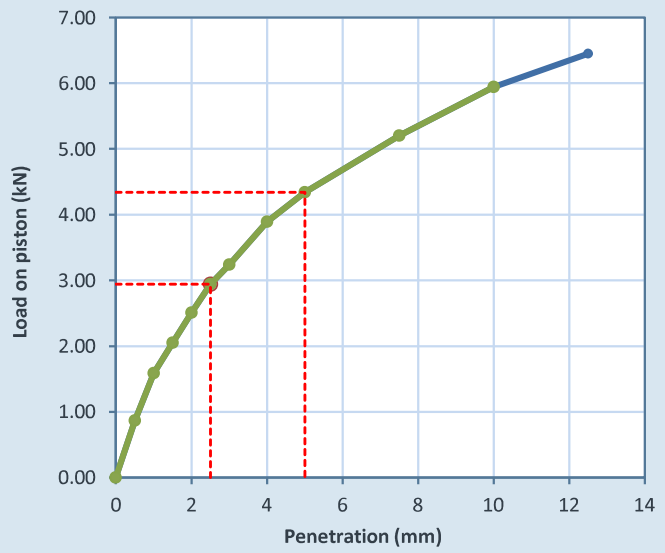
No oversize material was retained on the 19mm sieve

Notes on test:

Notes on compaction test

SUMMARY OF CALIFORNIA BEARING RATIO TEST RESULT

Penetration (mm):		0.0	0.5	1.0	1.5	2.0	**2.5**	3.0	4.0	**5.0**	7.5	10.0	12.5	**Correction:**	
Load (kN)	**Original**	0.00	0.87	1.59	2.05	2.51	2.94	3.24	3.89	4.34	5.20	5.94	6.45		
	Corrected	0.00	0.87	1.59	2.05	2.51	2.94	3.24	3.89	4.34	5.20	5.94			



Dry density t/m^3	before soaking:	**1.96**
	after soaking	**1.96**
Density ratio	before soaking	**95.0%**
	after soaking	**95.0%**
Moisture ratio at compaction:		**102.5%**
Duration of soaking (days):		**4**
Surcharge applied (kg):		**6.8**
Moisture content top 30mm:		**11.9%**
Moisture content remainder:		**11.0%**
Swell after soaking:		**NIL**
Bearing ratio at 2.5mm penetration:		**20.0%**
Bearing ratio at 5.0mm penetration:		**20.0%**

Penetration (mm) **2.5** **CBR Value** **20%**

Definitions: ND = Not determined

Specimen prepared by: rk **Tested by:** PK **On:** 11/10/22

Results reviewed by: PKent **Date reported:** **12/10/22**

Cert. ref.:	**PS128388-02_TP03_TRP22-0117_CBRS_2209160_Rep-22086212**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
	THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	**Paul Kent - Laboratory Manager**

For issue

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Soils testing - Determination of the California Bearing Ratio of a soil

Standard laboratory method for a remoulded specimen (Soaked)

AS 1289.6.1.1-2014

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209161**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	**0.30 - 0.60**
Project name:	Konnongorring Receival Facility	**TP05**		**Client sample ref.:**	
Project reference:		**Loc. ref.:**			
Sample description:	(SP-SM) Gravelly SAND, with silt, fine to coarse grained, brown, fine to coarse grained gravel, non-plastic fines.			**Sampled by:**	**Tested as received**
				Sampled type:	**Bulk**

SPECIMEN PREPARATION - SUMMARY OF COMPACTION AND MOISTURE CONTENT TEST RESULTS

Initial moisture content:	**9.3% As rcvd.**
Compaction method:	AS1289.5.2.1-2017 Modified
Maximum dry density (t/m^3):	**2.10**
Optimum moisture content:	**8.5%**
Oversize material (>19mm):	-
Compaction moisture content:	**8.6%**

Note on compaction:

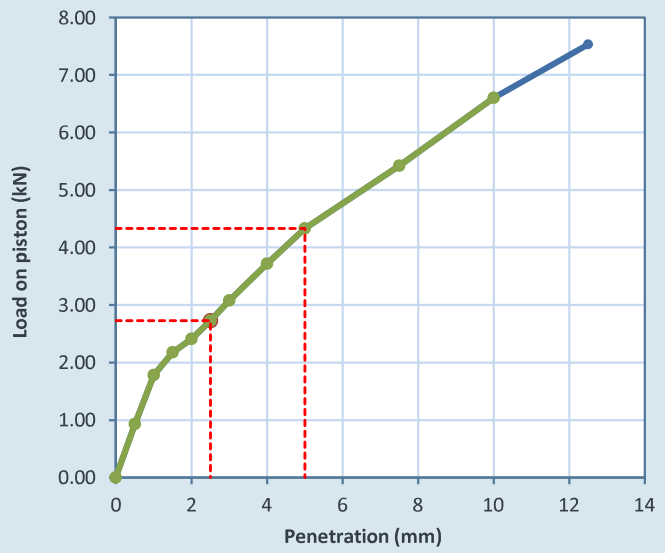
No oversize material was retained on the 19mm sieve

Notes on test:

Notes on compaction test

SUMMARY OF CALIFORNIA BEARING RATIO TEST RESULT

Penetration (mm):		0.0	0.5	1.0	1.5	2.0	**2.5**	3.0	4.0	**5.0**	7.5	10.0	12.5	**Correction:**	
Load (kN)	**Original**	0.00	0.93	1.78	2.18	2.41	2.73	3.08	3.72	4.33	5.42	6.60	7.53		
	Corrected	0.00	0.93	1.78	2.18	2.41	2.73	3.08	3.72	4.33	5.42	6.60			



Dry density t/m^3	before soaking:	**1.94**
	after soaking	**1.94**
Density ratio	before soaking	**92.5%**
	after soaking	**92.0%**
Moisture ratio at compaction:		**101.5%**
Duration of soaking (days):		**4**
Surcharge applied (kg):		**6.8**
Moisture content top 30mm:		**14.0%**
Moisture content remainder:		**11.6%**
Swell after soaking:		**NIL**
Bearing ratio at 2.5mm penetration:		**20.0%**
Bearing ratio at 5.0mm penetration:		**20.0%**

Penetration (mm) **2.5** **CBR Value** **20%**

Definitions:

ND = Not determined

Specimen prepared by: rk **Tested by:** PK **On:** 11/10/22

Results reviewed by: PKent **Date reported:** **12/10/22**

Cert. ref.: **PS128388-02_TP05_TRP22-0117_CBRS_2209161_Rep-22086213**

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth

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Soils testing - Determination of the California Bearing Ratio of a soil

Standard laboratory method for a remoulded specimen (Soaked)

AS 1289.6.1.1-2014

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209162**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	**1.00 - 1.50**
Project name:	Konnongorring Receival Facility	**TP09**		**Client sample ref.:**	
Project reference:		**Loc. ref.:**			
Sample description:	(GP-GM) Sandy GRAVEL, with silt, fine to coarse grained, light brown, fine to coarse grained sand, non-plastic fines.			**Sampled by:**	**Tested as received**
				Sampled type:	**Bulk**

SPECIMEN PREPARATION - SUMMARY OF COMPACTION AND MOISTURE CONTENT TEST RESULTS

Initial moisture content:	**12.5% As rcvd.**
Compaction method:	AS1289.5.2.1-2017 Modified
Maximum dry density (t/m^3):	**2.04**
Optimum moisture content:	**9.0%**
Oversize material (>19mm):	-
Compaction moisture content:	**9.3%**

Note on compaction:

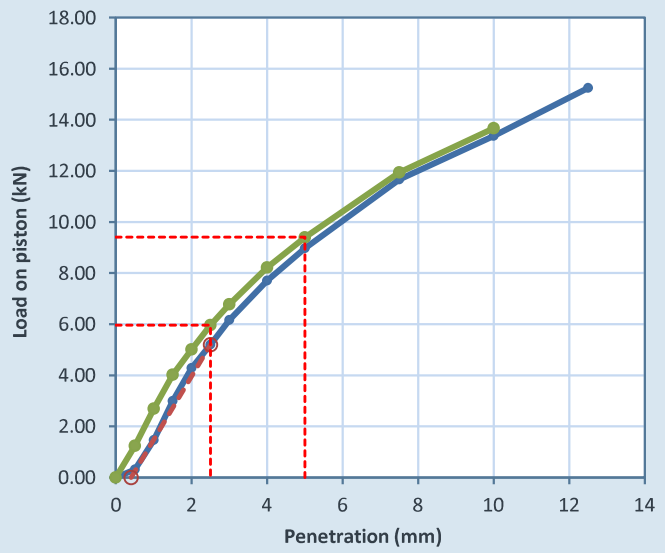
No oversize material was retained on the 19mm sieve

Notes on test:

Notes on compaction test

SUMMARY OF CALIFORNIA BEARING RATIO TEST RESULT

Penetration (mm):		0.0	0.5	1.0	1.5	2.0	**2.5**	3.0	4.0	**5.0**	7.5	10.0	12.5	**Correction:**	**0.4mm**
Load (kN)	**Original**	0.00	0.32	1.47	3.00	4.28	5.20	6.16	7.71	8.97	11.66	13.36	15.24		
	Corrected	0.00	1.24	2.69	4.02	5.02	5.97	6.78	8.21	9.40	11.93	13.66			



Dry density t/m^3	before soaking:	**1.93**
	after soaking	**1.94**
Density ratio	before soaking	**95.0%**
	after soaking	**95.0%**
Moisture ratio at compaction:		**103.0%**
Duration of soaking (days):		**4**
Surcharge applied (kg):		**6.8**
Moisture content top 30mm:		**13.1%**
Moisture content remainder:		**11.0%**
Swell after soaking:		**Nil**
Bearing ratio at 2.5mm penetration:		**45.0%**
Bearing ratio at 5.0mm penetration:		**45.0%**

Penetration (mm) **2.5** **CBR Value** **45%**

Definitions:

ND = Not determined

Specimen prepared by: PK **Tested by:** PK **On:** 11/10/22

Results reviewed by: PKent **Date reported:** **12/10/22**

Cert. ref.:	**PS128388-02_TP09_TRP22-0117_CBRS_2209162_Rep-22086214**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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Soils testing - Determination of the California Bearing Ratio of a soil

Standard laboratory method for a remoulded specimen (Soaked)

AS 1289.6.1.1-2014

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209163**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	**1.30 - 1.50**
Project name:	Konnongorring Receival Facility	**TP15**		**Client sample ref.:**	
Project reference:		**Loc. ref.:**			
Sample description:	(SM) Gravelly silty SAND, fine to coarse grained, brown, non-plastic fines, fine to coarse grained gravel.			**Sampled by:**	**Tested as received**
				Sampled type:	**Bulk**

SPECIMEN PREPARATION - SUMMARY OF COMPACTION AND MOISTURE CONTENT TEST RESULTS

Initial moisture content:	**12.5% As rcvd.**
Compaction method:	AS1289.5.2.1-2017 Modified
Maximum dry density (t/m^3):	**1.96**
Optimum moisture content:	**12.0%**
Oversize material (>19mm):	1.0%
Compaction moisture content:	**12.3%**

Note on compaction:

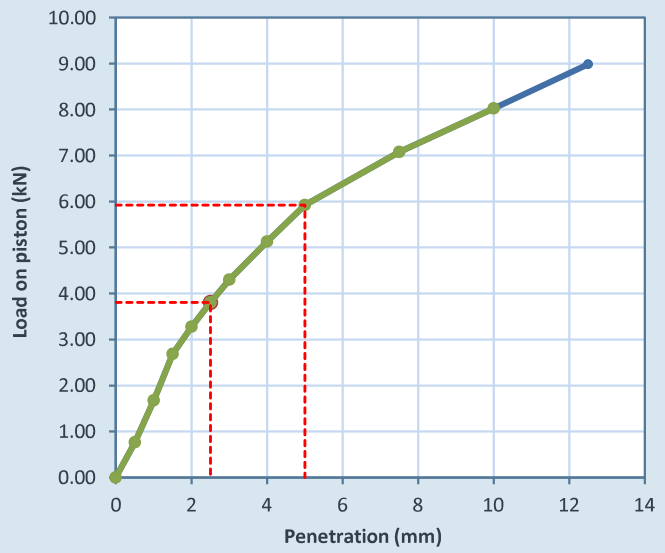
Oversize material has been excluded from the test

Notes on test:

Notes on compaction test

SUMMARY OF CALIFORNIA BEARING RATIO TEST RESULT

Penetration (mm):		0.0	0.5	1.0	1.5	2.0	**2.5**	3.0	4.0	**5.0**	7.5	10.0	12.5	**Correction:**	
Load (kN)	**Original**	0.00	0.77	1.68	2.69	3.28	3.81	4.30	5.13	5.92	7.08	8.02	8.98		
	Corrected	0.00	0.77	1.68	2.69	3.28	3.81	4.30	5.13	5.92	7.08	8.02			



Dry density t/m^3	before soaking:	**1.80**
	after soaking	**1.81**
Density ratio	before soaking	**92.0%**
	after soaking	**92.0%**
Moisture ratio at compaction:		**102.5%**
Duration of soaking (days):		**4**
Surcharge applied (kg):		**6.7**
Moisture content top 30mm:		**16.4%**
Moisture content remainder:		**14.6%**
Swell after soaking:		**Nil**
Bearing ratio at 2.5mm penetration:		**30.0%**
Bearing ratio at 5.0mm penetration:		**30.0%**

Penetration (mm) **2.5** **CBR Value** **30%**

Definitions:

ND = Not determined

Specimen prepared by: rk **Tested by:** PK **On:** 11/10/22

Results reviewed by: PKent **Date reported:** **12/10/22**

Cert. ref.:	**PS128388-02_TP15_TRP22-0117_CBRS_2209163_Rep-22086215**	**Approved signatory:**
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Soils testing - Determination of the California Bearing Ratio of a soil

Standard laboratory method for a remoulded specimen (Soaked)

AS 1289.6.1.1-2014

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209164**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	**0.50 - 0.70**
Project name:	Konnongorring Receival Facility	**TP16**		**Client sample ref.:**	
Project reference:		**Loc. ref.:**			
Sample description:	(SC) Clayey SAND, with gravel, fine to coarse grained, brown, low plasticity, fine to medium grained gravel.			**Sampled by:**	**Tested as received**
				Sampled type:	**Bulk**

SPECIMEN PREPARATION - SUMMARY OF COMPACTION AND MOISTURE CONTENT TEST RESULTS

Initial moisture content:	**15.6% As rcvd.**
Compaction method:	AS1289.5.2.1-2017 Modified
Maximum dry density (t/m^3):	**1.97**
Optimum moisture content:	**13.5%**
Oversize material (>19mm):	-
Compaction moisture content:	**13.8%**

Note on compaction:

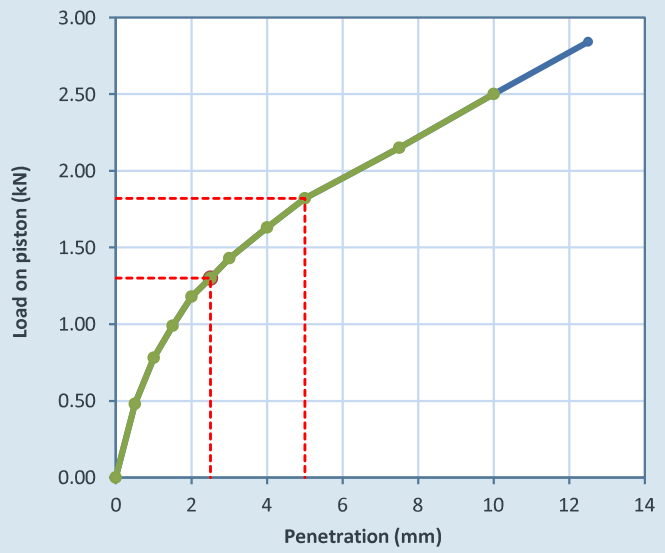
No oversize material was retained on the 19mm sieve

Notes on test:

Notes on compaction test

SUMMARY OF CALIFORNIA BEARING RATIO TEST RESULT

Penetration (mm):		0.0	0.5	1.0	1.5	2.0	**2.5**	3.0	4.0	**5.0**	7.5	10.0	12.5	**Correction:**	
Load (kN)	**Original**	0.00	0.48	0.78	0.99	1.18	1.30	1.43	1.63	1.82	2.15	2.50	2.84		
	Corrected	0.00	0.48	0.78	0.99	1.18	1.30	1.43	1.63	1.82	2.15	2.50			



Dry density t/m^3	before soaking:	**1.81**
	after soaking	**1.81**
Density ratio	before soaking	**91.5%**
	after soaking	**91.5%**
Moisture ratio at compaction:		**102.5%**
Duration of soaking (days):		**4**
Surcharge applied (kg):		**6.8**
Moisture content top 30mm:		**16.5%**
Moisture content remainder:		**16.0%**
Swell after soaking:		**NIL**
Bearing ratio at 2.5mm penetration:		**10.0%**
Bearing ratio at 5.0mm penetration:		**9.0%**

Penetration (mm) **2.5** **CBR Value** **10%**

Definitions:

ND = Not determined

Specimen prepared by: rk **Tested by:** dp **On:** 12/10/22

Results reviewed by: PKent **Date reported:** **13/10/22**

Cert. ref.:	**PS128388-02_TP16_TRP22-0117_CBRS_2209164_Rep-22086312**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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For issue

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Soils testing - Determination of the dry density moisture relationship

Modified compaction method

AS 1289.5.2.1-2017

WSP GOLDER

Test request ID:	**TRP22-0117**	**Specimen ID:**	**LPER202209160**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	0.30 - 0.60
Project name:	Konnongorring Receival Facility	**TP03**		**Client sample ref:**	
Project reference:		**Loc. ref.:**			

Specimen description:	(SC) Clayey SAND, fine to coarse grained, brown, low plasticity, trace of fine to medium gravel.	**Sampling co-ordinates** Easting (m) / Northing (m)	**Reduced Level**

SPECIMEN PREPARATION & CURING COMPLIANCE

Material type						
Granular	Liquid Limit			**Moisture content:**	9.3% Field	*AS 1289 2.1.1-2005*
	Measured: 23%	Assumed:	Adopted:			
	Curing times are compliant	**Cure time:**	3 hrs	**Portion test performed on:**		-19 mm

TEST REPORT - COMPACTION RESULTS

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Dry density (t/m³):	1.83	1.97	2.05	1.95	1.88	
Moisture content:	5.0%	6.3%	9.3%	11.1%	13.1%	

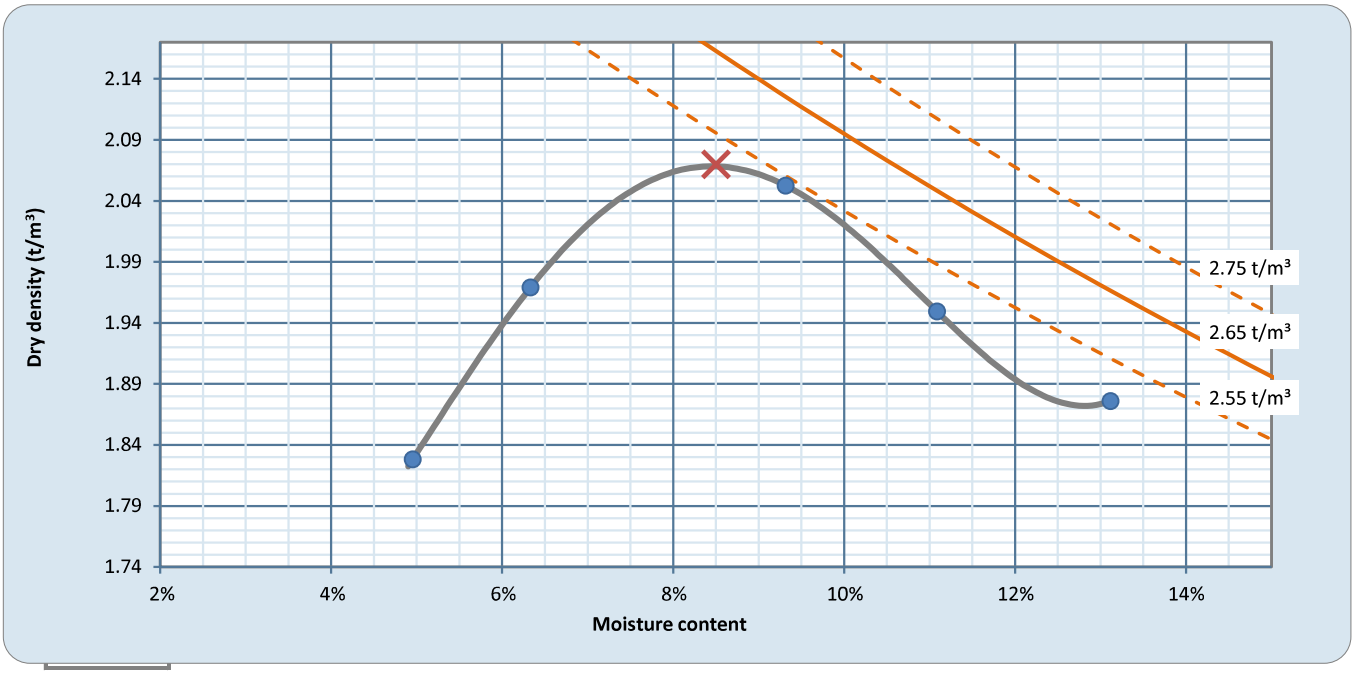
Oversize material - (by dry mass)

No oversize correction required

+19 mm: 0%

+37.5 mm: 0%

No oversize material present



Notes:

	Result	**Adjusted for oversize**
Modified maximum dry density (t/m³):	2.07	
Modified optimum moisture content:	8.5%	

Specimens prepared by:	DP	**Tests performed by:**	DP	**Date tested:**	27/09/2022
Definition:	ND = Not Determined	**Results reviewed by:**	PKent	**Date reported:**	10/10/2022

Cert. ref.:	**PS128388-02_TP03_TRP22-0117_ModComp_s2209160_Rep22086140**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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Soils testing - Determination of the dry density moisture relationship

Modified compaction method

AS 1289.5.2.1-2017

WSP GOLDER

Test request ID:	**TRP22-0117**	**Specimen ID:**	**LPER202209161**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	0.30 - 0.60
Project name:	Konnongorring Receival Facility	**TP05**		**Client sample ref:**	
Project reference:		**Loc. ref.:**			

Specimen description:	(SP-SM) Gravelly SAND, with silt, fine to coarse grained, brown, fine to coarse grained gravel, non-plastic fines.	**Sampling co-ordinates** Easting (m) / Northing (m)	**Reduced Level**

SPECIMEN PREPARATION & CURING COMPLIANCE

Material type						
Granular	Liquid Limit	Measured:	Assumed:	Adopted:	**Moisture content:** 9.3% Field	*AS 1289 2.1.1-2005*
	Curing times are compliant		**Cure time:**	4 hrs	**Portion test performed on:**	-19 mm

TEST REPORT - COMPACTION RESULTS

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Dry density (t/m³):	1.94 1.95*	2.06 2.07*	2.07 2.08*	2.03 2.03*		
Moisture content:	5.8% 5.8%*	7.1% 7.1%*	10.1% 10.1%*	12.0% 12.0%*		

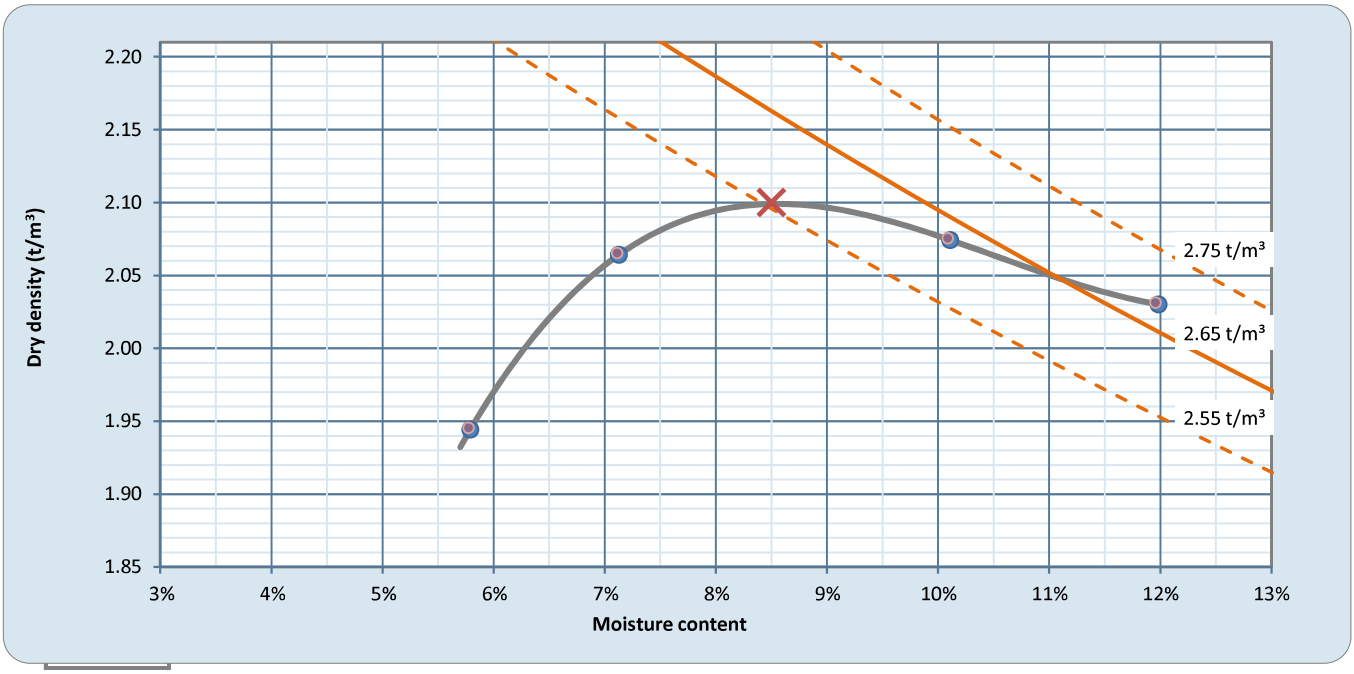
Oversize material - (by dry mass)

*Denotes value adjusted for oversize material

+19 mm: 0%

+37.5 mm: 0%

Oversize material was discarded



Notes:

	Result	**Adjusted for oversize**
Modified maximum dry density (t/m³):	2.10	**2.10**
Modified optimum moisture content:	8.5%	**8.5%**

Specimens prepared by:	JO	**Tests performed by:**	DP	**Date tested:**	27/09/2022
Definition: ND = Not Determined		**Results reviewed by:**	PKent	**Date reported:**	10/10/2022

Cert. ref.:	**PS128388-02_TP05_TRP22-0117_ModComp_s2209161_Rep22086141**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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Soils testing - Determination of the dry density moisture relationship

Modified compaction method

AS 1289.5.2.1-2017

WSP GOLDER

Test request ID:	**TRP22-0117**	**Specimen ID:**	**LPER202209162**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	1.00 - 1.50
Project name:	Konnongorring Receival Facility	**TP09**		**Client sample ref:**	
Project reference:		**Loc. ref.:**			

Specimen description:	(GP-GM) Sandy GRAVEL, with silt, fine to coarse grained, light brown, fine to coarse grained sand, non-plastic fines.	**Sampling co-ordinates** Easting (m) / Northing (m)	**Reduced Level**

SPECIMEN PREPARATION & CURING COMPLIANCE

Material type	Liquid Limit	**Moisture content:**	12.5% Field	*AS 1289 2.1.1-2005*
Granular	Measured: Assumed: Adopted:			
	Curing times are compliant **Cure time:** 2.5 hrs	**Portion test performed on:**	-19 mm	

TEST REPORT - COMPACTION RESULTS

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Dry density (t/m³):	1.90 1.90*	1.97 1.97*	2.04 2.04*	2.01 2.01*		
Moisture content:	3.6% 3.6%*	6.4% 6.4%*	8.9% 8.9%*	10.4% 10.3%*		

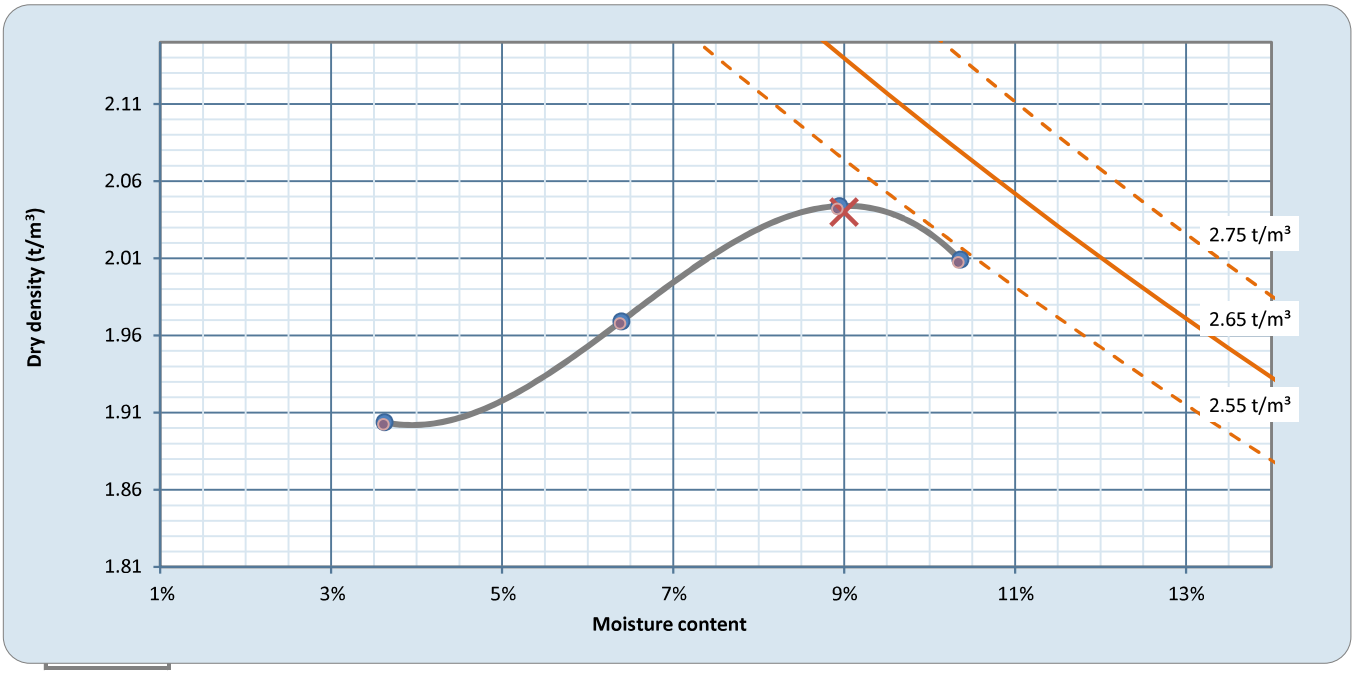
Oversize material - (by dry mass)

*Denotes value adjusted for oversize material

+19 mm: 0%

+37.5 mm: 0%

Oversize material was discarded



Notes:

	Result	**Adjusted for oversize**
Modified maximum dry density (t/m³):	2.04	**2.04**
Modified optimum moisture content:	9.0%	**9.0%**

Specimens prepared by:	JO	**Tests performed by:**	DP	**Date tested:**	27/09/2022
Definition:	ND = Not Determined	**Results reviewed by:**	SWai	**Date reported:**	10/10/2022

Cert. ref.:	**PS128388-02_TP09_TRP22-0117_ModComp_s2209162_Rep22086142**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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Soils testing - Determination of the dry density moisture relationship

Modified compaction method

AS 1289.5.2.1-2017

WSP GOLDER

Test request ID:	**TRP22-0117**	**Specimen ID:**	**LPER202209163**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**		**Sample depth (m):**	1.30 - 1.50
Project name:	Konnongorring Receival Facility	**TP15**		**Client sample ref:**	
Project reference:		**Loc. ref.:**			

Specimen description: (SM) Gravelly silty SAND, fine to coarse grained, brown, non-plastic fines, fine to coarse grained gravel.

Sampling co-ordinates — **Easting (m)** | **Northing (m)** | **Reduced Level**

SPECIMEN PREPARATION & CURING COMPLIANCE

Material type	Liquid Limit			Moisture content:	12.5% Field	AS 1289 2.1.1-2005
Granular	Measured:	Assumed:	Adopted:			
	Curing times are compliant	Cure time:	2.5 hrs	Portion test performed on:		-19 mm

TEST REPORT - COMPACTION RESULTS

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Dry density (t/m³):	1.81 1.81*	1.95 1.95*	1.96 1.96*	1.92 1.93*	1.82 1.83*	
Moisture content:	7.8% 7.7%*	10.8% 10.7%*	12.3% 12.2%*	14.2% 14.1%*	16.8% 16.6%*	

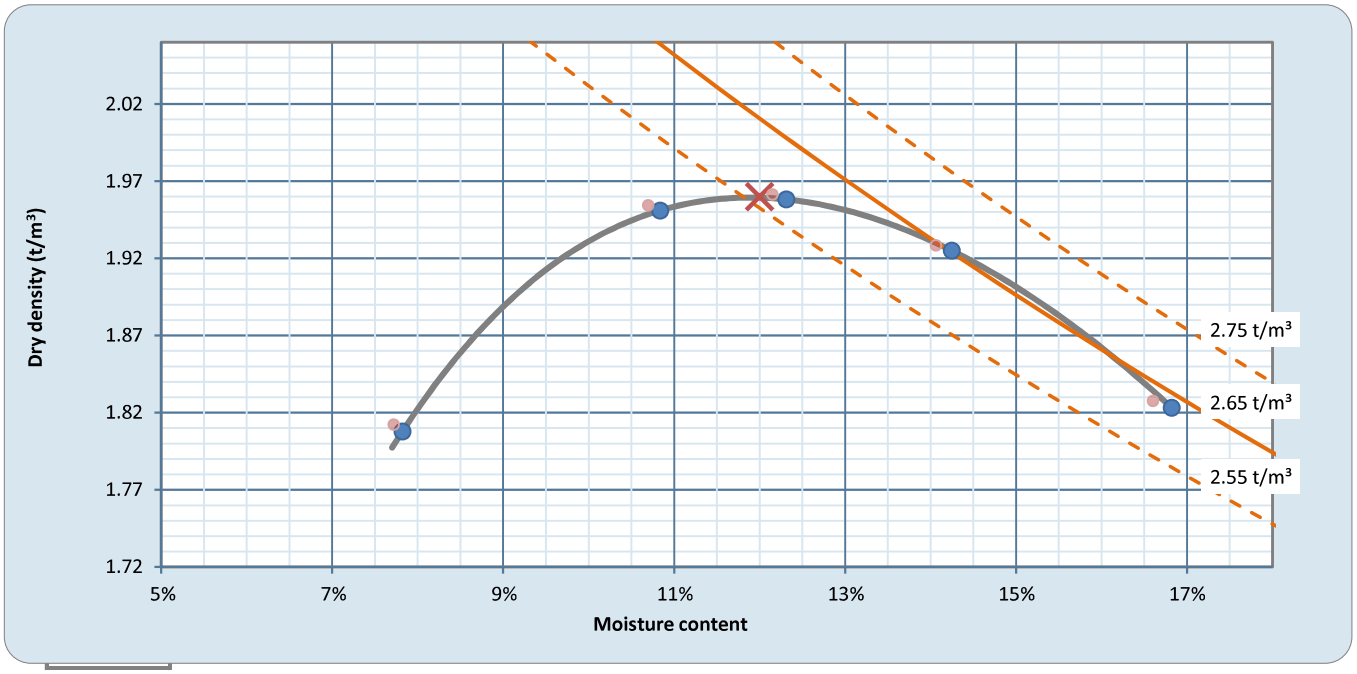
Oversize material - (by dry mass)

*Denotes value adjusted for oversize material

+19 mm: 1%

+37.5 mm: 0%

Oversize material was discarded



Notes:

	Result	Adjusted for oversize
Modified maximum dry density (t/m³):	1.96	**1.96**
Modified optimum moisture content:	12.0%	**11.5%**

Specimens prepared by:	JO	**Tests performed by:**	DP	**Date tested:**	28/09/2022
Definition:	ND = Not Determined	**Results reviewed by:**	SWai	**Date reported:**	10/10/2022

Cert. ref.:	**PS128388-02_TP15_TRP22-0117_ModComp_s2209163_Rep22086143**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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Soils testing - Determination of the dry density moisture relationship

Modified compaction method

AS 1289.5.2.1-2017

WSP GOLDER

Test request ID:	**TRP22-0117**	**Specimen ID:**	**LPER202209164**	**Golder Associates Pty Ltd**	
Client:	CBH Group			**PERTH GEOTECHNICAL LABORATORY**	
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000			84 Guthrie Street, Osborne Park, Western Australia 6017	
Project ID:	**PS128388-02**	**Exploratory Hole**			
Project name:	Konnongorring Receival Facility	**TP16**		**Sample depth (m):**	0.50 - 0.70
Project reference:		**Loc. ref.:**		**Client sample ref:**	

Specimen description:	(SC) Clayey SAND, with gravel, fine to coarse grained, brown, low plasticity, fine to medium grained gravel.	**Sampling co-ordinates** Easting (m) / Northing (m)	**Reduced Level**

SPECIMEN PREPARATION & CURING COMPLIANCE

Material type					
Granular	Liquid Limit Measured: 28% Assumed: Adopted:	**Moisture content:**	15.6% Field	*AS 1289 2.1.1-2005*	
	Curing times are compliant **Cure time:** 3 hrs	**Portion test performed on:**	-19 mm		

TEST REPORT - COMPACTION RESULTS

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Dry density (t/m³):	1.71	1.77	1.92	1.83		
Moisture content:	8.5%	10.3%	12.4%	15.6%		

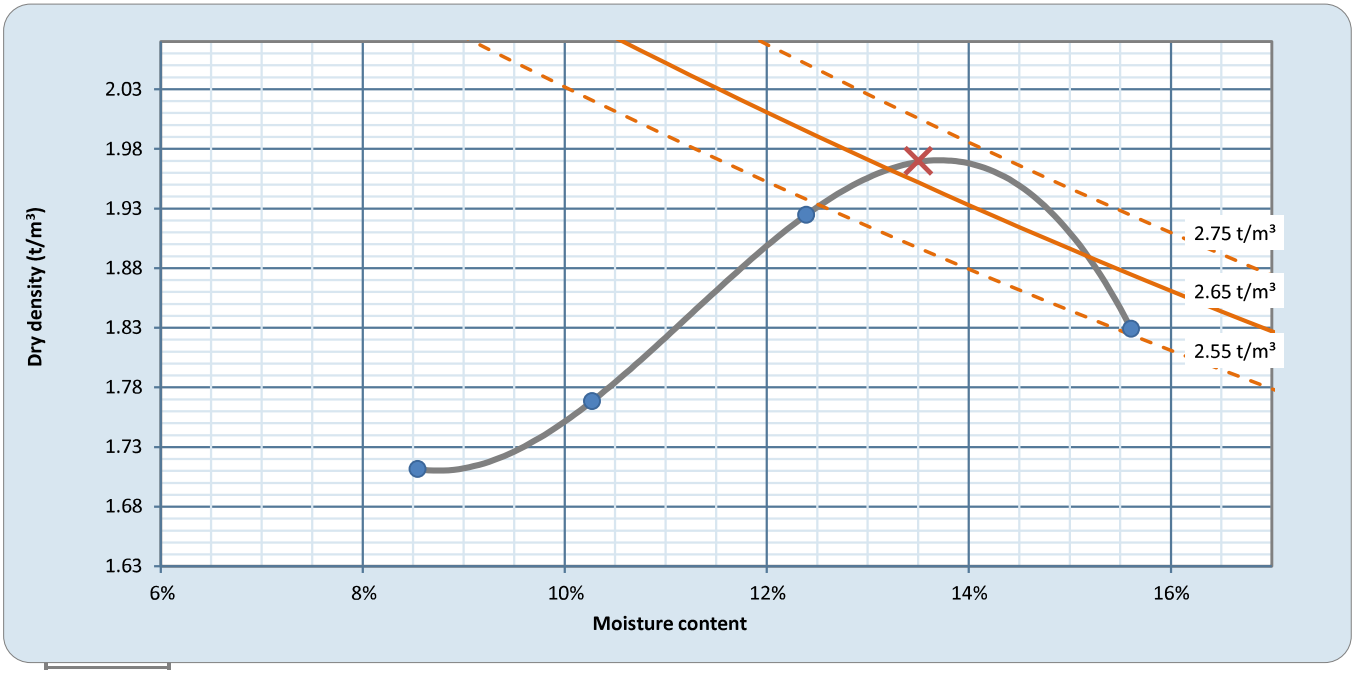
Oversize material - (by dry mass)

No oversize correction required

+19 mm: 0%

+37.5 mm: 0%

No oversize material present



Notes:

	Result	**Adjusted for oversize**
Modified maximum dry density (t/m³):	1.97	
Modified optimum moisture content:	13.5%	

Specimens prepared by:	JO	**Tests performed by:**	sw	**Date tested:**	27/09/2022
Definition:	ND = Not Determined	**Results reviewed by:**		**Date reported:**	10/10/2022

Cert. ref.:	**PS128388-02_TP16_TRP22-0117_ModComp_s2209164_Rep22086144**	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	
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Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209166**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**	**Exploratory Hole**	**BH01**
Project name:	Konnongorring Receival Facility		
Project reference:			

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 6.00 - **Client sample ref:** SPT

Loc. ref.: CBH Konnongorring

Specimen description: (MH) Sandy SILT, high plasticity, white, fine to coarse grained sand.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	100%		
9.5 mm	100%		
6.7 mm	100%		
4.75 mm	100%		
2.36 mm	100%		
1.18 mm	91%		
600 µm	72%		
425 µm	66%		
300 µm	63%		
212 µm	61%		
150 µm	59%		
75 µm	56%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	21.6% As Rcvd.	51%	31%	20%	5.5%	Cracking
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	LSM length (mm):	125

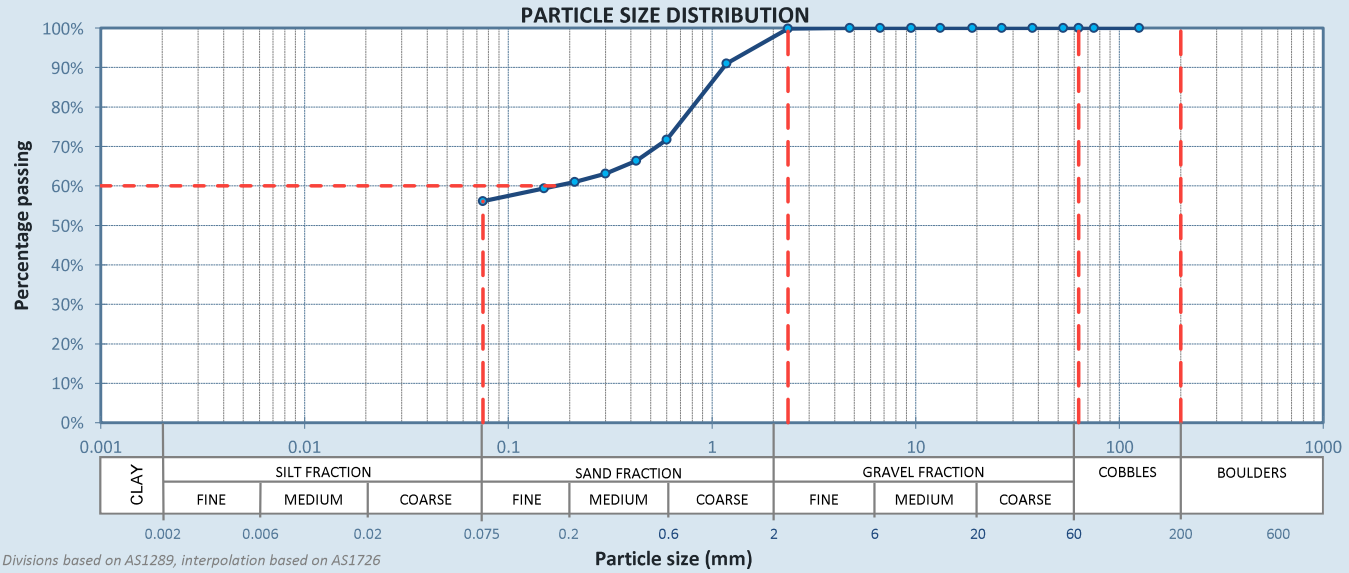
Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
56.1%	43.7%	0.2%	0.0%

*Proportions based on guidance in AS1726-2017 Section 6.1.4.2



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 03/10/22 - 06/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_BH01_TRP22-0117_PSD_2209166_Rep22086130

Approved signatory:

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

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For issue

These tests were carried out in accordance with the Australian standards identified in this certificate.
Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209165**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**	**Exploratory Hole**	**BH01**
Project name:	Konnongorring Receival Facility		
Project reference:			

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 1.50 - **Client sample ref:** SPT

Loc. ref.: CBH Konnongorring

Specimen description: (MI) sandy SILT, medium plasticity, white mottled brown, fine to coarse grained sand, trace of fine to medium grained gravel.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	94%		
9.5 mm	94%		
6.7 mm	92%		
4.75 mm	91%		
2.36 mm	86%		
1.18 mm	73%		
600 µm	60%		
425 µm	55%		
300 µm	51%		
212 µm	49%		
150 µm	47%		
75 µm	44%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	28.7% As Rcvd.	49%	32%	17%	4.0%	None
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	LSM length (mm):	125

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

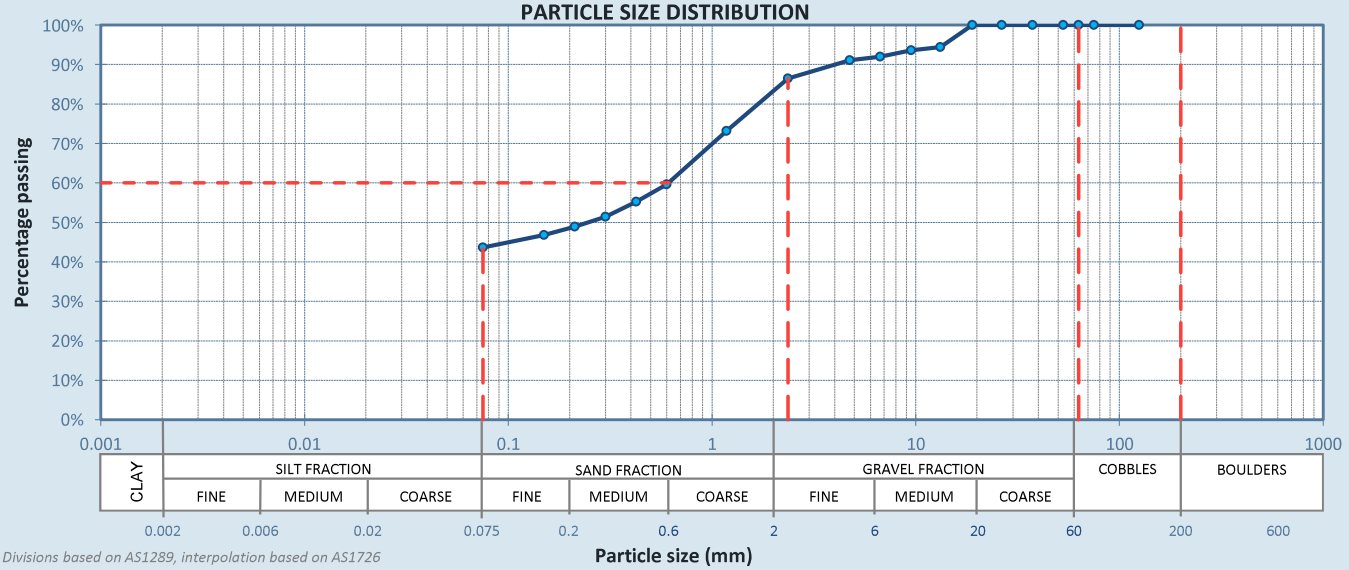
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
43.7%	42.8%	13.5%	0.0%

*Proportions based on guidance in AS1726-2017 Section 6.1.4.2

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 12/10/22 - 12/10/22 **Results reviewed by:** PKent **Date reported:** 13/10/2022

Cert. ref.: PS128388-02_BH01_TRP22-0117_PSD_2209165_Rep22086311

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

Paul Kent - Laboratory Manager

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

For issue

These tests were carried out in accordance with the Australian standards identified in this certificate.
Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209167**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**	**Exploratory Hole**	**BH01**
Project name:	Konnongorring Receival Facility		
Project reference:			

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 12.00 - **Client sample ref:** SPT

Loc. ref.: CBH Konnongorring

Specimen description: (Cl) Sandy CLAY, medium plasticity, pale white/yellow, fine to coarse grained sand.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	100%		
9.5 mm	100%		
6.7 mm	100%		
4.75 mm	100%		
2.36 mm	100%		
1.18 mm	92%		
600 µm	71%		
425 µm	64%		
300 µm	57%		
212 µm	52%		
150 µm	48%		
75 µm	42%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	18.9% As Rcvd.	47%	22%	25%	5.0%	None
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	LSM length (mm):	125

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

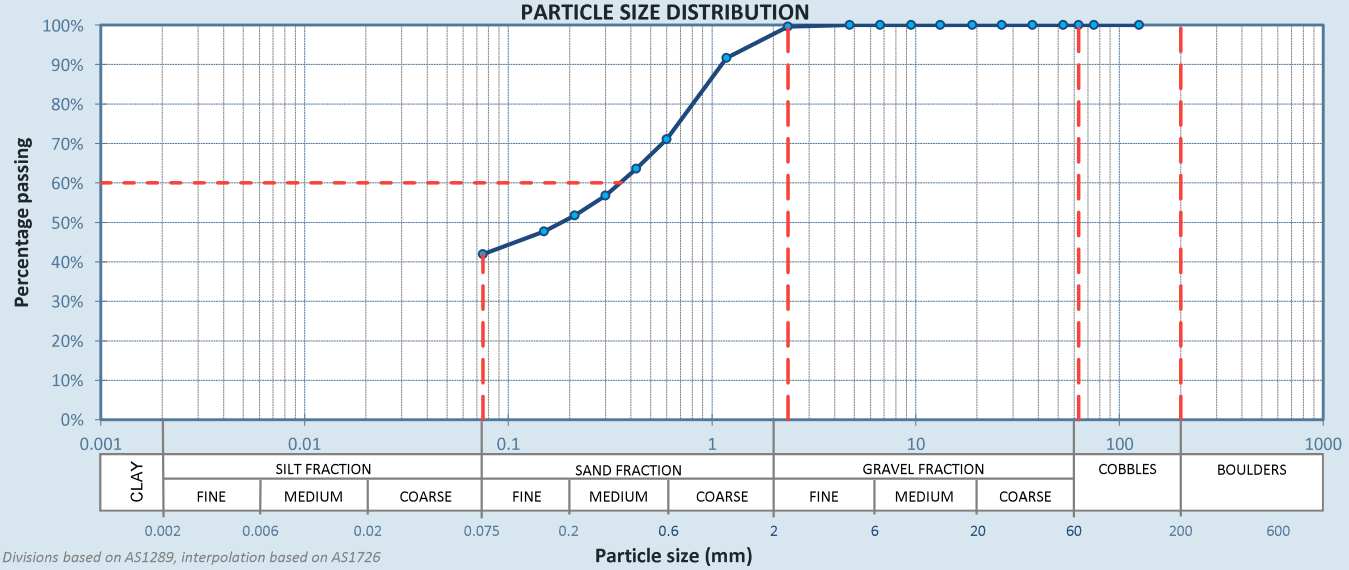
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
42.0%	57.6%	0.4%	0.0%

*Proportions based on guidance in AS1726-2017 Section 6.1.4.2

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 03/10/22 - 06/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_BH01_TRP22-0117_PSD_2209167_Rep22086131

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

Paul Kent - Laboratory Manager

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

For issue

These tests were carried out in accordance with the Australian standards identified in this certificate.
Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209168**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**		
Project name:	Konnongorring Receival Facility		
Project reference:			

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Exploratory Hole	Sample depth (m):	Client sample ref:
BH02	4.50 -	SPT

Loc. ref.: CBH Konnongorring

Specimen description: (MI) Sandy SILT, medium plasticity, pale white, fine to coarse grained sand.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	100%		
9.5 mm	100%		
6.7 mm	100%		
4.75 mm	100%		
2.36 mm	100%		
1.18 mm	92%		
600 µm	79%		
425 µm	72%		
300 µm	68%		
212 µm	64%		
150 µm	60%		
75 µm	54%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	20.8% As Rcvd.	43%	29%	14%	4.0%	None
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	LSM length (mm):	125

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

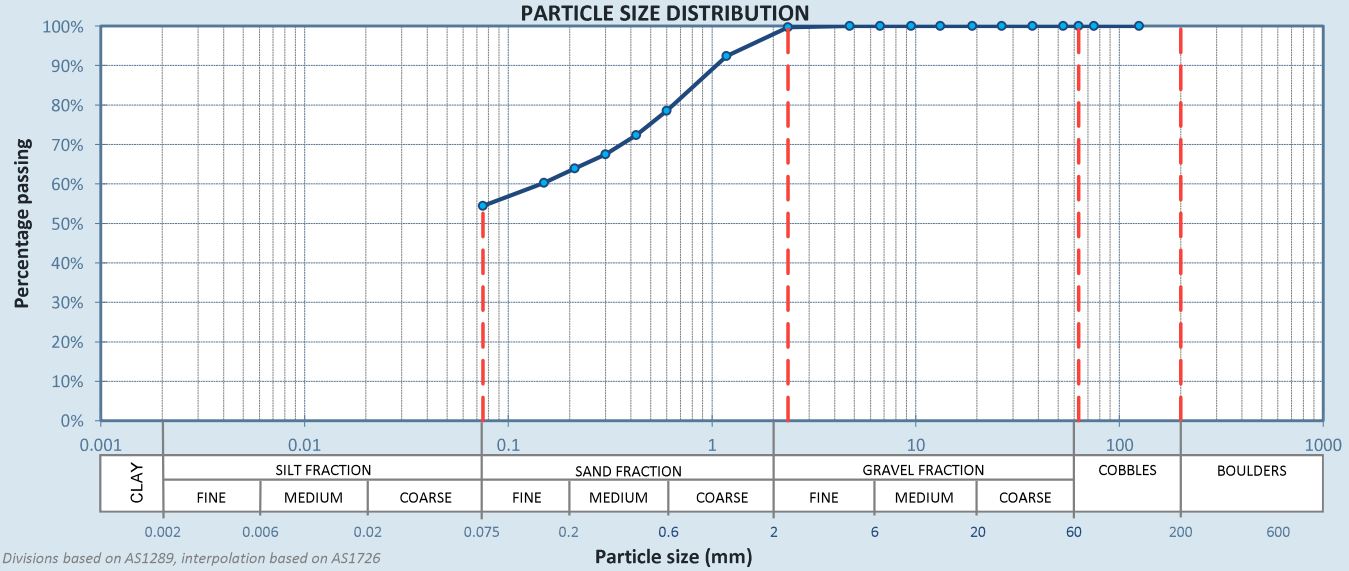
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
54.4%	45.3%	0.3%	0.0%

*Proportions based on guidance in AS1726-2017 Section 6.1.4.2

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 03/10/22 - 06/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_BH02_TRP22-0117_PSD_2209168_Rep22086132

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

Paul Kent - Laboratory Manager

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209169**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**		
Project name:	Konnongorring Receival Facility		
Project reference:			

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Exploratory Hole	Sample depth (m):	Client sample ref:
BH02	10.50 -	SPT

Loc. ref.: CBH Konnongorring

Specimen description: (MI) Sandy SILT, medium plasticity, pale white, fine to coarse grained sand, trace of fine grained gravel.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	100%		
9.5 mm	100%		
6.7 mm	100%		
4.75 mm	100%		
2.36 mm	97%		
1.18 mm	85%		
600 µm	72%		
425 µm	68%		
300 µm	64%		
212 µm	61%		
150 µm	59%		
75 µm	55%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	21.4% As Rcvd.	45%	30%	15%	3.0%	None
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	LSM length (mm):	125

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

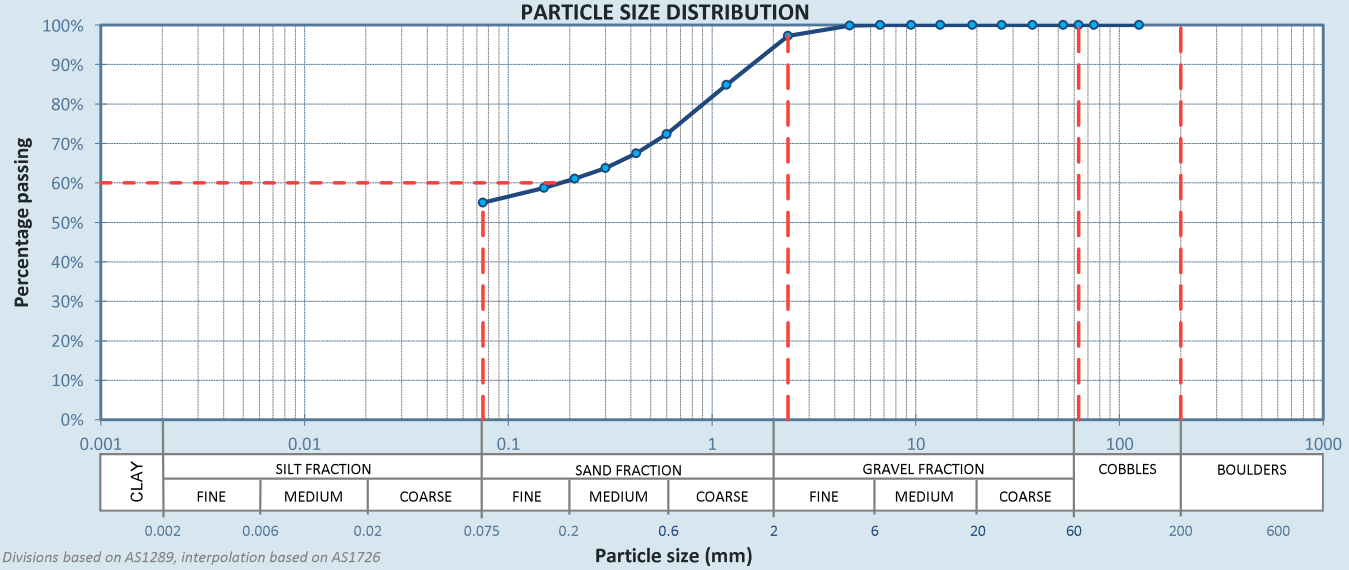
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
55.0%	42.2%	2.8%	0.0%

**Proportions based on guidance in AS1726-2017 Section 6.1.4.2*

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 30/09/22 - 06/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_BH02_TRP22-0117_PSD_2209169_Rep22086133

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

Paul Kent - Laboratory Manager

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

For issue

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Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER2022091610**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**	**Exploratory Hole**	**BH02**
Project name:	Konnongorring Receival Facility		
Project reference:			

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 15.00 - **Client sample ref:** SPT

Loc. ref.: CBH Konnongorring

Specimen description: (GM/GC) Clayey/silty GRAVEL, with sand, fine to medium grained, pale white, low plasticity, fine to coarse grained sand.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	78%		
9.5 mm	69%		
6.7 mm	64%		
4.75 mm	59%		
2.36 mm	53%		
1.18 mm	44%		
600 µm	38%		
425 µm	35%		
300 µm	33%		
212 µm	31%		
150 µm	30%		
75 µm	27%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	12.1% As Rcvd.	34%	24%	10%	2.5%	None
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	LSM length (mm):	125

Specimen history/notes: Specimen mass does not comply with AS1289.1.1 Clause 5.7 Table 1, insufficient sample provided to labororatory
Preparation of specimen and testing performed on sample supplied to the laboratory

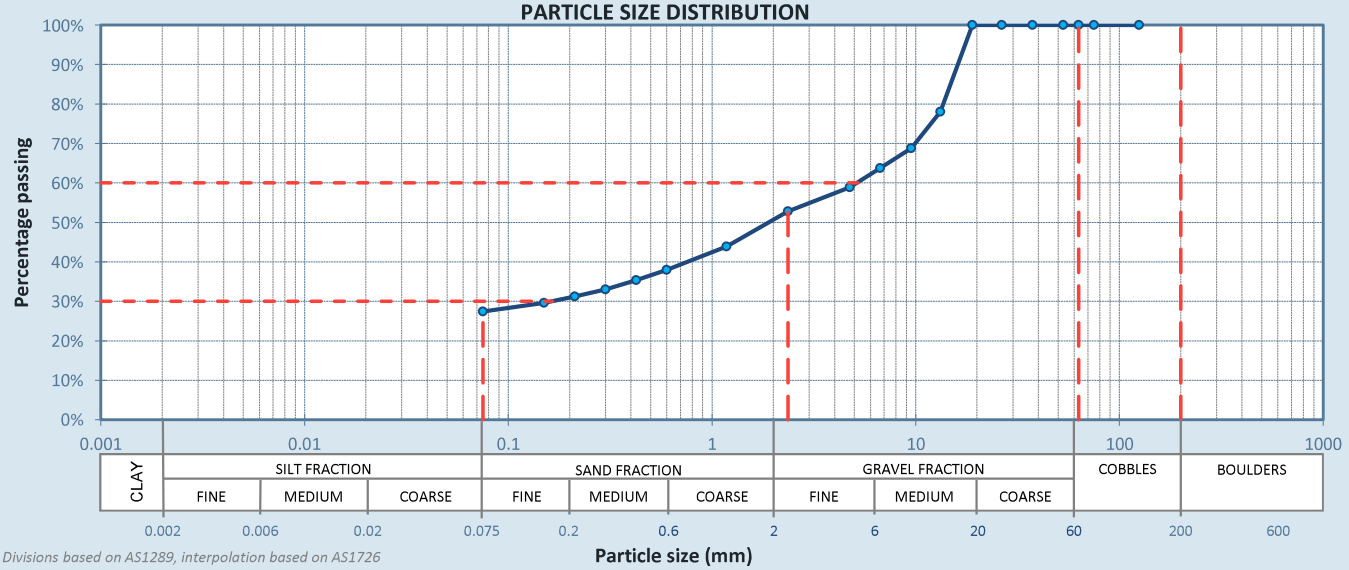
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
27.4%	25.4%	47.2%	0.0%

*Proportions based on guidance in AS1726-2017 Section 6.1.4.2

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 03/10/22 - 06/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_BH02_TRP22-0117_PSD_22091610_Rep22086134

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

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For issue

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Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209160**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**	**Exploratory Hole**	**TP03**
Project name:	Konnongorring Receival Facility		
Project reference:		**Loc. ref.:**	CBH Konnongorring

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 0.30 - 0.60

Client sample ref:

Specimen description: (SC) Clayey SAND, fine to coarse grained, brown, low plasticity, trace of fine to medium gravel.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	98%		
9.5 mm	95%		
6.7 mm	92%		
4.75 mm	89%		
2.36 mm	85%		
1.18 mm	75%		
600 µm	64%		
425 µm	59%		
300 µm	53%		
212 µm	45%		
150 µm	36%		
75 µm	23%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	**1 point Liquid limit**	**Plastic limit**	**Plasticity index**	**Linear shrinkage**	**Curling/ Crumbling/ Cracking**
Result:	10.4% As Rcvd.	23%	12%	11%	2.5%	None
LB S:						-
UB S:						-

Att. preparation method:	Dry sieved	**LSM length (mm):**	125

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

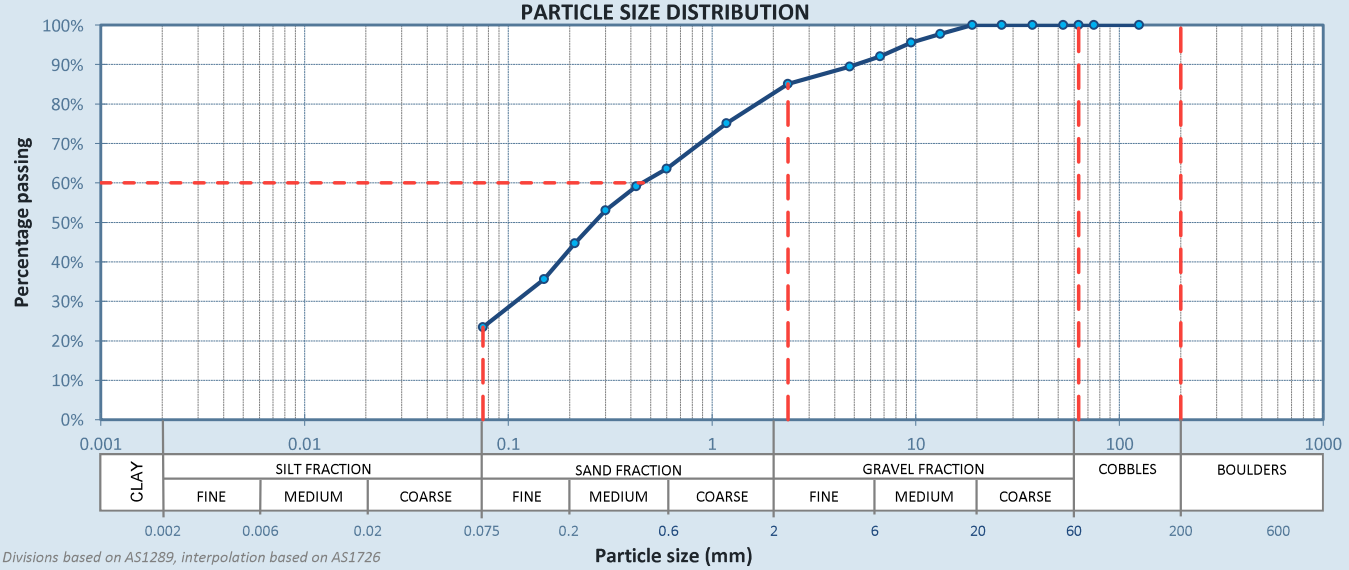
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
23.4%	61.7%	14.9%	0.0%

**Proportions based on guidance in AS1726-2017 Section 6.1.4.2*

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 03/10/22 - 05/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_TP03_TRP22-0117_PSD_2209160_Rep22086135

Approved signatory:

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

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For issue

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Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209161**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**		
Project name:	Konnongorring Receival Facility		
Project reference:			

Exploratory Hole: TP05

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 0.30 - 0.60

Client sample ref:

Loc. ref.: CBH Konnongorring

Specimen description: (SP-SM) Gravelly SAND, with silt, fine to coarse grained, brown, fine to coarse grained gravel, non-plastic fines.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	94%		
9.5 mm	87%		
6.7 mm	76%		
4.75 mm	66%		
2.36 mm	56%		
1.18 mm	49%		
600 µm	39%		
425 µm	35%		
300 µm	29%		
212 µm	23%		
150 µm	18%		
75 µm	11%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	9.3% As Rcvd.	SIB	NP	ND		
LB S:						-
UB S:						-
Att. preparation method:		Dry sieved		LSM length (mm):		

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

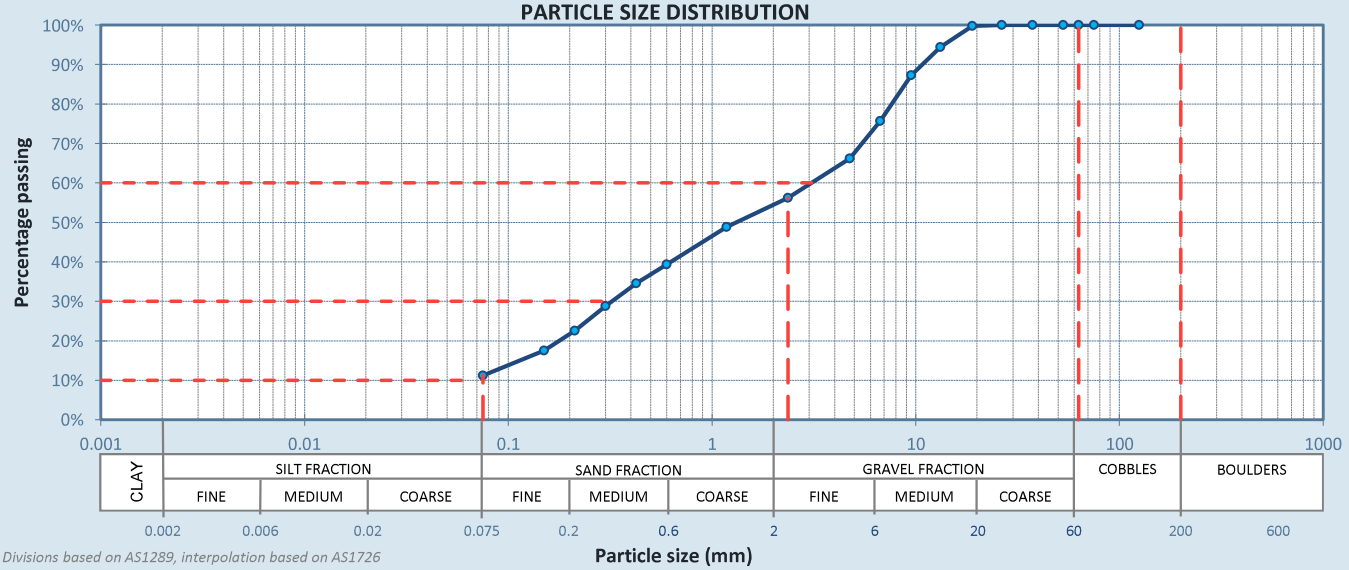
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
11.2%	45.0%	43.8%	0.0%

*Proportions based on guidance in AS1726-2017 Section 6.1.4.2

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 27/09/22 - 06/10/22 **Results reviewed by:** PKent **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_TP05_TRP22-0117_PSD_2209161_Rep22086136

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
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For issue

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Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209162**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**		
Project name:	Konnongorring Receival Facility		
Project reference:			

Exploratory Hole: TP09

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 1.00 - 1.50

Client sample ref:

Loc. ref.: CBH Konnongorring

Specimen description: (GP-GM) Sandy GRAVEL, with silt, fine to coarse grained, light brown, fine to coarse grained sand, non-plastic fines.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	83%		
9.5 mm	68%		
6.7 mm	56%		
4.75 mm	49%		
2.36 mm	43%		
1.18 mm	35%		
600 µm	28%		
425 µm	26%		
300 µm	22%		
212 µm	18%		
150 µm	14%		
75 µm	9%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	12.5% As Rcvd.	SIB	NP	ND		
LB S:						-
UB S:						-
Att. preparation method:		Dry sieved		LSM length (mm):		

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

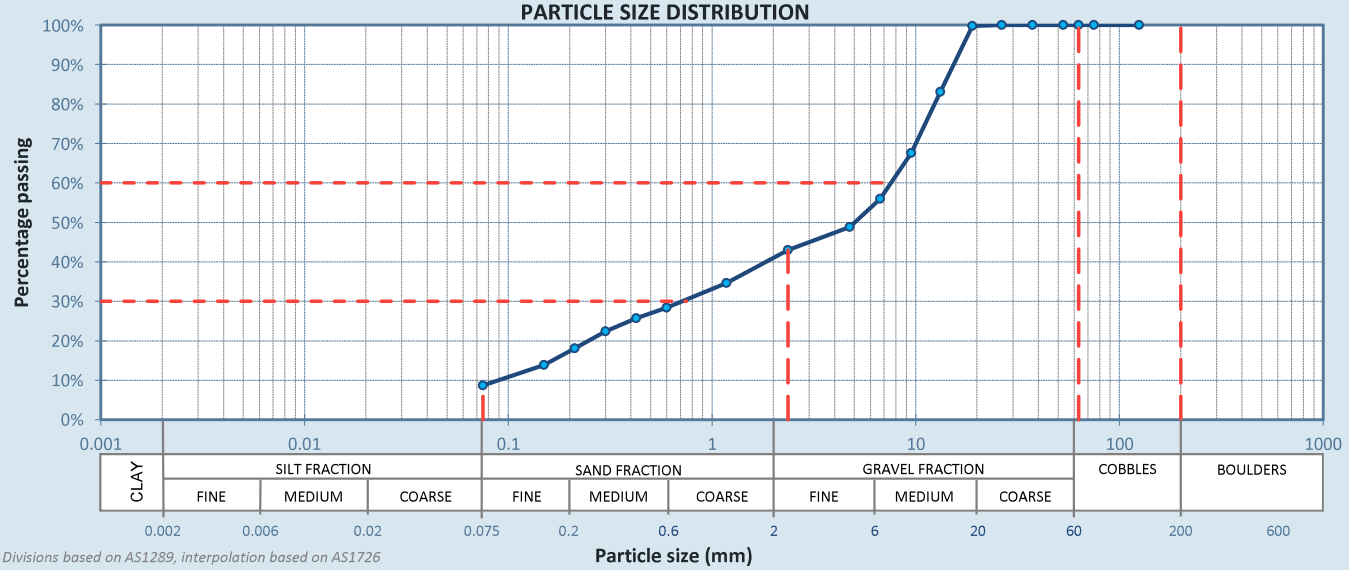
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
8.7%	34.3%	57.0%	0.0%

**Proportions based on guidance in AS1726-2017 Section 6.1.4.2*

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 23/09/22 - 06/10/22 **Results reviewed by:** SWai **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_TP09_TRP22-0117_PSD_2209162_Rep22086137	**Approved signatory:**
NATA accreditation number: 1961 - Site:1598 - Perth Accredited for compliance with ISO/IEC 17025 - Testing	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL (Sheet 1 of 1)	**Paul Kent - Laboratory Manager**

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

For issue

These tests were carried out in accordance with the Australian standards identified in this certificate.
Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209163**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**		
Project name:	Konnongorring Receival Facility		
Project reference:			

Exploratory Hole: TP15

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 1.30 - 1.50

Client sample ref:

Loc. ref.: CBH Konnongorring

Specimen description: (SM) Gravelly silty SAND, fine to coarse grained, brown, non-plastic fines, fine to coarse grained gravel.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	99%		
13.2 mm	93%		
9.5 mm	81%		
6.7 mm	73%		
4.75 mm	69%		
2.36 mm	65%		
1.18 mm	58%		
600 µm	50%		
425 µm	44%		
300 µm	37%		
212 µm	30%		
150 µm	23%		
75 µm	14%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking
Result:	12.5% As Rcvd.	SIB	NP	ND		
LB S:						-
UB S:						-
Att. preparation method:		Dry sieved		LSM length (mm):		

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

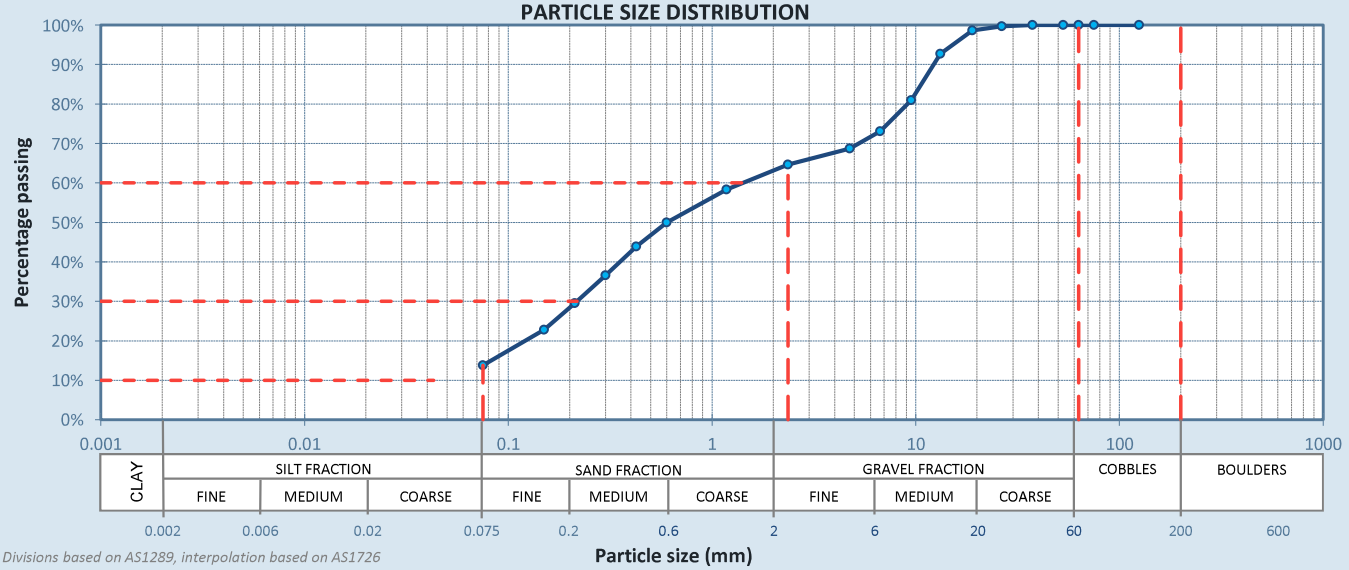
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
13.8%	50.9%	35.3%	0.0%

**Proportions based on guidance in AS1726-2017 Section 6.1.4.2*

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 03/10/22 - 06/10/22 **Results reviewed by:** SWai **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_TP15_TRP22-0117_PSD_2209163_Rep22086138

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

Paul Kent - Laboratory Manager

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

For issue

These tests were carried out in accordance with the Australian standards identified in this certificate.
Test results relate only to the specimens tested.

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving)

AS1289.3.6.1, 2.1.1, 3.1.2, 3.2.1, 3.3.1 & 3.4.1

WSP GOLDER

Test request #:	**TRP22-0117**	**Specimen ID:**	**LPER202209164**
Client:	CBH Group		
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000		
Project ID:	**PS128388-02**		
Project name:	Konnongorring Receival Facility		
Project reference:			

Exploratory Hole: TP16

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Sample depth (m): 0.50 - 0.70

Client sample ref:

Loc. ref.: CBH Konnongorring

Specimen description: (SC) Clayey SAND, with gravel, fine to coarse grained, brown, low plasticity, fine to medium grained gravel.

Sampling: Tested as received

Easting (m)	Northing (m)	Level (m)

PARTICLE SIZE DISTRIBUTION AS 1289.3.6.1

Sieve Size	Passing	LB S	UB S
125 mm	100%		
75 mm	100%		
63 mm	100%		
53 mm	100%		
37.5 mm	100%		
26.5 mm	100%		
19 mm	100%		
13.2 mm	95%		
9.5 mm	90%		
6.7 mm	87%		
4.75 mm	83%		
2.36 mm	80%		
1.18 mm	71%		
600 µm	63%		
425 µm	58%		
300 µm	52%		
212 µm	46%		
150 µm	39%		
75 µm	29%		

Method:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	
	Moisture content	**1 point Liquid limit**	**Plastic limit**	**Plasticity index**	**Linear shrinkage**	**Curling/ Crumbling/ Cracking**
Result:	16.0% As Rcvd.	28%	16%	12%	3.0%	None
LB S:						-
UB S:						-
Att. preparation method:	Dry sieved		**LSM length (mm):**			125

Specimen history/notes: Compliance check AS 1289.1.1 - Clause 5.7 - Table 1 - OK
Preparation of specimen and testing performed on sample supplied to the laboratory

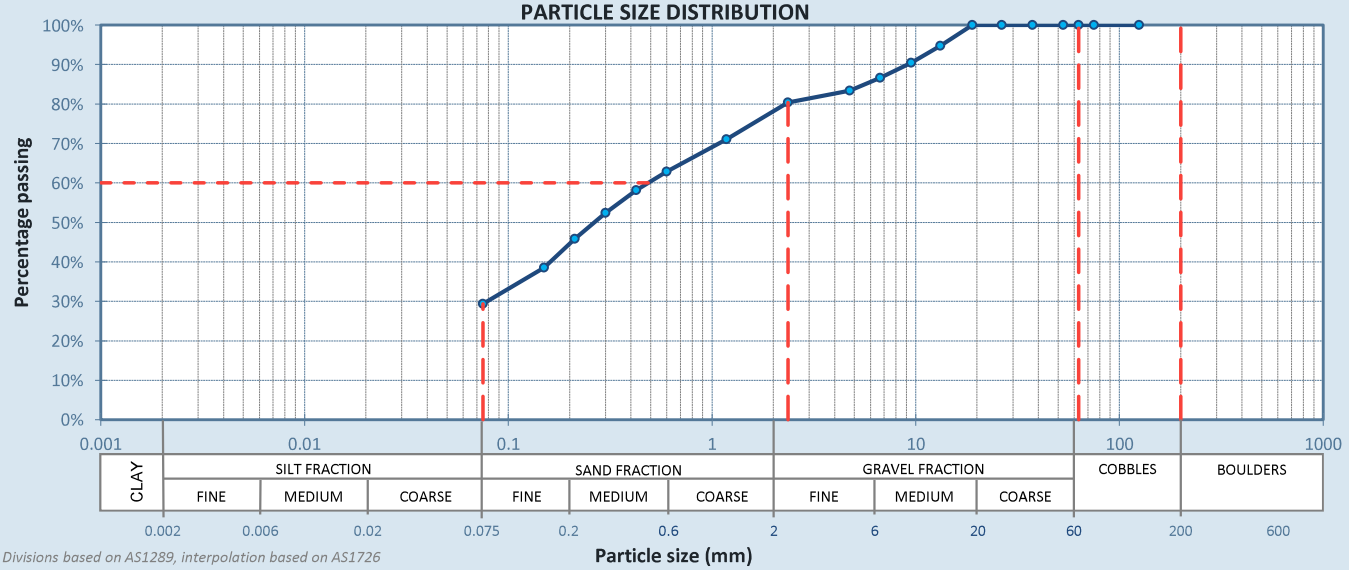
Definitions:
LB S = Lower bound specification
LSM = Linear shrinkage mould
UB S = Upper bound specification
N/A = Not applicable
ND = Not determined; SIB = Slip in bowl
NO = Not obtainable; NP = Non plastic

GRADING SUMMARY

Fines (<75 µm)	Sand* (>75 µm - <2.36 mm)	Gravel* (>2.36 mm - <63 mm)	Cobbles* (>63mm - <200 mm)
29.4%	51.0%	19.6%	0.0%

**Proportions based on guidance in AS1726-2017 Section 6.1.4.2*

PARTICLE SIZE DISTRIBUTION



Divisions based on AS1289, interpolation based on AS1726

Testing by: DP **Dates:** 28/09/22 - 06/10/22 **Results reviewed by:** **Date reported:** 10/10/2022

Cert. ref.: PS128388-02_TP16_TRP22-0117_PSD_2209164_Rep22086139

Approved signatory:

NATA

NATA accreditation number: 1961 - Site:1598 - Perth
Accredited for compliance with ISO/IEC 17025 - Testing

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL (Sheet 1 of 1)

Paul Kent - Laboratory Manager

Rocks testing - Determination of point load strength index

Including tests on; Axial (**A**), Diametral (**D**) or irregular Lump (**L**) specimens

AS 4133.4.1-2007

TEST REPORT - SUMMARY OF ANALYSIS

WSP GOLDER

Test request ID:	**TRP22-0117**	**Lab sample IDs:**	22091611 - 22091612	**Lab report ref.:**	LPER_22086216
Client:	CBH Group	**Project reference:**			
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000	**Location:**	CBH Konnongorring		
Project ID:	PS128388-02	**Project name:**	Konnongorring Receival Facility		

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84 Guthrie Street,
Osborne Park,
Western Australia 6017

Exploratory hole reference	Sample depth (m)	Specimen reference	Sub-specimen:	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
BH01	1.20 1.50	CORE	Test type:	D									
			**Compliant test:	Yes									
Lab sample ID	LPER2022091611		Failure mode	M									
Sampling By	Date:		Failure load [kN]	0.22									
	Method:	-	Defect orientation	90°									
Moisture content			Is [MPa]	0.081									
Moisture content type:			$Is_{(50)}$ [MPa]	0.083									
Density (t/m^3)	As received	Dry	Lithological description	FURRUGINISED GRANITE									

Location test conducted: Laboratory

Mean values: *Calculation excludes specimens which are not compliant with the tolerances specified in the test method*

Axial	Diametral	Irregular
	0.22	
-	-	-
	0.081	
	0.083	

History: Test performed on samples submitted to the laboratory.

Client ref.:

Exploratory hole reference	Sample depth (m)	Specimen reference	Sub-specimen:	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
BH01	14.80 15.30	CORE	Test type:	A									
			**Compliant test:	Yes									
Lab sample ID	LPER2022091612		Failure mode	M									
Sampling By	Date:		Failure load [kN]	0.5									
	Method:	-	Defect orientation	180°									
Moisture content			Is [MPa]	0.13									
Moisture content type:			$Is_{(50)}$ [MPa]	0.14									
Density (t/m^3)	As received	Dry	Lithological description	GRANITE									

Location test conducted: Laboratory

Mean values: *Calculation excludes specimens which are not compliant with the tolerances specified in the test method*

Axial	Diametral	Irregular
0.5		
-	-	-
0.13		
0.14		

History: Test performed on samples submitted to the laboratory.

Client ref.:

Definitions:

Test types: A = Axial, **D** = Diametral, **L** = Lump / Irregular

Failure modes: B = Along bedding plane, **M** = Through rock matrix, **J** = Along joint, **W** = Along a plane of weakness, **DF** = Didn't Fail

n/a = Not applicable, **ND** = Not determined

** A non compliant test = platen gap at failure being outside of the tolerance of the method

Cert. ref.:	PS128388-02_TRP22-0117_PtLd_22091611 - 22091612_Rep-22086216	**Specimens prepared by:**	PK
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	**Tests performed by:**	PK ,PK 12/10/22
		Results reviewed by:	PKent
	THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	**Date reported:**	**12/10/2022**

Approved signatory:

Paul Kent - Laboratory Manager

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

Rocks testing - Determination of point load strength index

Including tests on; Axial (**A**), Diametral (**D**) or irregular Lump (**L**) specimens

AS 4133.4.1-2007

TEST REPORT - SUMMARY OF ANALYSIS

WSP GOLDER

Test request ID:	**TRP22-0117**	**Lab sample IDs:**	22091613 - 22091614	**Lab report ref.:**	LPER_22086217
Client:	CBH Group	**Project reference:**			
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000	**Location:**	CBH Konnongorring		
Project ID:	PS128388-02	**Project name:**	Konnongorring Receival Facility		

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84 Guthrie Street,
Osborne Park,
Western Australia 6017

Exploratory hole reference	Sample depth (m)	Specimen reference	Sub-specimen:	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
BH01	15.60 16.00	CORE	Test type:	D									
			**Compliant test:	Yes									
Lab sample ID	LPER2022091613		Failure mode	M									
Sampling By	Date:		Failure load [kN]	1.5									
	Method:	-	Defect orientation	90°									
Moisture content			Is [MPa]	0.54									
Moisture content type:			$Is_{(50)}$ [MPa]	0.56									
Density (t/m³)	As received	Dry	Lithological description	GRANITE									

Location test conducted: Laboratory

Mean values: *Calculation excludes specimens which are not compliant with the tolerances specified in the test method*

Axial	Diametral	Irregular
	1.5	
-	-	-
	0.54	
	0.56	

History: Test performed on samples submitted to the laboratory.

Client ref.:

Exploratory hole reference	Sample depth (m)	Specimen reference	Sub-specimen:	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
BH01	16.20 16.50	CORE	Test type:	A									
			**Compliant test:	Yes									
Lab sample ID	LPER2022091614		Failure mode	M									
Sampling By	Date:		Failure load [kN]	0.46									
	Method:	-	Defect orientation	180°									
Moisture content			Is [MPa]	0.12									
Moisture content type:			$Is_{(50)}$ [MPa]	0.13									
Density (t/m³)	As received	Dry	Lithological description	GRANITE									

Location test conducted: Laboratory

Mean values: *Calculation excludes specimens which are not compliant with the tolerances specified in the test method*

Axial	Diametral	Irregular
0.46		
-	-	-
0.12		
0.13		

History: Test performed on samples submitted to the laboratory.

Client ref.:

Definitions:

Test types: A = Axial, **D** = Diametral, **L** = Lump / Irregular

n/a = Not applicable, **ND** = Not determined

Failure modes: B = Along bedding plane, **M** = Through rock matrix, **J** = Along joint, **W** = Along a plane of weakness, **DF** = Didn't Fail

** A non compliant test = platen gap at failure being outside of the tolerance of the method

Cert. ref.:	PS128388-02_TRP22-0117_PtLd_22091613 - 22091614_Rep-22086217	**Specimens prepared by:** PK	**Approved signatory:**
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	**Tests performed by:** PK 12/10/22 **Results reviewed by:** PKent	
	THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	**Date reported:** **12/10/2022**	**Paul Kent - Laboratory Manager**

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

Rocks testing - Determination of point load strength index

Including tests on; Axial (**A**), Diametral (**D**) or irregular Lump (**L**) specimens

AS 4133.4.1-2007

TEST REPORT - SUMMARY OF ANALYSIS

WSP GOLDER

Test request ID:	**TRP22-0117**	**Lab sample IDs:**	22091615 - 22091616	**Lab report ref.:**	LPER_22086218
Client:	CBH Group	**Project reference:**			
Client address:	Level 6, 240 St Georges Terrace, PERTH WA 6000	**Location:**	CBH Konnongorring		
Project ID:	PS128388-02	**Project name:**	Konnongorring Receival Facility		

Golder Associates Pty Ltd
PERTH GEOTECHNICAL LABORATORY
84 Guthrie Street,
Osborne Park,
Western Australia 6017

Exploratory hole reference	Sample depth (m)	Specimen reference	Sub-specimen:	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
BH02	0.56 0.90	CORE	Test type:	D									
			**Compliant test:	Yes									
Lab sample ID	LPER2022091615		Failure mode	M									
Sampling By	Date:		Failure load [kN]	2.6									
	Method:	-	Defect orientation	90°									
Moisture content			Is [MPa]	0.98									
Moisture content type:			$Is_{(50)}$ [MPa]	0.99									
Density (t/m³)	As received	Dry	Lithological description	FURRUGINISED GRANITE									

Location test conducted: Laboratory

Mean values: *Calculation excludes specimens which are not compliant with the tolerances specified in the test method*

Axial	Diametral	Irregular
	2.6	
-	-	-
	0.98	
	0.99	

History: Test performed on samples submitted to the laboratory.

Client ref.:

Exploratory hole reference	Sample depth (m)	Specimen reference	Sub-specimen:	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
BH02	1.30 1.60	CORE	Test type:	A									
			**Compliant test:	Yes									
Lab sample ID	LPER2022091616		Failure mode	M									
Sampling By	Date:		Failure load [kN]	0.32									
	Method:	-	Defect orientation	180°									
Moisture content			Is [MPa]	0.079									
Moisture content type:			$Is_{(50)}$ [MPa]	0.088									
Density (t/m³)	As received	Dry	Lithological description	FURRUGINISED GRANITE									

Location test conducted: Laboratory

Mean values: *Calculation excludes specimens which are not compliant with the tolerances specified in the test method*

Axial	Diametral	Irregular
0.32		
-	-	-
0.079		
0.088		

History: Test performed on samples submitted to the laboratory.

Client ref.:

Definitions:

Test types: A = Axial, **D** = Diametral, **L** = Lump / Irregular

Failure modes: B = Along bedding plane, **M** = Through rock matrix, **J** = Along joint, **W** = Along a plane of weakness, **DF** = Didn't Fail

n/a = Not applicable, **ND** = Not determined

** A non compliant test = platen gap at failure being outside of the tolerance of the method

Cert. ref.:	PS128388-02_TRP22-0117_PtLd_22091615 - 22091616_Rep-22086218	**Specimens prepared by:**	PK
NATA	**NATA accreditation number: 1961 - Site:1598 - Perth** Accredited for compliance with ISO/IEC 17025 - Testing	**Tests performed by:**	PK 12/10/22
		Results reviewed by:	PKent
	THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	**Date reported:**	**12/10/2022**

Approved signatory:

Paul Kent - Laboratory Manager

Phone: +61 (0)8 9441 0700 **Fax:** +61 (0)8 9441 0701 **E-mail:** perthlab@golder.com.au **Web:** www.golder.com.au

APPENDIX D

ASS and Chemical Laboratory Certificates

		<4		<3			
		4-5					
Golder Sample ID	ALS Sample Number	pH (water)	Colour of soil & water	pH (peroxide)	Colour of soil & peroxide	Reaction strength	pH (water) - pH (peroxide)
ASS01 - Ground Surface	EP2212121-001	6.95	light brown	4.87	light brown	SI	2.08
ASS01 - 0.5 m blg	EP2212121-002	6.29	light brown	4.85	light brown	SI	1.44
ASS02 - Ground Surface	EP2212121-003	6.89	light brown	5.14	light brown	SI	1.75
ASS02 - 0.5 m blg	EP2212121-004	6.71	light brown	5.21	light brown	SI	1.50
ASS02 - 1.0m blg	EP2212121-005	6.94	light brown	5.26	light brown	M	1.68
ASS03 - Ground Surface	EP2212121-006	6.91	brown	5.66	brown	M	1.25
ASS03 - 0.5 m blg	EP2212121-007	5.44	brown	3.90	brown	M	1.54
ASS03 - 1.0m blg	EP2212121-008	**4.92**	brown	3.28	brown	M	1.64
ASS04 - Ground Surface	EP2212121-009	6.23	light brown	4.61	light brown	M	1.62
ASS04 - 0.5 m blg	EP2212121-010	6.33	light brown	4.72	light brown	SI	1.61
ASS04 - 1.0m blg	EP2212121-011	6.43	light brown	4.69	light brown	SI	1.74
ASS05 - Ground Surface	EP2212121-012	7.14	brown	5.16	brown	M	1.98
ASS05 - 0.5 m blg	EP2212121-013	6.02	brown	4.11	brown	SI	1.91
ASS BH02 - Ground Surface	EP2212121-014	7.66	brown	6.08	brown	SI	1.58
ASS BH02 - SPT@1.5 m	EP2212121-015	5.61	grey	4.45	grey	SI	1.16
ASS BH02 - SPT@3.0 m	EP2212121-016	5.52	grey	4.07	grey	SI	1.45

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2212121**	Page	: 1 of 2
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR DALE SCREECH	Contact	: Customer Services EP
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara Western Australia Australia 6065
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9406 1301
Project	: PS128388 Konnon Rail Facility	Date Samples Received	: 16-Sep-2022 13:30
Order number	: ----	Date Analysis Commenced	: 20-Sep-2022
C-O-C number	: ----	Issue Date	: 29-Sep-2022 17:48
Sampler	: CALVIN KRESS		
Site	: ----		
Quote number	: EN/002/21		
No. of samples received	: 16		
No. of samples analysed	: 4		

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*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, Western Australia

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.

- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	ASS01 - 0.5 m blg	ASS02 - 1.0m blg	ASS04 - 0.5 m blg	ASS BH02 - SPT@1.5 m	----
			Sampling date / time	08-Sep-2022 00:00	08-Sep-2022 00:00	08-Sep-2022 00:00	07-Sep-2022 00:00	----
Compound	CAS Number	LOR	Unit	EP2212121-002	EP2212121-005	EP2212121-010	EP2212121-015	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.0	6.6	6.3	5.4	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	35.1	12.6	28.4	50.8	----
ED040S: Soluble Major Anions								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	20	70	40	40	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	110	10	30	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2212121**	Page	: 1 of 3
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR DALE SCREECH	Contact	: Customer Services EP
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara Western Australia Australia 6065
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9406 1301
Project	: PS128388 Konnon Rail Facility	Date Samples Received	: 16-Sep-2022
Order number	: ----	Date Analysis Commenced	: 20-Sep-2022
C-O-C number	: ----	Issue Date	: 29-Sep-2022
Sampler	: CALVIN KRESS		
Site	: ----		
Quote number	: EN/002/21		
No. of samples received	: 16		
No. of samples analysed	: 4		

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

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*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, Western Australia

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA002: pH 1:5 (Soils) (QC Lot: 4593179)									
EP2212108-041	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.7	6.5	3.5	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4596380)									
EP2211971-005	Anonymous	EA055: Moisture Content	----	0.1	%	3.4	3.4	0.0	No Limit
ED040S: Soluble Major Anions (QC Lot: 4593180)									
EP2212121-002	ASS01 - 0.5 m blg	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	20	20	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 4593181)									
EP2212121-002	ASS01 - 0.5 m blg	ED045G: Chloride	16887-00-6	10	mg/kg	<10	10	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 4593179)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.6	102
				----	7 pH Unit	99.6	98.6	102
ED040S: Soluble Major Anions (QCLot: 4593180)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	750 mg/kg	99.5	91.7	116
ED045G: Chloride by Discrete Analyser (QCLot: 4593181)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	50 mg/kg	106	88.0	112
				<10	5000 mg/kg	99.3	88.0	112

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride by Discrete Analyser (QCLot: 4593181)							
EP2212121-005	ASS02 - 1.0m blg	ED045G: Chloride	16887-00-6	5000 mg/kg	98.1	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2212121**	Page	: 1 of 5
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR DALE SCREECH	Telephone	: +61-8-9406 1301
Project	: PS128388 Konnon Rail Facility	Date Samples Received	: 16-Sep-2022
Site	: ----	Issue Date	: 29-Sep-2022
Sampler	: CALVIN KRESS	No. of samples received	: 16
Order number	: ----	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Soils)						
Snap Lock Bag ASS BH02 - SPT@1.5 m	28-Sep-2022	14-Sep-2022	**14**	----	----	----
Snap Lock Bag ASS01 - 0.5 m blg, ASS02 - 1.0m blg, ASS04 - 0.5 m blg	28-Sep-2022	15-Sep-2022	**13**	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Snap Lock Bag ASS BH02 - SPT@1.5 m	----	----	----	23-Sep-2022	21-Sep-2022	**2**
Snap Lock Bag ASS01 - 0.5 m blg, ASS02 - 1.0m blg, ASS04 - 0.5 m blg	----	----	----	23-Sep-2022	22-Sep-2022	**1**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Snap Lock Bag (EA002) ASS BH02 - SPT@1.5 m	**07-Sep-2022**	**28-Sep-2022**	14-Sep-2022	×	**28-Sep-2022**	28-Sep-2022	✓
Snap Lock Bag (EA002) ASS01 - 0.5 m blg, ASS02 - 1.0m blg, ASS04 - 0.5 m blg	**08-Sep-2022**	**28-Sep-2022**	15-Sep-2022	×	**28-Sep-2022**	28-Sep-2022	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag (EA055) ASS BH02 - SPT@1.5 m	**07-Sep-2022**	**----**	----	----	**23-Sep-2022**	21-Sep-2022	×
Snap Lock Bag (EA055) ASS01 - 0.5 m blg, ASS02 - 1.0m blg, ASS04 - 0.5 m blg	**08-Sep-2022**	**----**	----	----	**23-Sep-2022**	22-Sep-2022	×

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED040S: Soluble Major Anions							
Snap Lock Bag (ED040S) ASS BH02 - SPT@1.5 m	**07-Sep-2022**	**28-Sep-2022**	05-Oct-2022	✓	**28-Sep-2022**	26-Oct-2022	✓
Snap Lock Bag (ED040S) ASS01 - 0.5 m blg, ASS02 - 1.0m blg, ASS04 - 0.5 m blg	**08-Sep-2022**	**28-Sep-2022**	06-Oct-2022	✓	**28-Sep-2022**	26-Oct-2022	✓
ED045G: Chloride by Discrete Analyser							
Snap Lock Bag (ED045G) ASS BH02 - SPT@1.5 m	**07-Sep-2022**	**28-Sep-2022**	05-Oct-2022	✓	**28-Sep-2022**	26-Oct-2022	✓
Snap Lock Bag (ED045G) ASS01 - 0.5 m blg, ASS02 - 1.0m blg, ASS04 - 0.5 m blg	**08-Sep-2022**	**28-Sep-2022**	06-Oct-2022	✓	**28-Sep-2022**	26-Oct-2022	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chloride Soluble By Discrete Analyser	ED045G	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	4	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride Soluble By Discrete Analyser	ED045G	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Major Anions - Soluble	ED040S	SOIL	In house: Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5630 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 8372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/18 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

PERTH 26 Rigon Way WA 6065 (Delivered to Advantage Way) Ph: 08 9406 1301 E: samples.perth@alsglobal.com

SYDNEY Ph: 02 87

TOWNS Ph: 07 47

WOLLO Ph: 02 42

Environmental Division Perth

Work Order Reference

EP2212121

Telephone : -- 61-8-9406 1301

CLIENT: GOLDER ASSOCIATES	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT (List due date):	FOR LA
OFFICE: 45 Francis Street, Northbridge, WA 6003		☐ Non Standard or urgent TAT (List due date):	Custody S
PROJECT: Konnon Rail Facility PROJECT NO.: PS128388	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice/ receipt?
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN: Australia	COC: 1 2 3 4 5 6 7	Random S
PROJECT MANAGER: Dale Screech CONTACT PH:		OF: 1 2 3 4 5 6 7	Other con
SAMPLER: Calvin Kress SAMPLER MOBILE: 0450 615 195	RELINQUISHED BY: Calvin Kress	RECEIVED BY:	RELINQUISHE
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default): DEFAULT			
Email Reports to (will default to PM if no other addresses are listed): calvin.kress@wsp.com & dale.screech@wsp.com	DATE/TIME: 08/09/22 and 07/09/22	DATE/TIME: 16/9 1330	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): calvin.kress@wsp.com & dale.screech@wsp.com			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: FURTHER SAMPLES TO ARRIVE IN A WEEK, PLEASE TEST THESE FIRST - PLEASE HOLD ONTO SAMPLES UNTIL FURTHER NOTICE

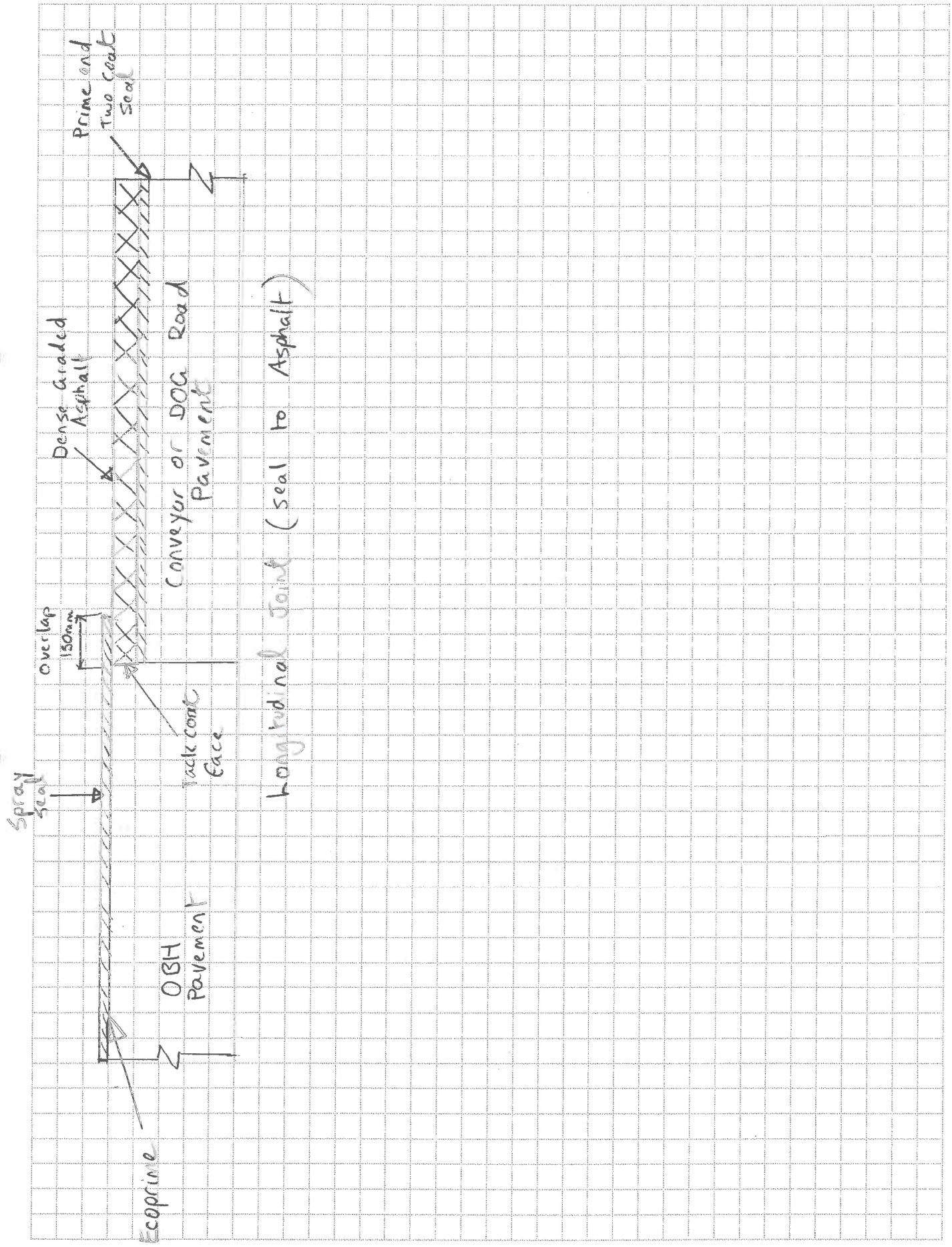
ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	ASS Field Screen	pH, chloride, sulfate							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	ASS01 - Ground Surface	8/09/2022	S			1								Hold For CRS
2	ASS01 - 0.5 m blg	8/09/2022	S			1	1							Hold For CRS
3	ASS02 - Ground Surface	8/09/2022	S			1								Hold For CRS
4	ASS02 - 0.5 m blg	8/09/2022	S			1								Hold For CRS
5	ASS02 - 1.0m blg	8/09/2022	S			1	1							Hold For CRS
6	ASS03 - Ground Surface	8/09/2022	S			1								Hold For CRS
7	ASS03 - 0.5 m blg	8/09/2022	S			1								Hold For CRS
8	ASS03 - 1.0m blg	8/09/2022	S			1								Hold For CRS
9	ASS04 - Ground Surface	8/09/2022	S			1								Hold For CRS
10	ASS04 - 0.5 m blg	8/09/2022	S			1	1							Hold For CRS
11	ASS04 - 1.0m blg	8/09/2022	S			1								Hold For CRS
12	ASS05 - Ground Surface	8/09/2022	S			1								Hold For CRS
13	ASS05 - 0.5 m blg	8/09/2022	S			1								Hold For CRS
14	ASS BH02 - Ground Surface	7/09/2022	S			1								Hold For CRS
15	ASS BH02 - SPT@1.5 m	7/09/2022	S			1	1							Hold For CRS
16	ASS BH02 - SPT@3.0 m	7/09/2022	S			1								Hold For CRS
					TOTAL	16	4							

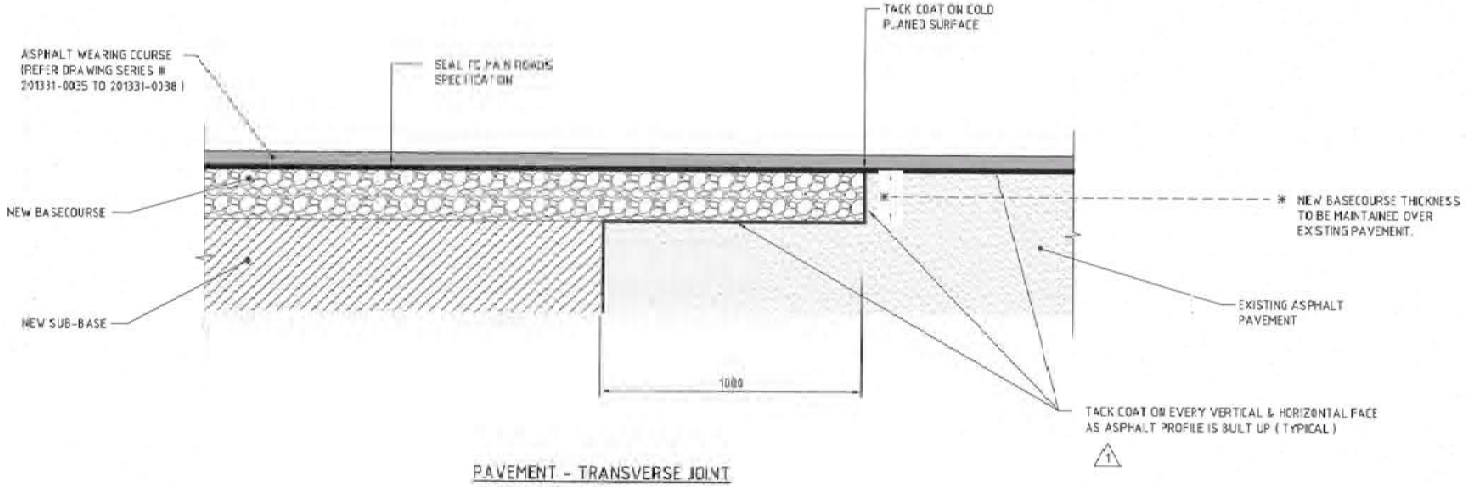
Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; U = Lugols Iodine Preserved Bottle; STT = Sterile Sodium Thiosulfate Preserved Bottle

APPENDIX E

Pavement Joints

SUBJECT	Appendix E - Longitudinal Joint	
Job No.:	Made by DMS	Date 01/02/19
Ref.	Checked by	Sheet of

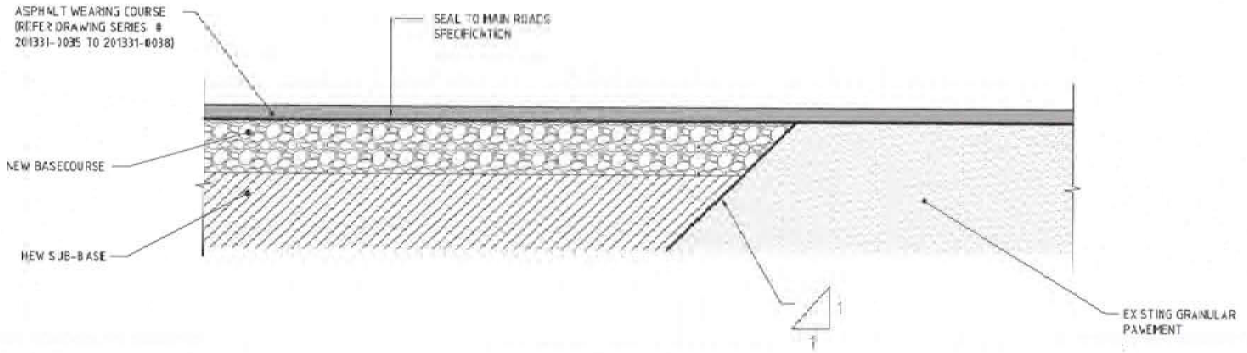




PAVEMENT - TRANSVERSE JOINT

NEW GRANULAR TO EXISTING ASPHALT

N.T.S.



PAVEMENT - TRANSVERSE JOINT

NEW GRANULAR TO EXISTING GRANULAR

N.T.S.

AMENDMENTS

No	DESCRIPTION	APPROVED & DATE
1	ASPHALT WEARING COURSE COLOUR CHANGE AND NOTES CHANGED AS SHOWN	

NOTES

1. ALL DIMENSIONS IN MILLIMETRES U.N.O.

LEGEND

- ASPHALT WEARING COURSE
- NEW BASECOURSE
- SEAL OR TACK COAT
- EXISTING PAVEMENT
- NEW SUB-BASE

mainroads WESTERN AUSTRALIA

PLANNING AND TECHNICAL SERVICES DIVISION

ROAD AND TRAFFIC ENGINEERING BRANCH

WATERLOO CRESCENT EAST PERTH 6004

Telephone (08) 9323 4430 Fax (08) 9323 4420

DESIGNED / DRAWN	C. SKANTZOS / A. BERRY
VERIFIED	S. HALLIGAN
APPROVED	B. SINGOR 20-11-2014

SCALES: A1

STANDARD DRAWING

PAVEMENT SERIES

TYPICAL DETAILS GRANULAR TRANSVERSE JOINTS

LOCAL INTEREST

MRWA DRAWING NUMBER

201331-0032 - 1

APPENDIX F

Important Information

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

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At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

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