
Report on Geotechnical Investigation

**Proposed Tamworth Regional Aquatic
Centre**

Jack Smyth Drive, Hillvue NSW

Prepared for Tamworth Regional Council

Project 226965.00

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Geotechnical Investigation

Proposed Tamworth Regional Aquatic Centre

Jack Smyth Drive, Hillvue NSW

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a Proposed Tamworth Regional Aquatic Centre at Jack Smyth Drive, Hillvue NSW (the site). The investigation was commissioned by an email instructing Douglas to proceed dated 19 January 2024 from Callum Fletcher of Tamworth Regional Council and was undertaken with reference to Douglas' proposal 226965.00.P.001.Rev0 dated 15 January 2024.

It is understood that Tamworth Regional Council (TRC) are proposing to construct a new Tamworth Regional Aquatic Centre (TRAC) and Northern Inland Centre of Sport and Health (NICSH) facility at the site. The proposed development will cover an area of approximately 24,000 m² with a building footprint of 6,500 m² and 7,000 m² of flexible pavement. It is further understood that the development could include the following:

- TRAC facilities:
 - o Ten lane 50 m indoor pool including spectator seating;
 - o Warm water pool, spa and sauna;
 - o Change rooms and amenities including wet and dry areas;
 - o Administration, offices, store, dry plant rooms and Café;
 - o Leisure pool with water play and learn to swim (Stage 2 Extension);
 - o 50 m outdoor swimming pool (Stage 3 Extension);
- NICSH facilities:
 - o Administration, office, teaching and study spaces;
 - o Testing lab and dry amenities;
 - o Strength and conditions gym (Stage 2 Extension); and
 - o Sprint track (Stage 2 Extension).

A geotechnical investigation was undertaken at the site to provide comment on the following:

- Subsurface soil and groundwater conditions at test locations;
- Site classification with reference to AS2870 (2011);
- Suitable footing types, founding depths and geotechnical design parameters;
- Suitable short and long term batter slopes;
- Recommended geotechnical pavement thickness design parameters i.e. subgrade CBR (it is understood that pavement thickness design will be performed by others.);
- Likely excavation conditions;
- Recommended earthworks and site preparation measures; and
- Recommendation for additional investigations or analysis, if required.

The geotechnical investigation was undertaken in conjunction with a preliminary site investigation for contamination which will be reported separately.

For the purpose of the investigation the Client provided a set of drawings of the proposed development by CO-OP Studio Pty Ltd, Project 100358, dated 2 May 2024 and included five drawings (DA101, DA201, DA202, DA401 and DA501).

The investigation included the drilling of seven boreholes (Bores 1 to 7) and excavation of twelve test pits (Pits 8 to 11 and C1 to C8). The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

This report must be read in conjunction with all appendices including the notes provided in Appendix A.

2. Site description

The site is located within part Lot 102 DP1262475 off Jack Smyth Drive, Hillvue as shown in Figure 1, below. The investigation area was generally level with a good covering of grass.

A slope of approximately 2 m in height was observed along the northern boundary and sloped down to the north at approximately 20°. A drainage swale up to 1 m deep was observed running south to north through the centre of the investigation area with a number of semi-mature to mature trees along the swale and sparsely across the site.

An existing fill mound was observed outside and adjacent to the east of the investigation area adjacent to the hockey fields. The mound was approximately 1 m high and 2 m wide and had a good covering of grass.



Figure 1: Aerial Photo of the investigation area (red outline) (image sourced from Google Earth dated November 2023)

The following photos show parts of the site during the investigation.



Figure 2: View north-east to south-east from approximate Test Pit C5 location



Figure 3: View north to south from approximate Test Pit 8 location



Figure 4: View north-west to north-east from southern extent of swale drain



Figure 5: View north from south-eastern corner of the site



Figure 6: View south along swale drain from northern extent



Figure 7: View south-east from approximate Bore 6 location



Figure 8: View east along batter slope at northern boundary of investigation area



Figure 9: View of ponded water within southern part of swale drain

3. Published data

3.1 Geology

Reference to the NSW Seamless Geology dataset (Figure 10) made available by the NSW Government Department of Regional New South Wales, indicates that the site is likely to be underlain by Mandowah Mudstone (purple shading) which typically comprises mudstone with thin siltstone and fine sandstone bands. The site is also mapped within close proximity to areas comprising Keepit Conglomerate (grey shading, which typically comprises conglomerate and sandstone) and Noumea Beds (brown shading, which typically comprises wacke, siltstone and mudstone).

A review of NCCA naturally occurring asbestos (NOA) mapping indicates the site is not within a mapped risk area of containing geological units which may contain naturally occurring asbestos.



Figure 10: Seamless geology dataset with approximate sporting precinct (blue outline) and investigation area (red outline)

3.2 Soil landscape

Reference to the Tamworth 1:100,000 scale Soil Landscape Sheet (Figure 11) indicates the site is located within residual soils of the Duri landscape, which is characterised by “extensive rolling to undulating hills and low hills. Slopes <10%”. Limitations for this soil landscape include gully erosion risk, sheet erosion risk, localised low wet bearing strength, localised dryland salinity, localised sodicity, localised shallow soils and localised poor drainage, localised permanently high water tables, localised known discharge and recharge areas, localised high run-on.

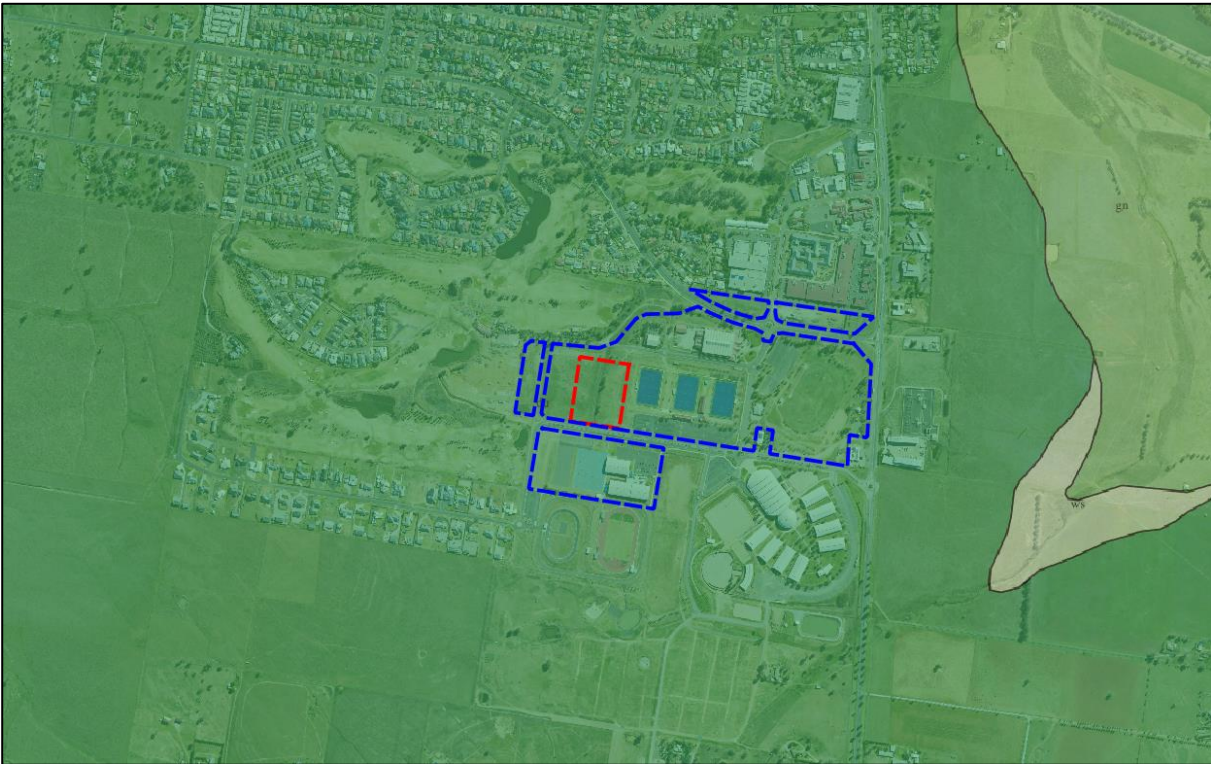


Figure 11: Soil landscape map with approximate sporting precinct (blue outline) and investigation area (red outline)

3.3 Acid sulfate soils

Reference to the NSW Acid Sulfate Soil Risk Map (Figure 12) indicates the site is not located within an area of known potential for acid sulfate soils.



Figure 12: Acid sulfate soils mapping with approximate sporting precinct (blue outline) and investigation area (red outline)

4. Field work

4.1 Methods

The field work was carried out during the period between 6 May 2024 and 23 May 2024 comprised the following:

- Service locating and site set-out;
- Seven boreholes (Bores 1 to 7) using a truck mounted drilling rig was undertaken during the period of 21 to 23 May 2024. The bores were advanced through soil and weathered rock using 100 mm diameter solid flight augers and rotary wash boring techniques. The underlying bedrock was recovered in two bores using NMLC diamond drilling techniques and termination depths for the bores ranged from 4.50 m to 5.62 m. Standard penetration tests (SPTs) were undertaken to provide information on the relative strengths or densities of the subsurface soils. Pocket penetrometer (PP) testing was also carried out on selected samples to supplement the SPTs;
- Twelve test pits (Pits 8 to 11 and C1 to C8) were undertaken using a 35 tonne excavator fitted with a 1.4 m wide toothed bucket and additional a single tyne attachment utilised in selected pits, and were excavated to depths ranging from 1.55 m to 4.70 m. Pits 8 to 11 were positioned to assess excavatability of the subsurface profile across proposed deep excavations. Pits 10 and 9 included additional excavation using a single tyne attachment where refusal of the bucket was encountered to further assess excavatability; and
- Dynamic penetrometer testing (DPT) with cone tip was undertaken adjacent to the test pits to depths of 0.55 m to 3.15 m.

The locations were set out by a senior geotechnical engineer from Douglas, with reference to client proposed test locations, existing site features, buried services and the proposed development. A geotechnical engineer logged the subsurface profile encountered and collected regular samples for laboratory testing and identification purposes.

The location of the bores and test pits, and respective surface levels were recorded using a differential GPS unit on fixed mode which generally has an accuracy of ± 0.1 m depending on satellite coverage and surrounding site conditions. The location (to GDA2020) and surface elevations (in mAHD) of the bores and test pits are presented on the relevant borehole and test pit logs in Appendix B. However, it should be noted that a detailed survey undertaken by registered surveyor has not been undertaken for our investigation.

The approximate borehole and test pit locations are shown on Drawing 1, in Appendix D.

4.2 Results

The subsurface conditions encountered at the test locations are presented in detail in the borehole and test pit logs in Appendix B. These should be read in conjunction with the accompanying notes in Appendix A, which explain the descriptive terms and classification methods used in the logs and plots.

The subsurface profiles are summarised into geotechnical units which are presented in Table 1 with a summary of the units at each location are presented in

Table 2.

Table 1: Summary of geotechnical units

Geotechnical Unit	Soil Type	Description
Unit 1.1	Topsoil (Fill)	Generally Silty CLAY, Sandy CLAY, Clayey SILT, brown, M<PL to M=PL
Unit 1.2	Fill	Generally comprising various mixtures of gravel, sand silt and clay materials with cobbles, asphalt, brick, concrete, metal, bricks, golf balls, timber, plastic barrier board and PVC pipes, M<PL to M>PL
Unit 2.1	Residual	Generally stiff to very stiff, grey, yellow, brown silty clay or clay, M<PL to M>PL
Unit 2.2	XWM	Generally hard or dense to very dense, pale yellow, yellow brown, grey, brown, silty clay, sandy clay, gravelly clay, clayey gravel and sandy gravel, M<PL to M=PL and dry Extremely weathered material (XWM) based on recovered samples and local knowledge of geology
Unit 3	Rock	Generally medium to high strength, highly weathered to slightly weathered siltstone, sandstone or conglomerate

Notes to Table 1:

M - Moisture content of soil

PL - Plastic limit of soil

XWM - Extremely weathered material

Table 2: Summary of geotechnical units at test locations

Location	Type	Surface Level (m, AHD) ¹	Depth Range of Each Unit (m)					Termination Depth(m)
			Unit 1.1 (Topsoil)	Unit 1.2 (Fill)	Unit 2 (Residual)	Unit 2.2 (XWM)	Unit 3 (Rock)	
1	BH	409.3	0.0 - 0.25	0.25 - 1.8	1.8 - 2.5	2.5 - 3.1	3.1 - 4.7 ^L	4.70
2	BH	409.1	0.0 - 0.2	0.2 - 2.75	2.75 - 3.7	3.7 - 5.4 ^R	-	5.40
3	BH	409.8	0.0 - 0.15 ³	0.15 - 2.25	2.25 - 4.0	4.0 - 4.5 ^R	-	4.50
4	BH	409.9	0.0 - 0.1	0.1 - 3.0	3.0 - 4.0	4.0 - 5.2 ^R	-	5.20
5	BH	409.4	-	0.0 - 2.0	-	2.0 - 3.05	3.05 - 5.2 ^L	5.20
6	BH	409.1	0.0 - 0.3	0.3 - 2.5	2.5 - 4.0	4.0 - 5.62 ^L	-	5.62
7	BH	410.0	0.0 - 0.1 ⁴	0.1 - 2.75	2.75 - 4.0	4.0 - 4.8 ^R	-	4.80
8	EP	409.4	0.0 - 0.6	0.6 - 2.8	2.8 - 4.4	4.4 - 4.7 ^R	-	4.70
9	EP	409.6	0.0 - 0.35	0.35 - 2.2	2.2 - 3.0	3.0 - 3.9 ^R	-	3.90
10	EP	410.2	0.0 - 0.25	0.25 - 2.3	2.3 - 3.0	3.0 - 4.1 ^R	-	4.10
11	EP	409.8	0.0 - 0.3	0.3 - 2.7	2.7 - 4.2	4.2 - 4.6 ^R	-	4.60
C1	TP	410.0	0.0 - 0.4	0.4 - 1.5	1.5 - 2.3 ^L	-	-	2.30
C2	TP	409.6	0.0 - 0.3	0.3 - 1.2	1.2 - 1.9	1.9 - 2.1 ^L	-	2.10
C3	TP	409.7	0.0 - 0.15	0.15 - 0.75	0.75 - 1.65 ^R	-	-	1.65
C4	TP	410.2	0.0 - 0.2	0.2 - 1.0	1.0 - 1.55 ^R	-	-	1.55
C5	TP	410.2	0.0 - 0.3	0.3 - 1.3	1.3 - 1.65 ^L	-	-	1.65
C6	TP	409.2	0.0 - 0.25	0.25 - 2.3 ^L	-	-	-	2.30
C7	TP	409.3	0.0 - 0.35	0.35 - 2.4 ^L	-	-	-	2.40
C8	TP	409.1	0.0 - 0.25	0.25 - 2.1 ^L	-	-	-	2.10

Notes to Table 2:

BH - Drill rig Borehole

EP - Excavation Test Pit

TP - Pavement Test Pit

- Not Encountered

L - Limit of investigation

R - Equipment Refusal

XWM - Extremely weathered material

1 - Surface levels measured using differential GPS in fixed mode

2 - includes possible XWM

3 - brown sandy gravel

4 - brown sandy gravelly clay

No free groundwater was encountered in the bores whilst auger drilling was undertaken, with groundwater observations obscured below these depths due to the introduction of drilling fluids, where introduced.

Seepage was observed within Pit 11 at 2.3 m depth during the investigation, no free groundwater was encountered in the remaining test pits whilst they remained open.

It should be noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and will therefore vary with time.

5. Laboratory testing

5.1 Geotechnical

Geotechnical laboratory testing was undertaken at Douglas Port Macquarie NATA registered laboratory on selected subsurface materials sampled from the boreholes and pits and comprised the following:

- Four standard compaction and 4 day soak California bearing ratio (CBR) tests for pavement thickness purposes;
- Two Shrink-Swell Index (Iss) tests on undisturbed samples of clay for assessment of seasonal shrink swell movements; and
- One Atterberg limit and linear shrinkage on sample of clay for assessment of seasonal shrink swell movements.

The detailed results of laboratory testing are included in Appendix C and are summarised below in Table 3 and Table 4.

Table 3: Results of laboratory testing - CBR and standard compaction

Location	Depth (m)	Description	FMC (%)	SOMC (%)	SMDD (t/m ³)	CBR (%)	Swell During Soaking Phase (%)	MC after soaking (%)	MC top 30 mm (%)
C3	0.8 - 1.0	Sandy SILT: grey white	10.5	17.5	1.76	7	0.5	18.9	18.8
C5	0.5 - 1.0	FILL: brown silty CLAY with gravel, trace sand	15.1	17.0	1.79	5	1.0	17.8	19.7
C6	0.5 - 1.0	FILL: brown sandy clay with gravel	8.6	11.0	2.04	10	0.0	11.4	11.7
C7	0.5 - 1.0	FILL: brown silty clay with gravel	14.7	18.0	1.74	8	0.5	19.3	19.9

Notes to Table 3:

FMC - Field Moisture Content

SOMC - Optimum Moisture Content (Standard)

SMDD - Maximum Dry Density (Standard)

CBR - California Bearing Ratio

MC - Moisture Content

Table 4: Results of laboratory testing - shrink swell and Atterberg limits

Location	Depth (m)	Description	FMC (%)	LL (%)	PL (%)	PI (%)	LS (%)	Shrink (%)	Swell (%)		Iss (% per ΔpF)	PP before soaking (kPa)	PP after soaking (kPa)
2	3.0 – 3.4	Silty CLAY: grey and yellow	15.6	43	14	29	13.0	-	-		-	-	-
6	3.35 – 3.75	CLAY: brown	12.8	-	-	-	-	1.9	-0.0		1.1	300	220
7	3.1 – 3.5	CLAY: dark brown	16.0	-	-	-	-	3.0	0.6		1.8	230	160

Notes to Table 4:

FMC - Field Moisture Content

LL - Liquid Limit

PL - Plastic Limit

PI - Plasticity Index

LS - Linear Shrinkage

Iss - Shrink-swell index

PP - Pocket Penetrometer reading

5.2 Chemical

Laboratory testing was undertaken by Envirolab Services Pty Ltd, a National Association of Testing Authorities, Australia (NATA) registered laboratory. Two soil samples were submitted for analysis to assess the aggressiveness of soil to steel/concrete structures. The laboratory testing comprised soluble sulphate, soluble chloride, electrical conductivity and pH on the soil sample.

Detailed laboratory report sheets are attached in Appendix C and the results are summarised in Table 5 below.

Table 5: Results of soil aggressivity testing

Bore	Depth (m)	Description	pH	EC (µS/cm)	Resistivity (ohm.cm)	Cl (mg/kg)	SO ₄ (mg/kg)
2	4.0	Silty CLAY: pale brown	8.2	91	10989	10	20
5	1.0	FILL: brown silty gravelly clay	8.2	160	6250	23	<10
7	2.5	FILL: dark brown sandy clay	8.3	150	6667	40	<10

Notes to Table 5:
 Cl - Chloride Content
 SO₄ - Sulphate Content
 µS - micro Siemens
 EC - Electrical conductivity

6. Comments

6.1 Appreciation of subsurface conditions

Based on the results of the investigations, the pertinent subsurface conditions are as follows:

- Existing uncontrolled fill materials (Unit 1.1 and 1.2) was encountered across the site to depths ranging from 0.75 m to 3.0 m. The existing fill generally consisted of various mixtures of gravel, sand silt and clay materials with cobbles, asphalt, brick, concrete, metal, bricks, golf balls, timber, plastic barrier board and PVC pipes;
- Residual grey, yellow, brown silty clay or clay (Unit 2.1) was encountered below the existing fill to depths ranging from 1.55 m and 4.4 m across the site;
- Extremely weathered material described as hard or dense to very dense, pale yellow, yellow brown, grey, brown, silty clay, sandy clay, gravelly clay was encountered across the site to depths ranging from 3.05 m to greater 5.62 m;
- Bedrock described as medium to high strength, highly weathered to slightly weathered siltstone, sandstone or conglomerate was encountered in Bores 1 and 5 only at depths of 3.1 m and 3.05 m respectively. The recovered rock was generally fractured to highly fractured;
- Excavator refusal was encountered in the test pits at locations 8 to 11, C3 and C4 at depths ranging from 1.55 m to 4.8 m. Auger refusal was encountered in the bores at locations 2 to 4 and 7 at depths ranging from 4.5 m to 5.4 m. This could be indicative of competent bedrock similar to Unit 3 material; and
- Free groundwater was not encountered in the bores prior to the introduction of drilling fluids in the bores or the test pits whilst they remained open. However, seepage was encountered in Pit 11 at 2.3 m depth, which is likely to have been perched within the fill layer at this location. The depth to the local groundwater level was not determined during the investigation.

6.2 Excavation conditions

Excavations will be required to a maximum depth of approximately 2.5 m or approximately RL 407.6 m for proposed pools and associated infrastructure. Table 6 below provides a summary of the subsurface conditions encountered in the bores or pits at the proposed depth of excavation.

Table 6: Summary of conditions at proposed excavation level

Location	Surface level (m AHD)	Bucket / Auger Refusal (m)	Approximate depth of excavation required (m)	Anticipated Excavation Level	Excavation Purpose	Conditions anticipated at Excavation Level
1	409.3	3.1	0.2	RL 409.1m	General Construction	Unit 1.1 – Topsoil (Fill) / Unit 1.2 – Fill
2	409.1	5.4	1.5	RL 407.6m	Swimming Pool	Unit 1.2 – Fill
3	409.8	4.5	2.2	RL 407.6m	Swimming Pool	Unit 1.2 – Fill / Unit 2.1 – Residual
4	409.9	5.2	2.3	RL 407.6m	Swimming Pool	Unit 1.2 – Fill
5	409.4	3.05	0.3	RL 409.1m	General Construction	Unit 1.2 - Fill
6	409.1	NE	0.8	RL 408.3m	Warm Water Pool	Unit 1.2 - Fill
7	410.0	4.8	2.4	RL 407.6m	Swimming Pool	Unit 1.2 – Fill / Unit 2.1 – Residual
8	409.4	4.7	1.8	RL 407.6m	Swimming Pool	Unit 1.2 - Fill
9	409.6	3.4 / 3.9 ^a	0.5	RL 409.1m	General Construction	Unit 1.2 - Fill
10	410.2	3.3 / 4.1 ^a	1.1	RL 409.1m	General Construction	Unit 1.2 - Fill
11	409.8	4.6	2.2	RL 407.6m	Swimming Pool	Unit 1.2 – Fill / Unit 2.1 – Residual

Notes to Table 6:

a - single tyne attachment refusal

Based on the conditions encountered within the boreholes and test pits, and as outlined in Table 6 above, excavation is anticipated to predominantly encounter fill materials, with possible residual silty clay and clay soils in parts.

It is expected that excavation of the fill materials (Unit 1.2) and residual clay soils (Unit 2.1) could be undertaken using medium sized conventional earthmoving plant such as backhoes and/or 8 to 15 tonne hydraulic excavators (or similar) subject to encountered anthropogenic materials encountered in the fill materials.

It should be recognised that the above excavatability estimates are based on materials encountered at the test locations only, and that excavation conditions may prove more difficult (or easier) between and beyond these test locations.

Excavatability of rock, if encountered, is not only dependent on rock strength, but also on the orientation and extent of discontinuities such as jointing, fracturing and bedding planes and other factors. For example, low strength rock which is slightly fractured may be more difficult to excavate than highly fractured, high strength rock.

It is noted that using a single tyne attachment in two of the pits (i.e. Pits 9 and 10) beyond the bucket refusal depth indicated excavation to approximately 0.4 m additional depth was undertaken in approximately 10 minutes.

The selection of methods and equipment for rock excavation should be undertaken by the contractor who should take into account the factors described above, together with economical production rates.

6.3 Re-use of excavated materials

It is considered that the majority of materials won from excavations will generally be gravelly clay soils which, where generally free of organic and deleterious material, will generally be suitable for re-use as bulk fill provided the placement moisture content is within about 2% of the optimum moisture content (OMC) for site compaction.

Any soils containing organic and deleterious matter should be stripped from the construction area and stockpiled for landscaping purposes or removal from site following appropriate waste classification. It is noted that various anthropogenic inclusions were encountered within the fill and may require removal (i.e. large pieces of concrete, asphalt, PVC pieces etc) prior to reuse onsite.

It should be further noted that the clay soils may be difficult to work when wet and may become untrafficable for rubber tyred plant. The use of tracked machinery may be required at these times. Wet and soft soils should be dried out or replaced. The provision of a granular working platform may be required to provide more reliable site access and trafficability.

In addition, re-use is also contingent upon particle size being controlled. In general, all particles coarser than approximately 75 mm should be discarded unless they are visually confirmed to break down under the passage of a roller.

The suitability of materials for off-site disposal should be undertaken with reference to a waste classification assessment for these soils. A preliminary waste classification assessment for off-site disposal of soils for the site will be reported separately.

6.4 Site preparation and earthworks

Based on the conditions encountered in the bores and pits, it is anticipated that the conditions that will be exposed at bulk excavation level will generally be gravelly clay fill materials (Unit 1.2), although silty clay or clay materials (Unit 2.1) may be encountered.

The following procedure is recommended for preparation of building platforms and pavement subgrades:

- Excavate to design subgrade or bulk excavation level;
- Remove any additional topsoil or unsuitable/deleterious materials;
- Rubber tyred vehicles should not be allowed to access the alluvial clay or silty clay subgrade (if exposed), subject to geotechnical assessment of prevailing soil moisture conditions;
- Inspect the exposed surface for its suitability to act as a building platform. The inspection should include a proof roll witnessed by a geotechnical engineer as well as dynamic penetrometer testing at regular spacings across the area inspected to confirm suitability to support the proposed development;
- Proof roll the exposed surface at proposed foundation level using a smooth drum roller with a dead weight of at least 8 tonnes, operating in non-vibratory mode, to inspect the exposed surface and identify any soft/weak areas. Compact the exposed subgrade to at least 98% standard compaction;
- Any areas deemed unsuitable or any identified soft/weak material should be removed and replaced with suitable select material and compacted to at least 98% Standard or 80% Density Index;
- Engineered fill should be placed and compacted under Level 1 Earthworks and testing in accordance with AS3798 (2007). Material should be placed in near horizontal layers not exceeding 300 mm loose thickness, with a maximum particle size not greater than two-thirds of the compacted layer thickness, and compacted to at least 98% Standard or 80% Density Index; and
- Adequate surface drainage should be provided to direct surface water away from engineered fill.

However, the use of shallow footings will be dependent on improvement of the existing fill materials at the site (refer Section 6.7.1) or the building should be founded on piled footings through the fill and founded in the underlying natural materials. Further comments around footings for the proposed development is made in Section 6.7, below.

Placement of Level 1 or engineered fill at the site will require the excavation of the existing fill material at the site and replaced under Level 1 testing and inspections as per AS 3798 (2007).

Geotechnical inspection, compaction testing and proof rolling of all engineered fill materials is recommended.

Douglas should be engaged to carry out an inspection of the exposed subgrade to confirm suitability, prior to the placement of select or pavement materials, immediately after excavation.

It is recommended that exposed external batter slopes be protected against erosion by topsoiling and grassing and are shaped to at least 1V:3H or flatter.

Earthworks construction procedures should be in accordance with AS3798 (2007).

6.5 Site classification

Site classification of foundation soil reactivity provides an indication of the propensity of the ground surface to move with seasonal variation in moisture. The site classification is based on procedures presented in AS2870 (2011), the typical soil profiles revealed in the bores and pits, and the results of laboratory testing.

Standard designs presented in AS2870 (2011) only apply to structures of similar size and flexibility to residential buildings. Notwithstanding this, structural engineers often incorporate expected reactive movements into the design of other structures, as could be adopted for the proposed development.

On the basis of the results of the field investigation together with the procedures presented in AS2870 (2011), the existing subsurface conditions within the proposed development would be classified 'Class P' due to the presence of existing fill up to 3.0 m depth.

Therefore, it is recommended that all footings be founded below the existing fill in the underlying natural materials (i.e. Unit 2.1 silty clay or clay, Unit 2.2 XWM or Unit 3 bedrock). If the fill is reworked as per Section 6.7.1, below the use of shallow footings could be utilised but would require re assessment following the reworking of the fill materials at the site.

Site classification, as stated above, is based on the information obtained from test bores and pits, and on the results of laboratory testing, and has involved some interpolation between data points. In the event that the conditions encountered during construction are different to those presented in this report, it is recommended that advice be sought from this office.

Articulation joints should be provided within masonry walls in accordance with TN61 (CCAA, 2008) in order to reduce the effects of differential movement.

It is recommended that maintenance measures are provided for the proposed development as outlined in Appendix B of AS2870 (2011) and in CSIRO Sheet BTF 18 (CSIRO, 2021).

6.6 Excavation support

The fill materials, clay soils and weathered rock encountered at the site will not stand vertically without support. Therefore, lack of support during construction could result in slope failure, which could have an adverse impact on the site and surrounding buildings. It will therefore be necessary for excavations to be either appropriately battered or supported both during the construction process and as part of the final development.

Where excavation is sufficiently distant from other properties, buildings, other infrastructure or existing footings and excavation depths less than 3 m in height, the sides of the excavation could be battered at the slopes given in Table 7 below. This approach could also be adopted for the sides of engineered and controlled fill platforms, if required.

Table 7: Recommended batter slopes

Material		Recommended Batter Slopes (H:V)	
		Short Term (< 6 months)	Long Term
Controlled Fill		1.5:1	2:1
Unit 1	Existing Uncontrolled fill (i.e. Gravelly Clay)	2.5:1*	3:1*
Unit 2	Residual silty clay & clay, and extremely weathered material	1.5:1*	2:1*

Note to Table 7:

* Subject to geotechnical inspection and assessment as it depends on joints and bedding planes, which may require the slope angle to be reduced. Instability has been known to occur in excavations within weathered serpentinite bedrock and hence it is recommended that inspection of the excavation during initial stages of bulk earthworks is undertaken by a geotechnical engineer to confirm the suitability of the above batter slopes and provide advice on any further stabilisation measures if required.

It should be noted that the batter slopes given above assume that no water egress occurs along the batter face. Where water egress occurs, advice should be obtained from a geotechnical consultant and the batter slopes may need to be revised. Notwithstanding this, it is recommended that diversion drains be installed above the crests of the batter to direct upslope runoff away from the batter.

Permanent batter slopes should be reduced to 3H:1V or less if maintenance is required (i.e. such as mowing) and to prevent erosion and minor regressive failure at the crest of the batter, if exposed to prevailing weather conditions.

For permanent retaining walls, where the wall will be free to deflect, design should be based on “active” (K_a) earth pressure coefficients, assuming a triangular earth pressure distribution. This would comprise any non-propped or laterally un-restrained walls (e.g. cantilever type walls).

Where structures or services are near the crest (which appears to be the case for the majority of the site boundary), or if the retaining walls are laterally restrained by the structure and not free to deflect, retaining wall design should be based on “at-rest” (K_o) earth pressure coefficients.

The preliminary long term (permanent) design soil parameters for retaining structures are shown in Table 8 below. The earth pressure coefficients are for level backfill. Any additional surcharge loads, including those imposed by inclined slopes behind the wall, during or after construction, and existing structures, should be accounted for in design.

Table 8: Recommended geotechnical parameters for retaining structures

Parameter	Symbol	Engineered Fill	Unit 1.2 – Existing Uncontrolled Fill (Gravelly Clay)	Unit 2.1 – Residual (Stiff to Very Stiff Clay)	Unit 2.2 – XWM (Very Stiff to Hard Clay)
Bulk Density (kN/m ³)	γ	18	18	20	21
Effective Cohesion (kPa)	c'	0	0	5	10
Angle of Friction (degrees)	ϕ'	25°	25°	25°	30°
'Active' Earth Pressure Coefficient – Cantilever Design (free to deflect)	K_a	0.3	0.4	0.3	0.25
'At-rest' Earth Pressure Coefficient – Propped / restrained wall	K_o	0.58	0.58	0.58	0.5
Ultimate Passive Earth Pressure / Coefficient	K_p	2.5	2.0	2.5	2.5

The active earth pressure coefficients presented in Table 8 above is suggested for design of a cantilever or single propped wall and can be calculated based on a triangular pressure distribution.

It should be noted that these parameters will produce unfactored, working (or serviceability) loadings and deflections. Resultant bending moments and anchor or strut forces (if proposed) should be factored for ultimate design loadings.

Retaining walls not designed to accommodate hydrostatic pressures should include free-draining single-size (10 mm single size gravel or coarser) aggregate backfill at the rear of the wall, with slotted drainage pipe at the base of the backfill. The pipes should discharge to the stormwater drainage system. The backfill should be encapsulated within geotextile fabric. It is also suggested that subsoil drainage lines be constructed with adequate access points to enable periodic flushing or clearing. Retaining walls greater than 2 m in height should include additional slotted pipes at approximately 2 m centres.

Specific geotechnical inspections of excavations for retaining walls should be undertaken during construction to confirm foundation conditions.

6.7 Foundations

Footings must not be founded in proposed or existing fill unless it has been adequately compacted and tested as per AS 3798 (2007).

Based on the results of the investigation uncontrolled fill was encountered across the site with depths ranging from approximately 1 m depth in the southern part of the site and increased towards the north to depths up to 3.0 m.

Therefore, shallow footings are not recommended for the site unless improvement to the existing fill material is undertaken (refer Section 6.7.1).

It is therefore recommended that the proposed development be support on piled footings founded through the fill in the underlying natural residual soils or bedrock at depths ranging from 1.0 m to 3.0 m depth across the site.

If no improvement is undertaken on the existing fill materials possible differential settlement of surface elements (i.e. footpaths, services etc) could occur relative to the building structure. In order to minimise differential settlement of these structures they should be founded in similar strata (i.e. natural or engineered fill) to the proposed building structure.

6.7.1 Site improvement options

Owing to the presence of uncontrolled fill to depths of up to 3 m at the site, the following methods could be adopted to improve the site and allow high level footings. However, it should be noted that there are some risks associated with each of the options which would need to be carefully assessed as to their suitability to provide a suitable finished product for the proposed development.

Potential options have been listed in order of increasing risk of long term settlement for the proposed development:

- **Remove and replace** – replace fill materials under Level 1 Inspections and testing as per AS 3798 (2007). Existing fill materials are generally likely to be suitable for re-use as fill subject to removal of over-size and deleterious material. Would require significant earthworks to complete;
- **Dynamic compaction** – generally suitable for silty sand and gravel up to a maximum depth of approximately 6 m. However, specialised heavy equipment would be required to achieve improved compaction to that depth and will generate vibrations which could damage nearby structures. Would require significant additional investigation and assessment, and likely a trial area;
- **Impact rolling** – generally suitable for sand, gravel with clay up to a maximum depth of approximately 3 m. However, specialised equipment would be required to complete impact rolling and will generate vibrations which could damage nearby structures. Would require significant additional investigation and assessment, and likely a trial area;
- **Pre-loading** – generally suitable for all types soil materials up to an infinite depth. However, significant earthworks or long lead times could be required to achieve suitable compaction in the fill materials especially in cohesive soils, which can take years to properly consolidate; and
- **Heavy rolling** – generally suitable for granular materials up to approximately maximum depth of 1.0 m. Would require significant additional investigation and assessment, and likely a trial area.

If any of the above improvement options are to be considered further specific geotechnical assessment of the proposed option should be undertaken to ensure that a suitable outcome can be achieved for the proposed development.

It is noted that upon completion of any of the above options further assessment of the site would need to be undertaken to confirm suitable shallow footing parameters for the proposed development.

Subject to suitable results from the above site improvement measures, pad, strip, raft, piled raft or piled footings could then be considered suitable for the proposed structure but would be dependent on the proposed loads and tolerable settlement.

6.7.1 Pile types

It is considered that conventional bored piles, driven piles and CFA piles may be suitable to support proposed development. Suitable pile types, along with their potential benefits and limitations are discussed below:

Bored piles: Conventional bored or cased bored piles are considered suitable for support of the proposed development. The installation of bored piles could also result in ground disturbance beyond and around the perimeter of the pile shaft if oversized materials are encountered (i.e. large concrete, gravels and cobbles). Casing could be required to prevent the collapse of the pile hole during drilling of existing fill materials and cohesive soils where groundwater inflow occurs, if encountered. Shaft adhesion should be ignored over the length of the cased section and end bearing should be on the underlying residual soil (Unit 2.1), XWM material (Unit 2.2) or bedrock (Unit 3).

The bedrock encountered was generally medium to high strength siltstone, sandstone or conglomerate was fractured which is expected to aid in the boring process. However, the presence of stronger or less fractured rock may require pre-drilling ("honeycombing") with percussion drill methods prior to drilling by convention boring rigs to allow penetration.

Depending on the final depth of the pile and any groundwater within the pile excavation, the concrete for the piles should utilise suitable methods to minimise the risk of segregation (i.e. tremie techniques etc.).

CFA piles: Continuous flight auger (CFA) piles (also commonly referred to as 'grout-injected' piles) could be installed at the site. This method would negate the need to pump water (if encountered), installation of casing etc., however, is generally limited to equipment fitted with augers having a diameter typically in the range 600 mm to 1200 mm.

CFA rigs are likely to have limited penetration into medium strength or stronger rock, unless suitability large enough equipment is used in construction.

Inspection of founding material during installation is not always possible with grout-injected piles, and additional bores are recommended to confirm pile parameters at the bridge pier locations.

Driven piles: Driven piles will likely refuse on the interface between the residual soil and the underlying medium to high strength siltstone, sandstone or conglomerate. Driven piles present the opportunity to achieve a certain amount of capacity through shaft friction during the pile driving exercise, and do not rely on end bearing alone. The monitoring of the installation process also provides the opportunity to correlate installation records with pile capacities using an appropriate dynamic theory.

Driven piles will likely refuse near the surface of the rock with minimal penetration to resist uplift and / or lateral loads.

Notwithstanding the above, piling contractors should be responsible for selecting an appropriate piling method with reference to the ground conditions, and the pile capacities required for design.

6.7.2 Geotechnical strength reduction factor (AS 2159, 2009)

The design geotechnical strength of a pile ($R_{d,g}$) is the ultimate strength ($R_{d,ug}$) multiplied by the geotechnical strength reduction factor (ϕ_g), such that:

$$R_{d,g} = \phi_g R_{d,ug}, \text{ which must exceed the Design Action Effect } E_d$$

The calculated value $R_{d,g}$ must equal or exceed the structural design action effect E_d . Selection of the geotechnical strength reduction factor (ϕ_g) is based on a series of individual risk ratings (IRR) which are weighted and lead to an average risk rating (ARR). The individual risk ratings and final value of ϕ_g depend on the following factors:

- Site: the type, quantity and quality of testing;
- Design: design methods and parameter selection;
- Installation: construction control and monitoring;
- Pile testing regime: testing benefit factor based on percentage of piles tested and the type of testing; and
- Redundancy: whether other piles can take up load if a given pile settles or fails.

It is anticipated that the pile configuration for the proposed development would be a low redundancy situation, and hence the appropriate basic geotechnical strength reduction factor is likely to be 0.52 provided appropriate load testing is undertaken with reference to AS 2159 (2009) and as discussed in Section 6.7.1. The redundancy category should be confirmed by the pile designer.

6.7.3 Deep footings (piles)

Piles should be founded in the Unit 2.1 (residual soil), Unit 2.2 (XWM) or Unit 3 (bedrock) and should be proportioned based on the parameters provided in Table 9. As the depth to rock and depth of weathering is expected to vary across the site, the actual conditions should be confirmed by additional geotechnical investigation at each proposed structure location and/or geotechnical inspections during piling works.

The design of bored piles or CFA piles may be based either on limit state design methods or a 'working stress' approach. The vertical Young's modulus (E_v) values and the ultimate limiting (end bearing and shaft adhesion) pressures given in Table 9 may be used to assess the limiting states for pile design purposes in accordance with AS 2159 (2009).

Alternatively, the piles may be proportioned on the basis of 'allowable or serviceability' parameters given in Table 9. The settlement of piles subject to vertical loads will vary depending on the ('serviceability' or 'working') loads applied and the foundation conditions below the pile toe.

Table 9: Geotechnical pile design parameters for bored and CFA piles

Rock Unit	Vertical Young's Modulus, $E_v^{(6)}$ (MPa)	Ultimate Strength		Serviceability / Maximum Allowable End Bearing Pressure ^{(3),(5)} (kPa)
		End Bearing ^{(3),(4)} (kPa)	Shaft Adhesion ^{(1),(2)} (kPa)	
Unit 2.1 Residual stiff to very stiff clay	10	650	25	250
Unit 2.2 XWM hard or dense to very dense silty clay, sandy clay, gravelly clay or clayey gravel	40	1,350	50	700
Unit 3 medium to high strength siltstone, sandstone or conglomerate	500	30,000	350	3,500

Notes to Table 9:

All pile end bearing parameters are based on pile penetration of at least four pile diameters below the ground surface;

- (1) Shaft adhesion parameters are only applicable where adequate socket roughness (roughness category "R2" or greater) is achieved. Roughness categories are defined in (Pells, Mostyn, & Walker, 1998);
- (2) For calculation of tension or uplift capacity the shaft adhesion should be taken as 70% of the above shaft adhesion parameters;
- (3) Bearing pressure values assume a minimum embedment of one pile diameter into the relevant bearing stratum, with an overall length of at least four pile diameters;
- (4) Ultimate end bearing parameters mobilised at large settlements (i.e. > 5% of pile diameter);
- (5) Allowable end bearing parameters could experience settlements of less than 1% of the pile diameter; and
- (6) A range of values has been given for vertical Young's Modulus (E_v) based on typical published correlations.

For calculation of serviceability geotechnical strength, the capacity can be calculated by using the serviceability end bearing values and ultimate shaft adhesion values. In the serviceability case, these values do not need to be factored. It is recommended that deflection under load is checked and compared to serviceability deflection limits.

The design of piles required to resist uplift for tension loads should be checked against the 'cone-pullout' failure mode as well as the shaft (i.e. 'piston pull-out') capacity of the pile. It is suggested that an inverted 60° cone from the base of the pile be used for calculation of uplift capacity.

Bored piles should have bases and sockets cleaned and free of debris and deleterious material at the time of concrete placement which may require specific specialist piling equipment such as cleaning buckets and grooving tools.

It is also recommended that geotechnical inspections and monitoring be undertaken during the installation of piles.

6.7.1 Pile testing

In accordance with Table 8.2.4(B) of AS 2159 (2009), if a geotechnical strength reduction (ϕ_g) factor of greater than 0.4 is adopted, testing shall be performed to verify the integrity of the pile. Higher values of ϕ_g can be justified by more comprehensive static or dynamic load testing.

Pile load testing could be carried out by the piling contractor on a select number of piles during construction, to confirm assumptions upon which the pile design has been based. The required number of pile load tests is dependent on the assessed ARR and Table 8.2.4(B) of AS 2159 (2009). AS 2159 (2009) also requires that 5% to 15% of piles should be subject to integrity testing if the adopted ϕ_g exceeds 0.4. Higher values of ϕ_g can be justified by more comprehensive static or dynamic load testing.

Dynamic pile testing could be performed on the bored / CFA piles and analysed using software such as CAPWAP or similar.

The use of dynamic pile testing in conjunction with inspection of drill cuttings is considered important as our previous experience indicates that the inspection of drill cuttings may be problematic when the boring equipment grinds and remoulds the foundation rock into a material that does not resemble the parent rock. This generally means it is difficult to accurately assess the rock strength during construction. The pile testing will ensure that adequate pile capacities are being achieved.

Alternatively core drilling and geotechnical logging of each bore at each pier group prior to construction to confirm rock strengths and depths could be adopted to assess and confirm design parameters and founding conditions.

6.8 Soil and water aggressivity

The results of laboratory testing of soil samples collected during field work have been compared to the exposure classifications for concrete and steel as outlined in AS 2159 (2009).

The laboratory results indicate a mild exposure classification for buried concrete in soil and a non-aggressive exposure classification for buried steel in soil.

It is suggested that additional protection against decay or corrosion should be considered, possibly by designing for a more severe classification as the aggressiveness may change over time. Reference should be made to AS 2159 (2009) for further details on requirements for different exposure classifications and concrete reinforcement cover.

6.9 Seismic site sub-soil class

Using the procedures described in AS 1170.4 (2007) an earthquake hazard factor of 0.06 is estimated for the site. AS 1170.4 (2007) indicates a site sub-soil Class C_e (shallow soil site) for earthquake design based on the subsurface profiles encountered in the investigation.

6.10 Design CBR

The results of laboratory testing on natural subgrade materials indicated a 4 day soaked CBR value of 7% on sandy silt materials. The results of laboratory testing on existing fill materials indicated a 4 day soaked CBR values in the range of 5% to 10% on clay, silty clay or sandy clay materials.

Based on the results of the in-situ testing and soaked CBR test results, together with Douglas' experience with clay soils and the propensity for clay soils to soften with increases in moisture, a design CBR of 5% has been adopted for this investigation.

It should be noted that depending on prevailing weather conditions during construction a select subgrade layer could be required beneath the pavement to allow suitable compaction of the overlying pavement layers. The thickness will need to be assessed during construction but based on previous experience a 300 mm to 500 mm thick layer should be suitable.

It should also be noted that existing uncontrolled fill will likely be encountered at proposed foundation level, which may not be suitable for support or long term performance of the proposed pavements. Further investigation of subgrade conditions across the site should be undertaken to confirm suitability of existing uncontrolled fill to support the proposed pavement.

7. Recommended additional geotechnical investigation

Given the presence of existing uncontrolled fill to variable depth across the site and the risk of total and differential settlement within the uncontrolled fill materials, it is recommended that additional investigations be undertaken to confirm assumptions and geotechnical parameters provided above.

The following additional investigations should be undertaken:

- Specific investigations for each structure to confirm founding conditions and confirm likely settlement predictions;
- Additional investigations within proposed pavement areas to assess suitability of existing fill material to support the proposed pavements; and
- Further assessment of existing fill material to assess suitable options for the existing fill material to remain onsite either through improvement options or removal and replacement (refer Section 6.7.1).

8. References

AS 1170.4. (2007). *Structural Design Actions, Part 4: Earthquake Actions in Australia*. Reconfirmed 2018. Incorporating Amendments 1 & 2: Standards Australia.

AS 2159. (2009). *Piling - Design and Installation*. Standards Australia.

AS 2870. (2011). *Residential Slabs and Footings*. Standards Australia.

AS 3798. (2007). *Guidelines on Earthworks for Commercial and Residential Developments*. Standards Australia.

CCAA. (2008). *TN61, Articulated Walling*. Technical Note 61, 3rd Edition: Cement Concrete & Aggregates Australia.

CSIRO. (2021). *Building Technology Resource: Foundation Maintenance and Footing Performance*. CSIRO Publishing.

Pells, P. J., Mostyn, G., & Walker, B. F. (1998). Foundations on Sandstone and Shale in the Sydney Region. *Australian Geomechanics, No 33 Part 3*, 17-29.

9. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at Jack Smyth Drive, Hillvue NSW with reference to Douglas' proposal 226965.00.P.001.Rev0 dated 15 January 2024 and acceptance received from Callum Fletcher dated 19 January 2024. The work was carried out under Local Government Procurement Master Agreement. This report is provided for the exclusive use of Tamworth Regional Council for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

About this Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Rock Descriptions

Sampling, Testing and Excavation Methodology

Introduction

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

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

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at

the time of construction as are indicated in the report; and

- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

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

Reports

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

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

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

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

continued next page

About this Report

Site Anomalies

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

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style **XW**. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

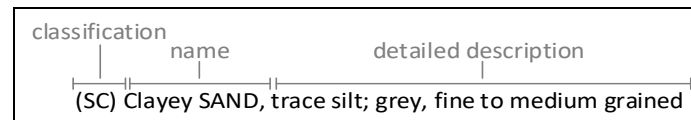
Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Introduction

All materials which are not considered to be “in-situ rock” are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:



The “classification” comprises a two character “group symbol” providing a general summary of dominant soil characteristics. The “name” summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either “fine grained” (also known as “cohesive” behaviour) or “coarse grained” (“non cohesive” behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as “oversize”	
Cobble	63 - 200		
Gravel ¹	2.36 - 63	Coarse	>65%
Sand ¹	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

¹ – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer “component proportions” below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a “Sandy CLAY”, this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a “primary”, “secondary”, or “minor” component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition ¹	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor ²	Present in the soil, but not significant to its engineering properties	All other components	All other components

¹ As defined in AS1726-2017 6.1.4.4

² In the detailed material description, minor components are split into two further sub-categories. Refer “identification of minor components” below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, “INTERBEDDED Silty CLAY AND SAND”.

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component ¹	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

¹ – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type	Particle size (mm)	
	Coarse	Fine
Gravel	19 - 63	6.7 - 19
	6.7 - 19	2.36 - 6.7
	2.36 - 6.7	0.6 - 2.36
Sand	0.6 - 2.36	0.21 - 0.6
	0.21 - 0.6	0.075 - 0.21
	0.075 - 0.21	

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code **NDF**, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example **(VS)**.

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as “extremely weathered material” in reports and by the abbreviation code **XWM** on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than ‘very low’ as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be “oversize” may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with “MIXTURE OF”.

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Rock Strength

Rock strength is defined by the unconfined compressive strength, and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $I_{s(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

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

¹ Rock strength classification is based on UCS. The UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site. The point load Index ranges shown above are as suggested in AS1726 and should not be relied upon without supporting evidence.

The following abbreviation codes are used for soil layers or seams of material “within rock” but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the “Description of Strata” and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil ¹	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.	RS
Extremely weathered ¹	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	XW
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 recognisable. 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.	HW
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 recognisable but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

¹ The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching or may be decreased due to precipitation of secondary minerals in pores.	DA

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

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

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

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

Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

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

Rock Descriptions

Terminology
Symbols
Abbreviations

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Cleavage	CL
Crushed seam	CS
Crushed zone	CZ
Drilling break	DB
Decomposed seam	DS
Drill lift	DL
Extremely Weathered seam	EW
Fault	F
Fracture	FC
Fragmented	FG
Handling break	HB
Infilled seam	IS
Joint	JT
Lamination	LAM
Shear seam	SS
Shear zone	SZ
Vein	VN
Mechanical break	MB
Parting	P
Sheared Surface	S

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CN
Coating	CT
Healed	HE
Infilled	INF
Stained	SN
Tight	TI
Veneer	VNR

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN
Pyrite	Py
Secondary material	MS
Silt	M
Quartz	Qz
Unidentified material	MU

Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RF
Smooth	SM
Slickensided	SL
Very rough	VR

Defect Orientation

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

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Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:

SAMPLE			DEPTH (m)	TESTING	
SAMPLE REMARKS	TYPE	INTERVAL		TEST TYPE	RESULTS AND REMARKS
	SPT		1.0 1.45	SPT	4,9,11 N=20

Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U ¹
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

¹ – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y = x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(L)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD ¹
Air Track	AT
Diatube	DT ¹
Hand auger	HA ¹
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA ¹
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT ¹
Ripping tyne/ripper	R
Rock roller	RR ¹
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON ¹
Mud/blade bucket	MB ¹
Toothed bucket	TB ¹
Vibrocure	VC ¹
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB ¹

¹ – numeric suffixes indicate tool diameter/width in mm

Appendix B

Borehole Logs (Bore 1 to 7)

Core Photoplates

Test Pit Logs (Pits 8 to 11 and C1 to C7)

Test Pit Photos

BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.3 AHD
COORDINATE: E:301347.7, N:6553955.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 1
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE		TESTING																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK							SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
					ORIGIN (#)	CONSIS. (1)	DENSITY (1)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)							DEFECTS & REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
22/05/24 No free groundwater observed	409	0.25	FILL / Silty CLAY: brown; low to medium plasticity; abundant organic matter.		FILL	NA	w<PL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

Tamworth Regional Aquatic Centre

Bore 1



3.10 m to 4.70 m



Project:	Proposed Tamworth Regional Aquatic Centre	Project:	226965.00
		Bore:	1
Location:	Jack Smyth Drive, Hillvue	Rev:	0
Client:	Tamworth Regional Council	Date:	1-Jul-24

BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.1 AHD
COORDINATE: E:301288.1, N:6553998.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 2
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS	
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL
22/05/24 No free groundwater observed	0.20	FILL / Sandy CLAY, trace gravel: brown; low to medium plasticity; fine to medium sand; fine gravel; abundant organic matter.		FILL	NA	w<PL			D	0.10
	0.50	FILL / Silty CLAY, with sand, trace gravel: brown; low to medium plasticity; fine to medium sand; fine to medium gravel; black pvc pipe.		FILL	NA	w<PL			D	0.50
	1.00	FILL / Silty CLAY, with sand, with gravel: brown; low to medium plasticity; fine to medium sand; fine to medium gravel.		FILL	NA	w<PL			D	1.00
	1.45			FILL	NA	w<PL			SPT	7,9,6 N=15
	1.50			FILL	NA	w<PL			D	1.50
	2.00			FILL	NA	w<PL			D	2.00
	2.50			FILL	NA	w<PL			D	2.50
	2.75	Silty CLAY, trace gravel: grey and yellow; medium to high plasticity; fine to medium gravel.		RS	F to St	w=PL			SPT	4,2,3 N=5 90-140kPa
	2.95			RS	F to St	w=PL			D	2.95
	3.00			RS	F to St	w=PL			U50	3.00
	3.40			RS	F to St	w=PL			D	3.40
	3.70	Silty CLAY, trace gravel: pale brown; low to medium plasticity; fine gravel.		XWM	H	w<PL			D	3.70
	4.00			XWM	H	w<PL		No sample recovered	SPT	14/10

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2
METHOD: Solid Flight Auger to 5.4m
REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.1 AHD
COORDINATE: E:301288.1, N:6553998.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 2
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 2 of 2

CONDITIONS ENCOUNTERED														SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
	404		[CONT] Silty CLAY, trace gravel; pale brown; low to medium plasticity; fine gravel.	X X X X X X	XWM	H		w<PL										
			Borehole discontinued at 5.40m depth. TC bit refusal.															
	403	6																
	402	7																
	401	8																
	400	9																

NOTES: ^(#)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 5.4m

CASING: Uncased

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.8 AHD
COORDINATE: E:301202.6, N:6553987.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 3
PROJECT No: 226965.00
DATE: 21/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED						SAMPLE		TESTING AND REMARKS	
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%)	DENSITY (g/cm³)	MOISTURE	REMARKS	TEST TYPE
21/05/24 No free groundwater observed	0.15	FILL / Sandy GRAVEL: brown; fine to medium; fine sand.		FILL	NA		D		
		FILL / Sandy CLAY, with gravel: brown; low to medium plasticity; fine to medium sand; fine to coarse gravel.							
	0.50						D		
	1.00						D		
	1.45			FILL	NA	w=PL	SPT		SPT 5,5,6 N=11
	2.00								
	2.25	Silty CLAY, trace gravel: brown; medium to high plasticity; fine gravel.					U50		
	2.40								PP ->400kPa
	2.50						SPT		SPT 5,7,8 N=15
	2.95			RS	St to VSt	w=PL			
4.00		Sandy CLAY, trace gravel: pale yellow; medium to high plasticity; fine to medium sand; fine to medium gravel.		XWM	H	w<PL	SPT		PP 380->400kPa
									SPT 10,20,25/140
Borehole discontinued at 4.50m depth. TC bit refusal.									

NOTES: #Soil origin is "probable" unless otherwise stated. %Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 4.5m

CASING: Uncased

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.9 AHD
COORDINATE: E:301252.5, N:6553973.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 4
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED							SAMPLE			TESTING AND REMARKS																
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%)	DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS													
RL (m)																										
22/06/24 No free groundwater observed	0.10	FILL / Sandy CLAY, with gravel: pale brown; low to medium plasticity; fine to medium sand; fine gravel; with organic matter. FILL / Silty CLAY, trace gravel: brown; low to medium plasticity.		FILL	NA	w<PL			D		0.10	SPT	9,21,22 N=43													
	4b9																D		0.50							
	1																D		1.00							
																	SPT		1.45							
																	D		1.50							
	2																D		2.00							
																	D		2.50							
																	SPT		2.95							
	2.50								FILL / Sandy CLAY, with gravel, trace silt: brown; low to medium plasticity; fine to medium sand; fine to medium gravel.		FILL			NA	w<PL			D		2.50	PP	100-140kPa				
	4b7																							SPT		5,5,5 N=10
																								D		2.95
	3.00								CLAY, trace silt: dark brown; low to medium plasticity.		RS			St to VSt	w<PL			U50		3.40						
	4b5	Gravelly CLAY, with sand: grey and grey brown; medium plasticity; fine to coarse, sub-angular to angular gravel; fine to medium sand.		XWM	H	w<PL			SPT		4.00	SPT	25/70													
4b5															4.07											

NOTES: #Soil origin is "probable" unless otherwise stated. %Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 5.2m

CASING: Uncased

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.9 AHD
COORDINATE: E:301252.5, N:6553973.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 4
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 2 of 2

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS			
			[CONT] Gravelly CLAY, with sand: grey and grey brown; medium plasticity; fine to coarse, sub-angular to angular gravel; fine to medium		XWM	H		w<PL									
			Borehole discontinued at 5.20m depth. TC bit refusal.														
		4.04															
		6															
		4.03															
		7															
		4.02															
		8															
		4.01															
		9															
		4.00															

NOTES: ^(#)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 5.2m

CASING: Uncased

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.4 AHD
COORDINATE: E:301341.4, N:6553909.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 5
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED														SAMPLE		TESTING				
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK							SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
					ORIGIN (#)	CONSISTENCY DENSITY (%)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS						
23/06/24 No free groundwater observed	409	0.10	FILL / Silty CLAY, trace gravel: pale brown; low to medium plasticity; fine gravel.		FILL	NA	w<PL													
		0.50																		
		1.00	FILL / Silty Gravelly CLAY: brown; low to medium plasticity; fine to medium gravel.																	
		1.45																		
		1.50																		
		2.00																		
		2.40	FILL / Gravelly CLAY, trace silt: pale yellow; low plasticity; fine to medium gravel.																	
		2.50																		
		2.87	Clayey GRAVEL, with sand: brown; fine to coarse, sub-angular to angular; fine to medium sand.																	
		3.05																		
	406	3.05	SILTSTONE: brown and yellow brown, fine grained, laminated		FILL	NA	w<PL													
		3.30																		
		3.44																		
		3.48																		
		3.51																		
		3.54																		
		3.56																		
		3.61																		
		4.44																		
		4.55																		
	405	4.55	4.55m-4.69m: Grey clay seam		XWM	D to VD	D													
		4.69	4.69m: Brown																	

NOTES: "H" Soil origin is "probable" unless otherwise stated. "C" Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 2.87m, NMLC to 5.20m

CASING: HW to 3m

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.4 AHD
COORDINATE: E:301341.4, N:6553909.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 5
PROJECT No: 226965.00
DATE: 22/05/24
SHEET: 2 of 2

CONDITIONS ENCOUNTERED														SAMPLE				TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK							SAMPLE REMARKS	TYPE	INTERVAL			DEPTH (m)
					ORIGIN (#)	CONSIS. ⁽¹⁾	DENSITY. ⁽²⁾	MOISTURE	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)				DEFECTS & REMARKS		
			[CONT] SILTSTONE: brown and yellow brown, fine grained laminated. Borehole discontinued at 5.20m depth. Limit of investigation.					MW		H	100	43		5.00-5.15m: JT x2/80°, PR, Fe, RF				PLT	PL(I)=2.16MPa	
		6																		
		7																		
		8																		
		9																		

NOTES: ⁽¹⁾Soil origin is "probable" unless otherwise stated. ⁽²⁾Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: ⁽¹⁾ Soil origin is "probable" unless otherwise stated. ⁽²⁾ Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 2.87m, NMLC to 5.20m

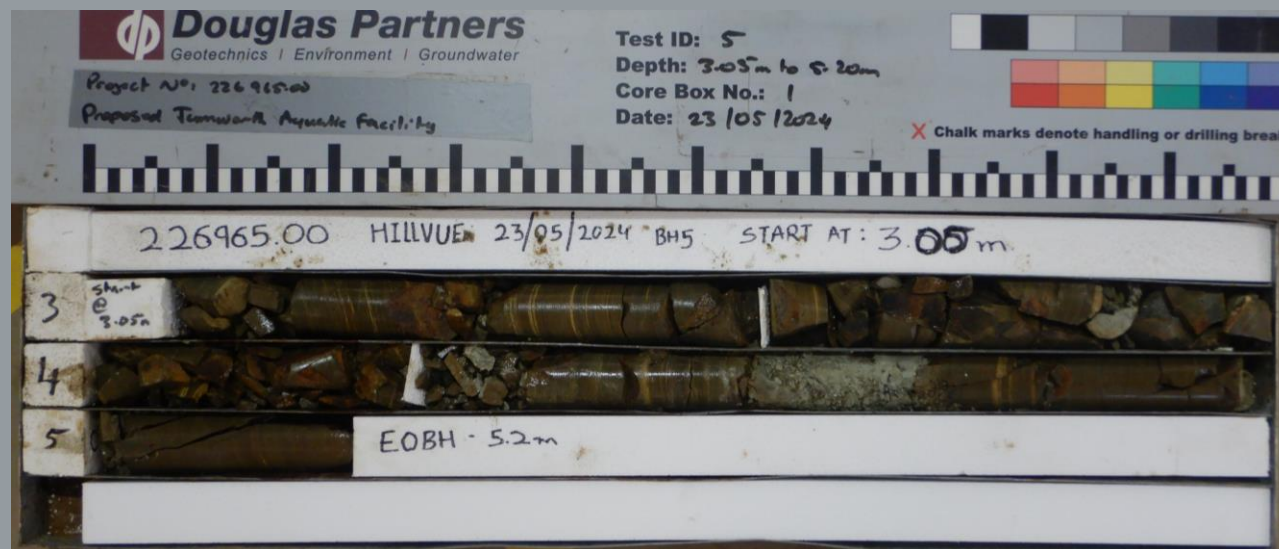
CASING: HW to 3m

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

Tamworth Regional Aquatic Centre

Bore 5



3.00 m to 5.20 m



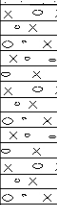
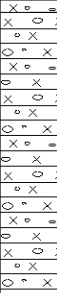
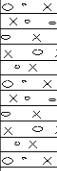
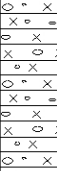
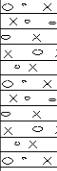
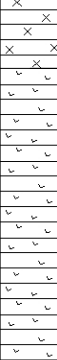
Project:	Proposed Tamworth Regional Aquatic Centre	Project:	226965.00
		Bore:	5
Location:	Jack Smyth Drive, Hillvue	Rev:	0
Client:	Tamworth Regional Council	Date:	1-Jul-24

BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.2 AHD
COORDINATE: E:301308.0, N:6553972.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 6
PROJECT No: 226965.00
DATE: 23/05/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
22/06/24 No free groundwater observed	0.30	FILL / Sandy CLAY, with gravel: brown; medium to high plasticity; fine to medium sand; fine to medium gravel; abundant organics.		FILL	NA	w<PL		D		0.10		4,7,7 N=14		
		FILL / Silty Gravelly CLAY, trace sand: brown; medium to high plasticity; fine to coarse gravel.		FILL	NA	w=PL		D		0.50				
	1.00	FILL / Silty Gravelly CLAY, trace sand: pale brown; low to medium plasticity; fine to coarse gravel.		FILL	NA	w<PL		D		1.00			SPT	
				FILL	NA	w<PL		SPT		1.45				
					FILL	NA		w<PL	D		1.50			
					FILL	NA		w<PL	D		2.00			
	2.20	FILL / Sandy CLAY, trace silt, trace gravel: grey and brown; low to medium plasticity; fine to medium sand; fine to medium gravel.		FILL	NA	w<PL		D		2.20				
	2.50	Silty CLAY, trace sand, trace gravel: grey and brown; low to medium plasticity; fine sand; fine gravel.		RS	F to St	w>PL		D		2.50	SPT			
								SPT		2.95				
	3.00	CLAY, with gravel: brown; medium to high plasticity; fine to medium gravel.		RS	St to VSt	w>PL		D		3.00				
										U50		3.35		
												3.75		
	4.00	Gravelly CLAY: grey, brown and yellow brown; medium plasticity; fine to medium, sub-angular to angular gravel.		XWM	H	w=PL		D		4.00				
								SPT		4.50	SPT	20,25/100		
										4.85				

NOTES: ^(*)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2
METHOD: Solid Flight Auger to 5.62m
REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar
CASING: HW to 3.1m

Refer to explanatory notes for symbol and abbreviation definitions

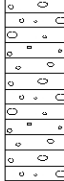


BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.2 AHD
COORDINATE: E:301308.0, N:6553972.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 6
PROJECT No: 226965.00
DATE: 23/05/24
SHEET: 2 of 2

CONDITIONS ENCOUNTERED														SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
																		
	404		[CONT] Gravelly CLAY: grey, brown and yellow brown; medium plasticity; fine to medium, sub-angular to angular gravel.		XWM	H		w=PL										
			Borehole discontinued at 5.62m depth. Limit of investigation.							D SPT		5.50 5.62	SPT	25/120				
	403	6																
	402	7																
	401	8																
	400	9																

NOTES: ^(*)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: #Soil origin is "probable" unless otherwise stated. %Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar

METHOD: Solid Flight Auger to 5.62m

CASING: HW to 3.1m

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 410.0 AHD
COORDINATE: E:301234.5, N:6553961.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 7
PROJECT No: 226965.00
DATE: 21/05/24
SHEET: 1 of 1

		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS							
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS			
21/06/24 No free groundwater observed	406	0.10	FILL / Sandy Gravelly CLAY: brown; low to medium plasticity; fine to coarse sand; fine to coarse gravel; abundant organics.		FILL	NA		w<PL		D		0.10		7,8,12 N=20			
										D		0.50					
		0.85	FILL / Silty Gravelly CLAY: brown; low to medium plasticity; fine to coarse gravel.		FILL	NA		w=PL		D		1.00	SPT		1.45	SPT	7,8,12 N=20
		1						SPT			1.50						
		1.50	FILL / Silty CLAY, with sand, trace gravel: pale brown; low to medium plasticity; fine to medium sand; fine gravel.		FILL	NA		w<PL		D		2.00			2.50	SPT	6,5,5 N=10 250-360kPa
		2.00						D			2.50						
		2.75	Silty CLAY: dark brown; medium to high plasticity.		RS	St to VSt		w>PL		SPT		2.95	PP		3.10	PP	180kPa
		3						SPT			3.10						
		3.10	CLAY, trace gravel: dark brown; medium to high plasticity; fine gravel.		RS	St to VSt		w>PL		U50		3.50			4.00	SPT	7,10,25/60
		4.00						D			4.00						
			Sandy CLAY, with gravel: pale yellow; low to medium plasticity; fine to medium sand; fine to coarse gravel.		XWM	H		w<PL	SPT		4.39						
								D		4.80							
Borehole discontinued at 4.80m depth. TC bit refusal.																	

NOTES: ^(*)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Scout 2
METHOD: Solid Flight Auger to 4.8m
REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

OPERATOR: Ground Test (Ellis)

LOGGED: Parmar
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.4 AHD
COORDINATE: E:301245.3, N:6554006.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 8
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS					
07/05/24 No free groundwater observed	4.03	0.60	FILL / Clayey SILT, with sand: brown; low plasticity; fine to medium sand; abundant organics.		FILL	NA		w<PL		D		0.50	PID	 <1ppm					
	4.06	1	FILL / Gravelly CLAY, with cobbles, trace sand: brown and grey brown; medium to high plasticity; fine to coarse, angular to sub-angular gravel; angular to sub-angular, fine to medium cobbles; fine to coarse sand; with asphalt and pvc pipe.		FILL							1							
	4.07	2			FILL	2													
	4.06	2.80	Silty CLAY: dark brown; medium to high plasticity.		RS	3	PP	300-350kPa											
	4.05	3.60	CLAY: yellow brown and grey brown; medium to high plasticity.		RS	4	PP	300-400kPa											
	4.05	4.40	Sandy GRAVEL, with cobbles: yellow brown; fine to coarse, angular to sub-angular; fine to coarse sand; fine to coarse cobbles.		XWM	D to VD	D												
Test Pit discontinued at 4.70m depth. Refusal.																			



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.6 AHD
COORDINATE: E:301315.2, N:6553938.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 9
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS						
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	
07/05/24 No free groundwater observed	405	0.35	FILL / Sandy CLAY, with gravel: brown; low to medium plasticity; fine to coarse sand; fine to coarse, angular to sub-angular gravel; abundant organics trace plastic bottle.		FILL					D		0.10	PID	<1ppm	
	403	1	FILL / Gravelly CLAY, with sand: brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel; fine to coarse sand; with concrete, metal, reo bar.		FILL	NA		w<PL		D		1.00	PID	<1ppm	
	408	2													
	407	2.20	Silty CLAY: grey brown; low to medium plasticity.		RS	VSt to H				D		2.50	PID PP	<1ppm >400kPa	
	406	3.00	Sandy GRAVEL: grey and orange brown.		XWM	D to VD		D				3			
	405	4	Test Pit discontinued at 3.90m depth. Refusal.												



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: Bucket refusal at 3.4m, single tyne ripper to 3.9m

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 410.2 AHD
COORDINATE: E:301272.9, N:6553925.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 10
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS							
07/05/24 No free groundwater observed	410	0.25	FILL / Silty CLAY: brown; low to medium plasticity; abundant organics.		FILL	NA		w=PL		D		0.10	PID								
			FILL / Sandy CLAY, trace gravel: pale brown; medium to high plasticity; fine to medium sand; fine to medium, sub-angular to sub-rounded gravel; with reinforced concrete and house bricks.		FILL						0.50	PID									
	0.70	1	FILL / Silty CLAY, with sand, trace gravel: grey white and pale brown; medium to high plasticity; fine to medium sand; fine to medium, sub-angular to sub-rounded gravel.		FILL						1										
		1.50	FILL / Sandy CLAY, with gravel: brown; medium to high plasticity; fine to medium sand; fine to coarse, sub-angular to sub-rounded gravel; with asphalt.		FILL						1.50										
	2	2.30	CLAY, trace silt: brown; medium to high plasticity.		RS	St to VSt	w=PL														
	3.00		Sandy GRAVEL, with cobbles: grey; fine to coarse, sub-angular to angular; fine to coarse sand; angular to sub-angular, fine to medium cobbles.		XWM	D to VD	D														
	4																				
	406																				
	Test Pit discontinued at 4.10m depth. Refusal.																				



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330
OPERATOR: TPE Civil (Peter)
LOGGED: Cowan
METHOD: 1.4m wide toothed bucket, from 3.3m with single tyne ripper. Approx 10min to excavate 400mm
REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.8 AHD
COORDINATE: E:301275.0, N:6553965.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 11
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
		0.30	FILL / Clayey SILT, trace sand, trace gravel: brown; low to medium plasticity; fine to coarse sand; fine to medium, angular to sub-angular gravel; abundant organics.		FILL			w=PL										
		1	FILL / Clayey SILT, with sand: grey brown; low plasticity; fine sand.		FILL					D		0.80	PID					
		1.20	FILL / Silty CLAY, with sand, with gravel: brown; medium plasticity; fine to coarse sand; fine to coarse, angular to sub-angular gravel; with asphalt with concrete, traffic barrier board.		FILL	NA												
		2			FILL			w<PL		D		2.00	PID	<1ppm				
		2.70	CLAY, trace sand: grey brown; medium to high plasticity; fine to medium sand.		RS	H							PP	>400kPa				
		4.20	Sandy GRAVEL: grey and grey brown; fine to coarse, angular to sub-angular.		XWM	D to VD		D										
			Test Pit discontinued at 4.60m depth. Refusal.															



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

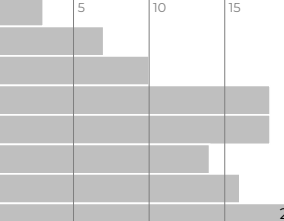
Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 410.0 AHD
COORDINATE: E:301247.6, N:6553906.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C1
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	
07/05/24 No free groundwater observed	0.40	FILL / Silty CLAY, with gravel: brown; low to medium plasticity; fine to coarse gravel; with organics.		FILL	NA	w<PL				1	DCP9/150		
	0.70	FILL / Silty CLAY, with gravel, trace sand: orange brown; low to medium plasticity; fine to medium, angular to sub-angular gravel; fine to medium sand.		FILL									
	1.10	FILL / Sandy SILT: brown; low plasticity; fine to medium sand; with organics.		FILL									
	1.50	FILL / Clayey SILT: grey brown; low plasticity.		FILL									
	2.00	CLAY, with silt, trace sand: brown; medium to high plasticity; fine sand.		RS	VSt to H				2	PP	>400kPa		
	3.00	Test Pit discontinued at 2.30m depth. Limit of investigation.											
	4.00												



NOTES: ^(#) Soil origin is "probable" unless otherwise stated. ^(*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ± 0.1 m

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.6 AHD
COORDINATE: E:301317.7, N:6553886.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C2
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
07/05/24 No free groundwater observed	409	0.30	FILL / Clayey SILT: brown; low to medium plasticity; abundant organics.		FILL	NA		w<PL					PID					
			FILL / Gravelly CLAY, with sand: brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel; fine to medium sand.		FILL													
		1																
		1.20	Sandy CLAY: grey brown; low to medium plasticity; fine to medium sand.		RS	VSt to H												
	408	1.90	Sandy CLAY, trace gravel: yellow brown; low plasticity; fine to medium sand; fine to medium, angular to sub-angular gravel.		XWM							2						
	407	2	Test Pit discontinued at 2.10m depth. Limit of investigation.															
	406	3																
	405	4																



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.7 AHD
COORDINATE: E:301312.7, N:6553862.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C3
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS							
07/05/24 No free groundwater observed	409	0.15	FILL / Sandy SILT: brown; low plasticity; fine to medium sand; abundant organics.		FILL	NA		w<PL					DCP9/150		5	10	15	22			
		FILL / Gravelly CLAY, trace sand: brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel; fine to coarse sand.		FILL																	
		0.75	Sandy SILT, trace clay: grey white; low plasticity; fine to medium sand.		RS	VSt to H															
		1	Silty CLAY, trace sand: brown; low plasticity; fine to medium sand.		RS																
		1.20	Test Pit discontinued at 1.65m depth. Refusal.																		
408	2																				
	407	3																			
		4																			
		406																			
	405																				

NOTES: ^(*)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

NOTES: #Soil origin is "probable" unless otherwise stated. IConsistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 410.2 AHD
COORDINATE: E:301255.4, N:6553855.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C4
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE				TESTING AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
07/05/24 No free groundwater observed	410	0.20	FILL / Silty CLAY, with gravel: brown; low to medium plasticity; fine to medium, angular to sub-angular gravel; abundant organics.		FILL	NA		w>PL					PID	DCP9/15C	5	10	15	24																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330
METHOD: 1.4m wide bucket with teeth
REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

OPERATOR: TPE Civil (Peter)
LOGGED: Cowan

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 410.3 AHD
COORDINATE: E:301222.8, N:6553883.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C5
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS		
RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/05/24 No free groundwater observed	0.30	FILL / Silty CLAY: brown; low plasticity; abundant organics.		FILL	NA	w<PL		D		0.20	PID	 <1ppm
		FILL / Silty CLAY, with gravel, trace sand: brown; low to medium plasticity; fine to coarse, sub-angular to sub-rounded gravel.		FILL				B		0.50	PP	>400kPa
	1			FILL						1.00		
	1.30	CLAY: brown; medium to high plasticity.		RS				VSt to H				
	2	Test Pit discontinued at 1.65m depth. Limit of investigation.										



NOTES: #Soil origin is "probable" unless otherwise stated. ¶Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ± 0.1 m

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.2 AHD
COORDINATE: E:301329.5, N:6554002.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C6
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS													
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS												
07/05/24 No free groundwater observed	4d5	0.25	FILL / Silty CLAY, trace gravel: brown; low plasticity; fine to coarse, angular to sub-angular gravel; abundant organics.		FILL	NA		w<PL				0.50	B	DCP9/150												
		1	FILL / Sandy CLAY, with gravel: brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel; with concrete and asphalt.		FILL																					
		1.10	FILL / Silty CLAY, with gravel: red brown; medium to high plasticity; fine to coarse, angular to sub-angular gravel.		FILL																					
		1.50	FILL / Silty CLAY, with gravel: grey; low to medium plasticity; fine to coarse, angular to sub-angular gravel.		FILL																					
		2																								
		2.00																								
		2.30																								
		2.30																								
		2.30																								
		2.30																								
Test Pit discontinued at 2.30m depth. Limit of investigation.																										

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.3 AHD
COORDINATE: E:301289.6, N:6554011.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C7
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS							
07/05/24 No free groundwater observed	409	0.35	FILL / Sandy CLAY, with gravel: brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel; abundant organics.		FILL	NA		w<PL				0.50	DCP9/150								
			FILL / Silty CLAY, with gravel: brown; medium to high plasticity; fine to coarse, angular to sub-angular gravel.		FILL									B	1.00						
		1	FILL / Silty CLAY, with gravel: grey brown; medium to high plasticity; fine to coarse, angular to sub-angular gravel; pvc pipe, timber, poly pipe, concrete.		FILL																
		1.10																			
		2.00	FILL / Gravelly CLAY, trace cobbles: brown; medium to high plasticity; fine to coarse, angular to sub-angular gravel; angular to sub-angular, fine to medium cobbles.		FILL										2						
	408		Test Pit discontinued at 2.40m depth. Limit of investigation.																		
	407																				
	406	3																			
	405	4																			

NOTES: ^(*) Soil origin is "probable" unless otherwise stated. ^(*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Tamworth Regional Council
PROJECT: Proposed Tamworth Regional Aquatic Centre
LOCATION: Jack Smyth Drive, Hillvue

SURFACE LEVEL: 409.1 AHD
COORDINATE: E:301262.0, N:6554020.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: C8
PROJECT No: 226965.00
DATE: 07/05/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														TESTING AND REMARKS																			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	SAMPLE			DEPTH (m)	TEST TYPE	RESULTS AND REMARKS																			
									REMARKS	TYPE	INTERVAL																						
07/05/24 No free groundwater observed	407	0.25	FILL / Silty CLAY: brown; low to medium plasticity; abundant organics.		FILL	NA		w<PL				1	DCP9/150		5	10	15	25															
		FILL / Silty CLAY, with gravel: yellow brown and brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel; with concrete.		FILL																													
		FILL / Silty CLAY: brown; medium to high plasticity.		FILL																													
		FILL / Silty CLAY, with gravel: grey brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel.		FILL																													
		FILL / Silty CLAY, with gravel: red brown; low to medium plasticity; fine to coarse, angular to sub-angular gravel.		FILL																													
		Test Pit discontinued at 2.10m depth. Limit of investigation.																															
		3																															
		4																															

NOTES: ^(*)Soil origin is "probable" unless otherwise stated. ^(*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.



NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco SK330

OPERATOR: TPE Civil (Peter)

LOGGED: Cowan

METHOD: 1.4m wide bucket with teeth

REMARKS: Coordinates and surface level recorded using dGPS in "fix" mode which has typical accuracy of ±0.1 m

Refer to explanatory notes for symbol and abbreviation definitions

Appendix C

Geotechnical Laboratory Test Results

Chemical Laboratory Test Results

Material Test Report

Report Number: 226965.00-2
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: Amended Sample Descriptions
Date Issued: 25/06/2024
Client: Tamworth Regional Council
PO Box 555, Tamworth NSW
Contact: Callum Fletcher
Project Number: 226965.00
Project Name: Proposed Tamworth Regional Aquatic Centre
Project Location: Jack Smyth Drive, Hillvue NSW
Work Request: 16238
Sample Number: PM-16238A
Date Sampled: 07/05/2024
Dates Tested: 16/05/2024 - 31/05/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: C3 , Depth: 0.8 - 1.0
Material: Sandy SILT: grey white



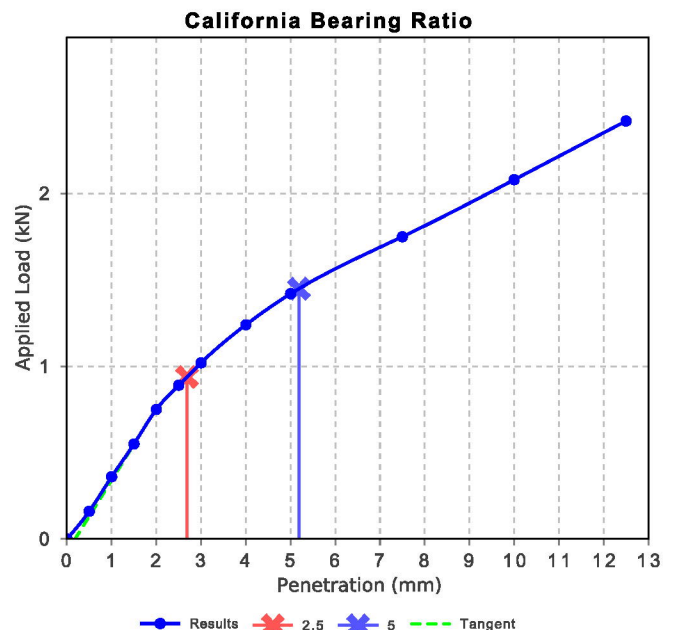
Douglas Partners Pty Ltd
Port Macquarie Laboratory
Unit 2, 32 Geebung Drive Port Macquarie NSW 2444
Phone: (02) 6581 5992
Email: luke.hetherington@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Luke Hetherington
Laboratory Manager
Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	7		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.76		
Optimum Moisture Content (%)	17.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m ³)	1.75		
Field Moisture Content (%)	10.5		
Moisture Content at Placement (%)	17.4		
Moisture Content Top 30mm (%)	18.8		
Moisture Content Rest of Sample (%)	18.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	97.0		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

Report Number: 226965.00-2
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: Amended Sample Descriptions
Date Issued: 25/06/2024
Client: Tamworth Regional Council
PO Box 555, Tamworth NSW
Contact: Callum Fletcher
Project Number: 226965.00
Project Name: Proposed Tamworth Regional Aquatic Centre
Project Location: Jack Smyth Drive, Hillvue NSW
Work Request: 16238
Sample Number: PM-16238B
Date Sampled: 07/05/2024
Dates Tested: 16/05/2024 - 31/05/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: C5 , Depth: 0.5 - 1.0
Material: FILL: brown silty CLAY with gravel, trace sand



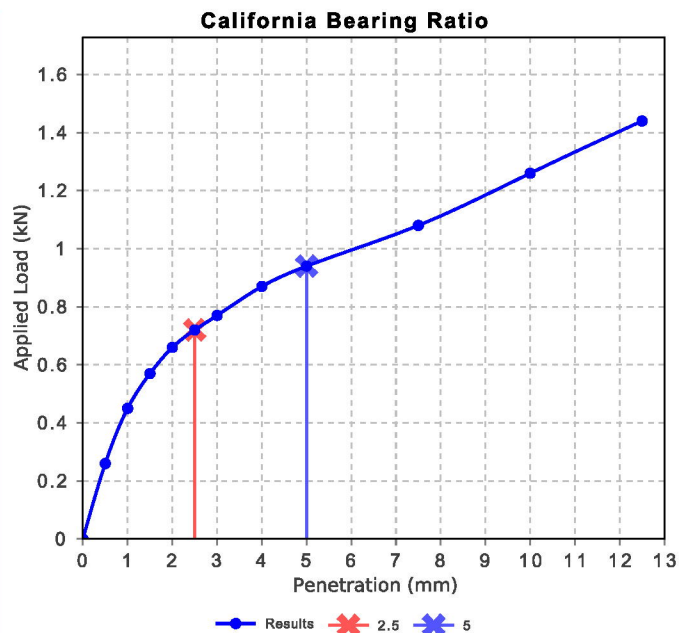
Douglas Partners Pty Ltd
Port Macquarie Laboratory
Unit 2, 32 Geebung Drive Port Macquarie NSW 2444
Phone: (02) 6581 5992
Email: luke.hetherington@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Luke Hetherington
Laboratory Manager
Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	5		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.79		
Optimum Moisture Content (%)	17.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m ³)	1.77		
Field Moisture Content (%)	15.1		
Moisture Content at Placement (%)	16.9		
Moisture Content Top 30mm (%)	19.7		
Moisture Content Rest of Sample (%)	17.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	97.5		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	18		



Material Test Report

Report Number: 226965.00-2
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: Amended Sample Descriptions
Date Issued: 25/06/2024
Client: Tamworth Regional Council
PO Box 555, Tamworth NSW
Contact: Callum Fletcher
Project Number: 226965.00
Project Name: Proposed Tamworth Regional Aquatic Centre
Project Location: Jack Smyth Drive, Hillvue NSW
Work Request: 16238
Sample Number: PM-16238C
Date Sampled: 07/05/2024
Dates Tested: 16/05/2024 - 31/05/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: C6 , Depth: 0.5 - 1.0
Material: FILL: brown sandy clay with gravel



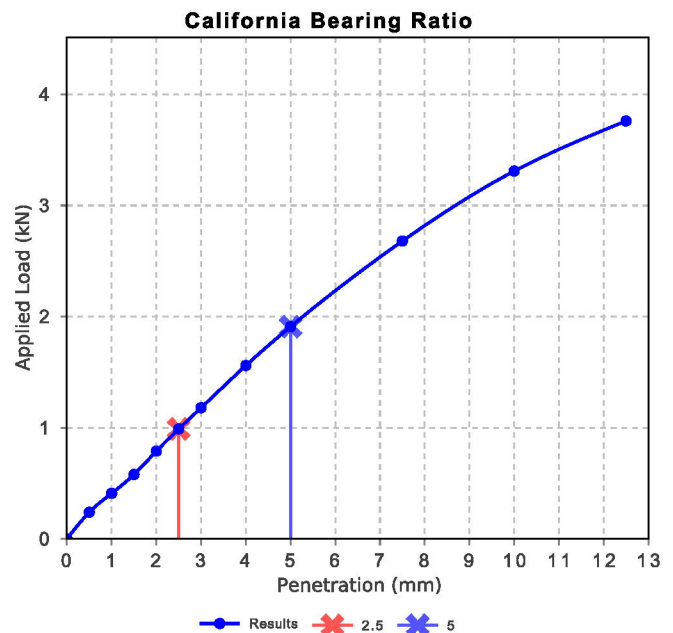
Douglas Partners Pty Ltd
Port Macquarie Laboratory
Unit 2, 32 Geebung Drive Port Macquarie NSW 2444
Phone: (02) 6581 5992
Email: luke.hetherington@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Luke Hetherington
Laboratory Manager
Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	10		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	2.04		
Optimum Moisture Content (%)	11.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	101.5		
Dry Density after Soaking (t/m ³)	2.04		
Field Moisture Content (%)	8.6		
Moisture Content at Placement (%)	11.1		
Moisture Content Top 30mm (%)	11.7		
Moisture Content Rest of Sample (%)	11.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	98.5		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	17		



Material Test Report

Report Number: 226965.00-2
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: Amended Sample Descriptions
Date Issued: 25/06/2024
Client: Tamworth Regional Council
PO Box 555, Tamworth NSW
Contact: Callum Fletcher
Project Number: 226965.00
Project Name: Proposed Tamworth Regional Aquatic Centre
Project Location: Jack Smyth Drive, Hillvue NSW
Work Request: 16238
Sample Number: PM-16238D
Date Sampled: 07/05/2024
Dates Tested: 16/05/2024 - 31/05/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: C7 , Depth: 0.5 - 1.0
Material: FILL: brown silty clay with gravel



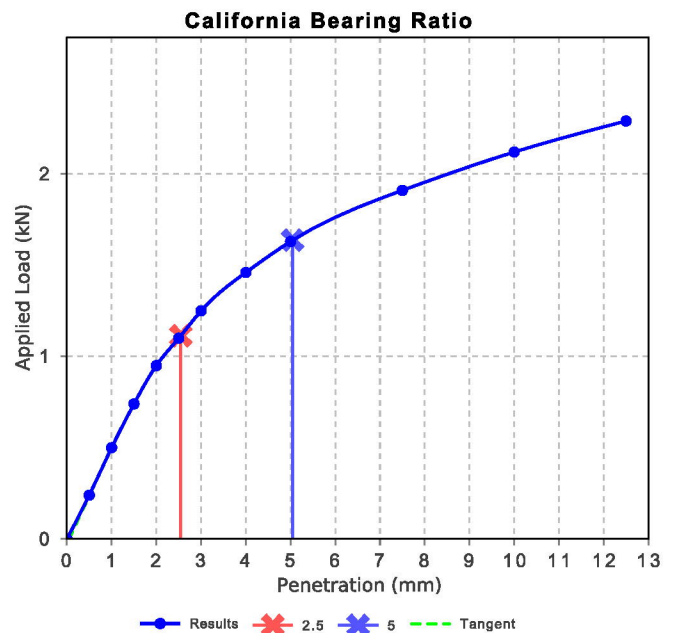
Douglas Partners Pty Ltd
Port Macquarie Laboratory
Unit 2, 32 Geebung Drive Port Macquarie NSW 2444
Phone: (02) 6581 5992
Email: luke.hetherington@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Luke Hetherington
Laboratory Manager
Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	8		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.74		
Optimum Moisture Content (%)	18.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	102.0		
Dry Density after Soaking (t/m ³)	1.73		
Field Moisture Content (%)	14.7		
Moisture Content at Placement (%)	18.1		
Moisture Content Top 30mm (%)	19.9		
Moisture Content Rest of Sample (%)	19.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	99.0		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	2		



Material Test Report

Report Number: 226965.00-3
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: Amended Sample Descriptions
Date Issued: 25/06/2024
Client: Tamworth Regional Council
PO Box 555, Tamworth NSW
Contact: Callum Fletcher
Project Number: 226965.00
Project Name: Proposed Tamworth Regional Aquatic Centre
Project Location: Jack Smyth Drive, Hillvue NSW
Work Request: 16278
Sample Number: PM-16278A
Date Sampled: 21/05/2024
Dates Tested: 29/05/2024 - 11/06/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 2 , Depth: 3.0 - 3.4
Material: Silty CLAY: grey and yellow



Douglas Partners Pty Ltd
Port Macquarie Laboratory
Unit 2, 32 Geebung Drive Port Macquarie NSW 2444
Phone: (02) 6581 5992
Email: luke.hetherington@douglaspartners.com.au



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Approved Signatory: Luke Hetherington
Laboratory Manager
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	43		
Plastic Limit (%)	14		
Plasticity Index (%)	29		
Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	None		
Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	15.6		

Material Test Report

Report Number: 226965.00-3
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: Amended Sample Descriptions
Date Issued: 25/06/2024
Client: Tamworth Regional Council
PO Box 555, Tamworth NSW
Contact: Callum Fletcher
Project Number: 226965.00
Project Name: Proposed Tamworth Regional Aquatic Centre
Project Location: Jack Smyth Drive, Hillvue NSW
Work Request: 16278
Date Sampled: 21/05/2024
Dates Tested: 29/05/2024 - 04/06/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Location: Jack Smyth Drive, Hillvue



Douglas Partners Pty Ltd
Port Macquarie Laboratory
Unit 2, 32 Geebung Drive Port Macquarie NSW 2444
Phone: (02) 6581 5992
Email: luke.hetherington@douglaspartners.com.au



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Approved Signatory: Luke Hetherington
Laboratory Manager
Laboratory Accreditation Number: 828

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	PM-16278B	PM-16278C			
Date Sampled	21/05/2024	21/05/2024			
Date Tested	04/06/2024	04/06/2024			
Material Source	U50	U50			
Sample Location	6 (3.35 - 3.75)	7 (3.1 - 3.5)			
Inert Material Estimate (%)	**	**			
Pocket Penetrometer before (kPa)	300	230			
Pocket Penetrometer after (kPa)	220	160			
Shrinkage Moisture Content (%)	12.8	16.0			
Shrinkage (%)	1.9	3.0			
Swell Moisture Content Before (%)	13.0	21.2			
Swell Moisture Content After (%)	17.3	26.1			
Swell (%)	-0.0	0.6			
Shrink Swell Index Iss (%)	1.1	1.8			
Visual Description	CLAY: brown	CLAY: dark brown			
Cracking	SC	HC			
Crumbling	No	No			
Remarks	**	**			

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.

Cracking Terminology: UC Uncracked, SC Slightly Cracked, MC Moderately Cracked, HC Highly Cracked, FR Fragmented.

NATA Accreditation does not cover the performance of pocket penetrometer readings.

CERTIFICATE OF ANALYSIS 353620

Client Details

Client	Douglas Partners Pty Ltd (Port Macquarie)
Attention	Joel Cowan
Address	PO Box 5463, Port Macquarie, NSW, 2444

Sample Details

Your Reference	<u>226965.00 Hillvue</u>
Number of Samples	3 Soil
Date samples received	12/06/2024
Date completed instructions received	12/06/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	19/06/2024
Date of Issue	18/06/2024
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By
Jenny He, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Misc Inorg - Soil				
Our Reference		353620-1	353620-2	353620-3
Your Reference	UNITS	2	5	7
Depth		4	1	2.5
Date Sampled		22/05/2024	22/05/2024	21/05/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	12/06/2024	12/06/2024	12/06/2024
Date analysed	-	14/06/2024	14/06/2024	14/06/2024
pH 1:5 soil:water	pH Units	8.2	8.2	8.3
Electrical Conductivity 1:5 soil:water	µS/cm	91	160	150
Chloride, Cl 1:5 soil:water	mg/kg	20	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	10	23	40

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			12/06/2024	[NT]	[NT]	[NT]	[NT]	12/06/2024	[NT]
Date analysed	-			14/06/2024	[NT]	[NT]	[NT]	[NT]	14/06/2024	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	108	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	109	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

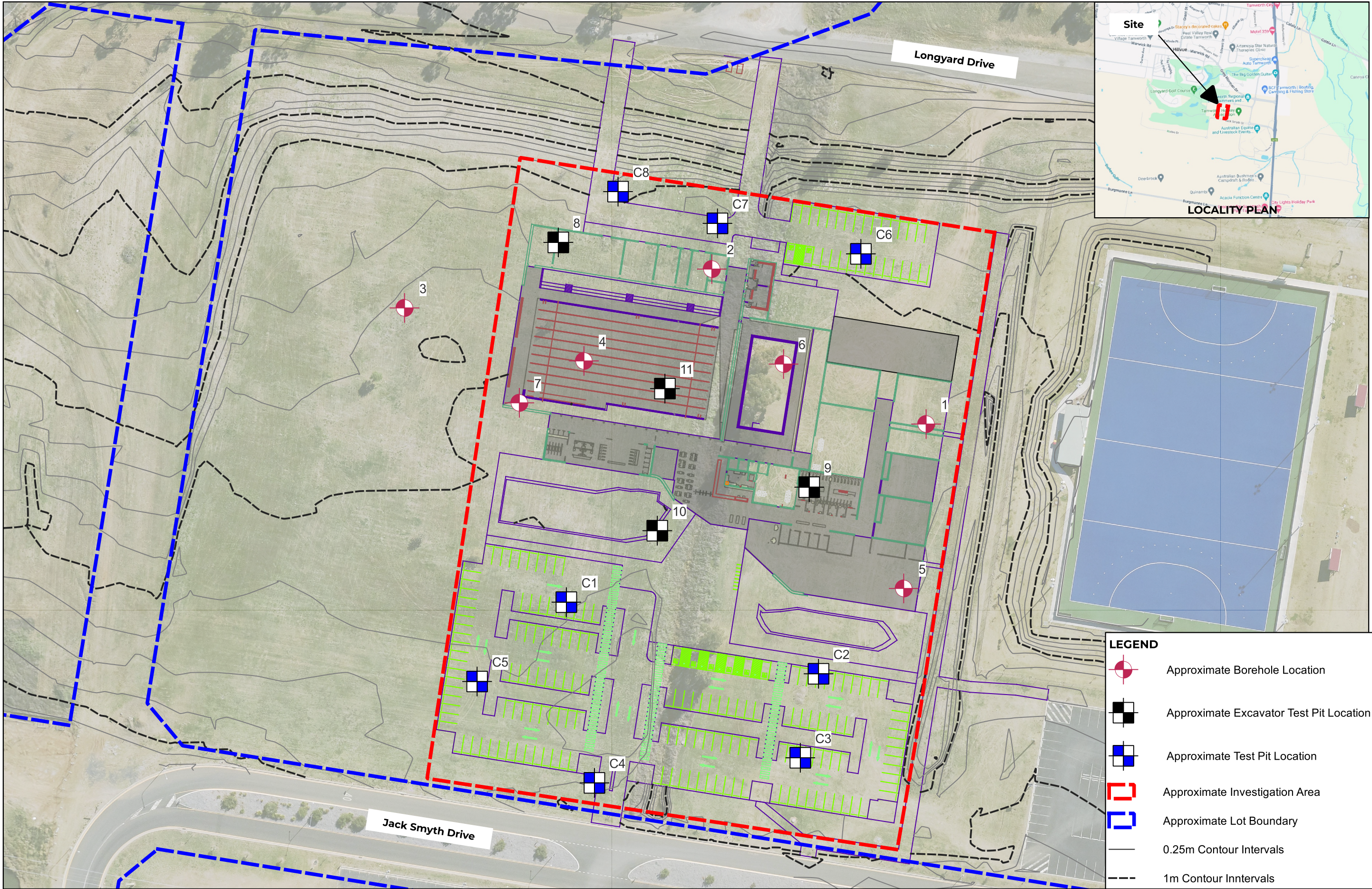
Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

MISC_INORG_DRY:pH/EC:Samples were out of the recommended holding time for this analysis.

Appendix D

Drawing 1 – Test Location Plan



REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Original Issue	18.06.2024	JRC
SCALE: 0 10 20 30 40 m 1:1000 @ A3			



Douglas
PARTNERS
OFFICE: PORT MACQUARIE
Unit 2, 32 Ceebung Drive, Port Macquarie
NSW 2444 Ph: (02) 6581 5992

CLIENT:



Tamworth Regional Council

NOTE:

1: Basemap from MetroMap (Dated 21 August 2023)
2: Base Plan from CO.OP Studio, Reference 240502, Revision 1 (Dated 02.05.2024)
3: 0.25m Contour intervals supplied by client

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Proposed Tamworth Regional Aquatic Centre

PROJECT ADDRESS:
Jack Smyth Drive, Hillvue, NSW

DRAWING TITLE:
Test Location Plan

PROJECT NO:
226965.00

DRAWING NO:
1

REVISION:
0