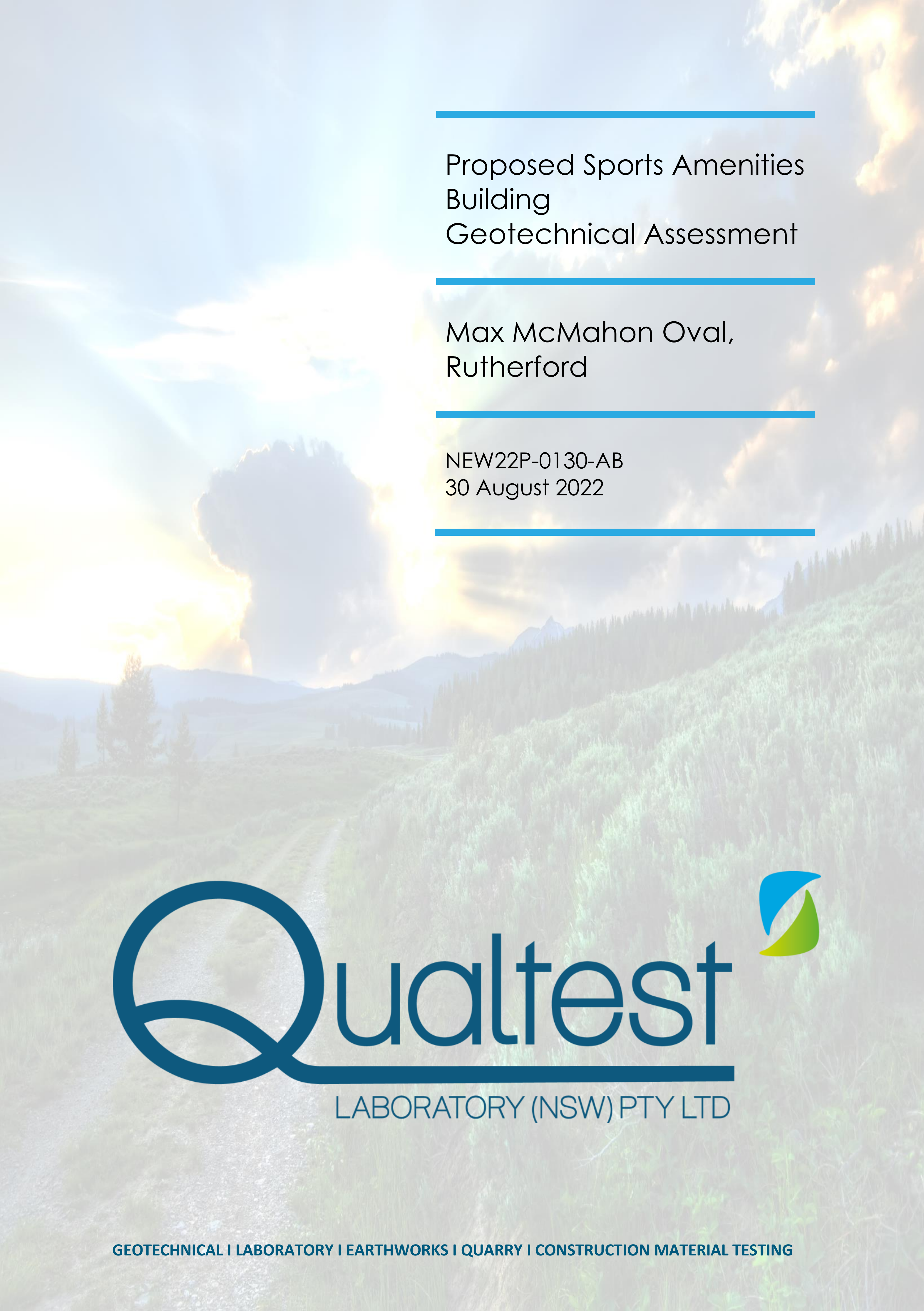


Proposed Sports Amenities Building Geotechnical Assessment

Max McMahon Oval, Rutherford

NEW22P-0130-AB
30 August 2022

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

30 August 2022

Maitland City Council
C/- EJE Architecture
412 King Street
NEWCASTLE NSW 2300

Attention: Mr Brock Hall

Dear Brock,

**RE:	PROPOSED SPORTS AMENITIES BUILDING**
MAX MCMAHON OVAL, RUTHERFORD
GEOTECHNICAL ASSESSMENT

Please find enclosed our Geotechnical Assessment report for the proposed sports amenities building to be located at Max McMahon Oval, Rutherford.

The report includes a description of geotechnical conditions at the site, Site Classification to AS2870-2011, recommendations for foundation design parameters, excavation conditions and earthworks.

If you have any questions regarding this report, please do not hesitate to contact Ben Bunting, Shannon Kelly, or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Jason Lee

Jason Lee
Principal Geotechnical Engineer

Table of Contents:

Attachments:

1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this report to EJE Architecture Pty Ltd (EJE) on behalf of Maitland City Council (MCC), for the proposed sports amenities building to be constructed at Max McMahon Oval, off Weblands Street, Rutherford.

It is understood that the proposed development is to comprise a new sports amenities building. At the time of writing this report, no architectural plans have been provided to Qualtest.

The scope of work for the geotechnical assessment included providing discussion and recommendations on the following:

- Site preparation;
- Excavation conditions and depth to rock (where encountered);
- The suitability of the site soils for use as fill, and fill construction procedures;
- Site Classification to AS2870-2011, "*Residential Slabs and Footings*";
- Foundation design parameters including allowable bearing pressures (within depth of investigation); and,
- Special requirements for construction procedures, including areas of unsuitable material.

This report presents the results of the field work investigations and laboratory testing, and provides recommendations for the scope outlined above.

A Contamination and Preliminary Waste Classification Assessment has been prepared concurrently to this report by Qualtest (ref. NEW22P-0130-AA, 12 August 2022). Selected information from the Contamination and Preliminary Waste Classification Assessment is included in this report. Reference should be made to that report for further details.

2.0 Field Work

The field work investigations were carried out on 14 July 2022 and comprised of:

- DBYD search and visual check of proposed test locations for the presence of underground services;
- Site walkover to make observations of surface features at the property and in the immediate surrounding area;
- Excavation of nine (9 no.) boreholes using a 2.7 tonne rubber tracked excavator equipped with a 300mm diameter auger to depths of between 0.60m and 1.45m within the proposed development area;
- Dynamic Cone Penetrometer (DCP) tests were undertaken at selected borehole locations to assist in the interpretation of the in-situ density / consistency of the soils. Tests were carried out to depths of between 0.50m to 1.18m;
- Boreholes were backfilled with the excavation spoil and compacted using the excavator auger and tracks.

Investigations were carried out by an experienced Geotechnical Engineer and Environmental Scientist from Qualtest who located the boreholes, carried out the testing and sampling, produced field logs of the boreholes, and made observations of the site surface conditions.

Engineering logs of the boreholes and DCP test results are presented in Appendix A.

Approximate borehole locations are shown on the attached Figure AB1. Boreholes were located in the field by handheld GPS and relative to existing site features.

3.0 Site Description

3.1 Surface Conditions

The subject site comprises the proposed development area totalling approximately 2,400m², located in the central western section of Lot 312 DP232261, west of the existing sports field. The site is approximately 25m wide by 115m long at its widest and longest points.

Max McMahon Oval is bounded by Rutherford Technology High School campus to the north, Avery Street the east, to the south and west by Alexandra Ave and Weblands Street, respectively, with low density urban residential allotments on the opposite sides of these streets.

The site is located in an area of gently undulating topography, on the eastern facing upper slopes of a minor north-south trending ridge formation. At the time of site investigation, the site contained existing sports facilities including amenities blocks and a grandstand and in the central portion of the site, generally comprised of concrete block walls, concrete floor slab and stairs, and steel/wooden roofing and seating. Steel fencing was observed on the western side of the grandstand and amenities block. The remainder of the site was mostly well-maintained grass with some concrete paths and stairs.

On the day of the investigation which was undertaken during a significant wet period, the site was judged to be moderately well drained. The site is judged to rely primarily on surface run-off for drainage.

Photographs of the site taken on the day of the site investigations are shown below.

Photograph 1: From southern end of site, facing north.

Photograph 2: From southern end of site, facing northeast.

Photograph 3: From near centre of western boundary of site, facing east.

Photograph 4: From near centre of western boundary of site, facing southeast.

Photograph 5: From near northern end of site, facing southwest.

Photograph 6: From near northern end of site, facing west.

Photograph 7: From near centre of eastern boundary of site, facing south.

Photograph 8: From near centre of eastern boundary of site, facing north.

3.2 Subsurface Conditions

Reference to the 1:250,000 Newcastle Gosford-Lake Macquarie Special Geology Geological Series (Sheet SI 56-2) indicates most of the site to be underlain by the Branxton Formation of the Maitland Group, which is characterised by Sandstone, Siltstone, and Tillitic Conglomerate rock types; the far western edge of the lot is indicated to be underlain by the Greta Coal Measures, which is characterised by Sandstone, Shale, Conglomerate, and Coal Rock types.

Table 1 presents a summary of the typical soil types encountered at borehole locations during the field investigation, divided into representative geotechnical units.

Table 2 contains a summary of the distribution of the above geotechnical units at the borehole locations.

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES

Unit	Soil Type	Description
1A	FILL-TOPSOIL	Sandy CLAY – medium to high plasticity, brown, fine to medium grained sand, with some fine grained angular gravel, root affected. Silty SAND, Clayey SAND, SAND – fine to medium grained, dark grey-brown to dark brown, brown, fines of low plasticity, root affected. Sandy CLAY – low to medium plasticity, dark grey-brown, fine to medium grained sand, root affected.
1B	FILL	Sandy CLAY – medium plasticity, generally dark grey-brown to pale brown, fine to coarse grained sand, with some fine to medium grained angular gravel, gravelly in places, with some roots in places. Clayey SAND – fine to medium grained, brown, fines of low plasticity.
2	RESIDUAL SOIL	CLAY – medium to high plasticity, brown to pale brown with some pale red-brown, with some fine to medium grained sand. Sandy CLAY – medium plasticity, brown to orange-brown and pale grey-brown / pale brown and pale red-brown, fine to medium grained sand, with gravel in places. Clayey SAND – fine grained, pale orange-brown and pale grey-brown, fines of low plasticity.
3	EXTREMELY WEATHERED ROCK (with soil properties)	Silty Sandstone; breaks down into Clayey SAND – fine to medium grained, pale brown to pale orange-brown, fines of low plasticity.
4	HIGHLY WEATHERED ROCK	Silty SANDSTONE, Sandy SILTSTONE – fine grained, pale grey and pale orange-brown, estimated low to medium strength. SANDSTONE – fine grained, brown.

TABLE 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT EACH BOREHOLE LOCATION

Location	Unit 1A FILL-Topsoil	Unit 1B FILL	Unit 2 Residual Soil	Unit 3 XW Rock	Unit 4 HW Rock
	Depth in metres (m)				
Geotechnical Investigation					
BH03	0.00 - 0.20	0.20 - 0.40	0.40 - 1.20	-	1.20 - 1.45*
BH05	-	-	0.00 - 0.70	0.70 - 1.00	1.00 - 1.15*
BH07	0.00 - 0.30	0.30 - 0.40	0.40 - 0.50	-	0.50 - 0.70*
Environmental Investigation					
BH01	0.00 - 0.10	0.10 - 0.40	0.40 - 0.80	-	-
BH02	0.00 - 0.10	0.10 - 0.30	0.30 - 0.80	-	-
BH04	0.00 - 0.10	0.10 - 0.40	0.40 - 0.60	-	-
BH06	0.00 - 0.10	0.10 - 0.40	0.40 - 0.55	-	0.55 - 0.60*
BH08	0.00 - 0.25	-	0.25 - 0.60	-	-
BH09	0.00 - 0.30	0.30 - 0.70	0.70 - 0.80	-	-
Notes:	* = Practical refusal of 2.7 tonne excavator with auger attachment.				

No groundwater was encountered in the test locations during the limited time that they remained open on the day of the field investigations.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

4.0 Laboratory Testing

Samples collected during the field investigations were returned to our NATA accredited Newcastle Laboratory for testing which comprised of:

- (2 no.) Shrink/Swell tests.

Results of the laboratory testing are presented in Appendix B, with a summary of the Shrink / Swell test results presented in Table 3 below.

TABLE 3 – SUMMARY OF SHRINK / SWELL TESTING RESULTS

Location	Depth (m)	Material Description	I_{ss} (%)
BH03	0.50 – 0.70	(CH) CLAY	2.6
BH05	0.40 – 0.55	(CL) Sandy CLAY	1.0

5.0 Discussion and Recommendations

5.1 Excavation Conditions

The depths of fill, topsoil, residual soils, and weathered rock are summarised in Table 2.

In terms of excavation conditions, site materials can generally be divided into:

- Clayey and Granular Soils (Units 1A, 1B, & 2). It is anticipated that these materials could be excavated by a conventional excavator or backhoe bucket.
- Weathered Rock (Units 3 & 4). Rippability is dependent on rock strength, degree of weathering and number of defects within the rock mass which can vary significantly.

It is anticipated that if Weathered Rock (Unit 3 & 4) materials are encountered, they could be excavated by conventional excavator (about 20 tonnes or greater) equipped with a toothed bucket at least to the depths indicated on the appended borehole logs.

Material below the depth of auger practical refusal may be excavatable by relatively large machinery and ripping to some greater depth; although, this has not been assessed as part of the current investigation.

Based upon our previous experience, refusal of the 300mm diameter auger on a 2.7 tonne excavator is roughly equivalent to refusal of a 20 tonne excavator with 450mm bucket equipped with tiger teeth; therefore, it is anticipated that excavators with toothed buckets may achieve limited depths of excavation into the bedrock below depths of practical refusal encountered in the boreholes.

The use of hydraulic rock hammers or other methods may be required where hard layers of weathered rock are encountered and for deep confined excavations such as for service trenches.

It is recommended that targeted investigations (e.g. cored boreholes) or excavation trials are carried out wherever deeper excavations are proposed where bedrock depth or excavatability is important to design or construction.

Groundwater was not encountered in the borehole locations during the limited time that they remained open on the day of the investigation.

There is potential for groundwater to exist from water perched above the clay / bedrock profile. It is possible that slow water inflow may be encountered from such layers, particularly if earthworks are carried out during or following periods of wet weather. If groundwater is encountered, it is generally expected to be manageable by de-watering by sump and pump methods.

Excavations should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected from erosion.

Temporary excavations should be battered at 1V:1H or flatter in cohesive soils, or 1V:1.5H or flatter in granular soils, and protected from erosion. Steeper excavations may be supported by means of temporary shoring.

Temporary excavations to depths of up to 1.2m in competent compact material with sufficient cohesion, such as clay of stiff consistency or better may be battered vertically, subject to inspection during excavation by the geotechnical authority.

The safe working procedures of Work Cover NSW Excavation work code of practice, dated January 2020 should be followed.

Care should be taken not to disturb or destabilise existing underground services or structures.

5.2 Site Preparation

Site preparation suitable for structures and site re-grading should consist of:

- Following any bulk excavation to proposed subgrade level, areas for proposed structures, should be stripped to remove all existing uncontrolled fill, vegetation, topsoil, root affected or any other potentially deleterious materials;
- Stripping is generally expected to be required to depths of about 0.20m to 0.40m to remove root affected topsoil and fill;
- Stripping to greater depths is anticipated in areas affected by deeper fill, including in the vicinity of BH09 (0.7m fill);
- Additional stripping may be required in any areas where poor, wet or saturated subgrade conditions are encountered.
- Following stripping, the exposed subgrade should be proof rolled (minimum 10 tonne static roller), to identify any wet or excessively deflecting material. Any such areas should be over excavated and backfilled with an approved select material;
- The moisture content of the subgrade materials and therefore the need for moisture conditioning or over-excavation and replacement, will be largely dependent on pre-existing and prevailing weather conditions at the time of construction;
- Subgrade preparation should be carried out using a tracked excavator equipped with a smooth sided (‘gummy’) bucket to minimise the risk of over-disturbance of soils;
- Protect the area after subgrade preparation to maintain moisture content as far as practicable; and,
- Site preparation should include provision of drainage and erosion control as required, as well as sedimentation control measures.

5.3 Fill Construction Procedures

Earthworks for support of foundations should consist of the following measures:

- Site fill beneath structures should be compacted in layers not exceeding 300mm loose thickness to a minimum density ratio of 98% Standard Compaction within ±2% of OMC in cohesive soils, or to a minimum density index of 80% (AS1289 5.6.1 for granular soils;
- All fill should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected against erosion;
- If fill is to be placed on slopes in excess of 1V:8H (7°), a prepared surface should be benched or stepped into the slope; and,
- Earthworks should be carried out in accordance with the recommendations outlined in AS3798-2007 ‘*Guidelines for Earthworks for Commercial and Residential Developments*’.

5.4 Suitability of Site Materials for Re-Use as Fill

The following comments are made with respect to suitability of site materials for re-use as fill:

- Unit 1A Fill-Topsoil / Topsoil materials are expected to be suitable for landscaping purposes only;

- Unit 1B - Fill materials may be variable. Some fill material may be suitable for landscaping purposes only due to the presence of roots and organics. If fill material is not affected by roots or other deleterious material, it is generally expected to be suitable for re-use as general fill for engineering purposes. Suitability for re-use should be confirmed prior to, or at the time of construction;
- Unit 2 – Residual Soil materials are generally expected to be suitable for re-use as general fill for engineering purposes; and,
- Units 3 & 4 – Weathered Rock materials are generally expected to be suitable for re-use as general fill for engineering purposes.

Final selection of fill materials should consider properties such as reactivity which is typically moderate for the site soils.

The suitability of material for re-use should be assessed and confirmed by the geotechnical authority at the time of construction. The materials may require some moisture conditioning.

5.5 Site Classification to AS2870-2011

Based on the results of the field work, the site at Max McMahon Oval, Rutherford is classified in its current condition in general accordance with AS2870-2011 *'Residential Slabs and Footings'*, as shown in Table 4.

TABLE 4 – SITE CLASSIFICATION TO AS2870-2011

Site Location	Site Classification
Areas with greater than 0.40m Uncontrolled Filling and/or Topsoil	**P**
Remainder of the site (expected to comprise most of the site based upon fill and topsoil depths not exceeding 0.4m at most borehole locations)	**H1**

Areas are classified as **Class 'P'** due to the inferred depth of fill greater than 0.40m (e.g. in the vicinity of BH09 location).

It is envisaged that if uncontrolled fill and topsoil depths are reduced to less than 0.4m, witnessed and documented by a geotechnical authority, then it is likely that those areas could be re-classified as **Class 'H1'**. This should be confirmed by the geotechnical authority following fill / topsoil removal.

Based upon the test results, previous experience and variable rock depths at the limited test locations, the overall site, (excluding those areas classified as **Class 'P'**), is classified as **Class 'H1'**; however, discrete areas where confirmed during construction to have Unit 4 – Highly Weathered rock depths of about 1.2m or less could be re-classified as **Class 'M'**.

If site re-grading works involving cutting or filling are performed after the date of this assessment, the classification may change and further advice should be sought.

As a preliminary guide, if the site is filled with site won Unit 4 Residual Soil or similar material with I_{ss} of about 3.5% or less, carried out to 'Level 1' criteria as defined in Clause 8.2 – Section 8, of AS3798-2007, lots are likely to be classified as **Class 'H1'** or **Class 'H2'**.

With engineering input and measures such as providing a sufficiently thick (about 0.2m to 0.3m depth) topsoil layer of very low to non-reactive soil, and using site won fill (of Iss less than 2.7%) placed to 'Level 1' criteria as defined in Clause 8.2 – Section 8, of AS3798-2007, it is envisaged that site classification of **Class 'H1'** could be achievable in most cases.

Final site classification will be dependent on a number of factors, including depth of topsoil, depth of fill and natural soil/rock, reactivity of the natural soil and any fill material placed, and the level of supervision carried out. Re-classification of the site should be confirmed by the geotechnical authority at the time of construction following any site re-grade works.

A characteristic free surface movement of 20mm to 40mm would apply for areas classified as **Class 'M'**.

A characteristic free surface movement of 40mm to 60mm would apply for areas classified as **Class 'H1'**.

A characteristic free surface movement of 60mm to 75mm would apply for areas classified as **Class 'H2'**.

The effects of changes to the soil profile by additional cutting and filling and the effects of past and future trees should be considered in selection of the design value for differential movement.

Footings for the proposed development should be designed and constructed in accordance with the requirements of AS2870-2011.

The classification presented above assumes that:

- All footings are founded in controlled fill (if applicable) or in medium dense or better natural sand, or stiff or better natural clay soils below all non-controlled fill, topsoil material / root zones and loose material, and fill under slab panels meets the requirements of AS2870-2011, in particular, the root zone must be removed prior to the placement of fill materials beneath slabs;
- The performance expectations set out in Appendix B of AS2870-2011 are acceptable, and that site foundation maintenance is undertaken to avoid extremes of wetting and drying of any reactive clay materials in the vicinity of the structure;
- Footings are to be founded outside of or below all zones of influence resulting from existing or future service trenches;
- The constructional and architectural requirements for reactive clay sites set out in AS2870-2011 are followed;
- Adherence to the detailing requirement outlined in Section 5 of AS2870-2011 '*Residential Slabs and Footings*'; and,
- Site maintenance complies with the provisions of CSIRO Sheet BTF 18, "*Foundation Maintenance and Footing Performance: A Homeowner's Guide*", a copy of which is attached in Appendix C.

All structural elements should be supported on footings founded beneath all uncontrolled fill, topsoil, layers of inadequate bearing capacity, soft/loose, or other potentially deleterious material.

If any areas of uncontrolled fill or loose soils of depths greater than 0.4m are encountered during construction, footings should be designed in accordance with engineering principles for Class 'P' sites.

5.6 Foundations

Shallow footings are generally not considered appropriate for areas affected by uncontrolled fill. Footings should be founded in suitable material beneath all uncontrolled fill, topsoil, deleterious material, very soft to firm or very loose and loose material, or these materials should be removed and replaced under engineering supervision.

Shallow footings founded on stiff or better natural clay, or approved controlled fill (placed under Level 1 supervision in accordance with AS3798-2007) may be proportioned for a maximum allowable bearing pressure of 100kPa.

Shallow footings founded on very stiff or better natural clay may be proportioned for a maximum allowable bearing pressure of 150kPa.

Shallow footings founded on Extremely Weathered Rock without clay layers may be proportioned for a maximum allowable bearing pressure of 300kPa.

Shallow footings founded on Highly Weathered Rock (Class V Sandstone or better, without clay or extremely weathered layers) may be proportioned for a maximum allowable bearing pressure of 600kPa.

As a preliminary guide, deep footings, such as bored piers, driven piles, screw piles and grout-injected piles, founded in stiff or better natural clay soil below depths of uncontrolled fill and unsuitable material, and at depths of greater than three effective diameters below ground surface level, may be proportioned for a maximum allowable base bearing capacity of 150kPa, and a shaft adhesion of 25kPa for the section within stiff or better natural clay.

Deep footings founded in Highly Weathered Rock (Class V Sandstone or better) may be proportioned for a maximum allowable base bearing capacity of 1000kPa, and a shaft adhesion of 50kPa for the section within weathered rock, (typically indicated to be below the depth where practical refusal or refusal of 2.7 tonne excavator with 300mm diameter auger was met on Highly Weathered or better Rock).

Increased capacity may be achieved in rock of medium strength or better; however, due to the investigations being limited to boreholes rather than rock coring, and potential for low strength layers to be present, it is recommended that the values provided above are adopted for Unit 4 rock unless further investigations are carried out to confirm or otherwise the presence of medium strength rock over the depth of proposed pile socket and below the base depth of proposed piles.

The recommended allowable bearing pressures assume that elastic settlements will be less than about 1% of least footing width; although, relevant ground movements related to reactive clay would also apply.

Footings are to be founded outside of or below all zones of influence resulting from existing or future service trenches and other excavations.

5.7 Special Requirements for Construction Procedures and Drainage

Adequate surface and subsurface drainage should be installed and connected to the stormwater disposal system.

It is recommended that surface and subsoil drainage be installed in line with the above advice, and in accordance with Maitland City Council specifications.

Inspection should be carried out by a geotechnical authority during construction to confirm the conditions assumed in this report and in the design.

6.0 Limitations

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

The extent of testing associated with this assessment is limited to discrete test locations. It should be noted that subsurface conditions between and away from the test locations may be different to those observed during the field work and used as the basis of the recommendations contained in this report.

If subsurface conditions encountered during construction differ from those given in this report, further advice should be sought without delay.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

If you have any further questions regarding this report, please do not hesitate to contact Ben Bunting, Shannon Kelly, or the undersigned.

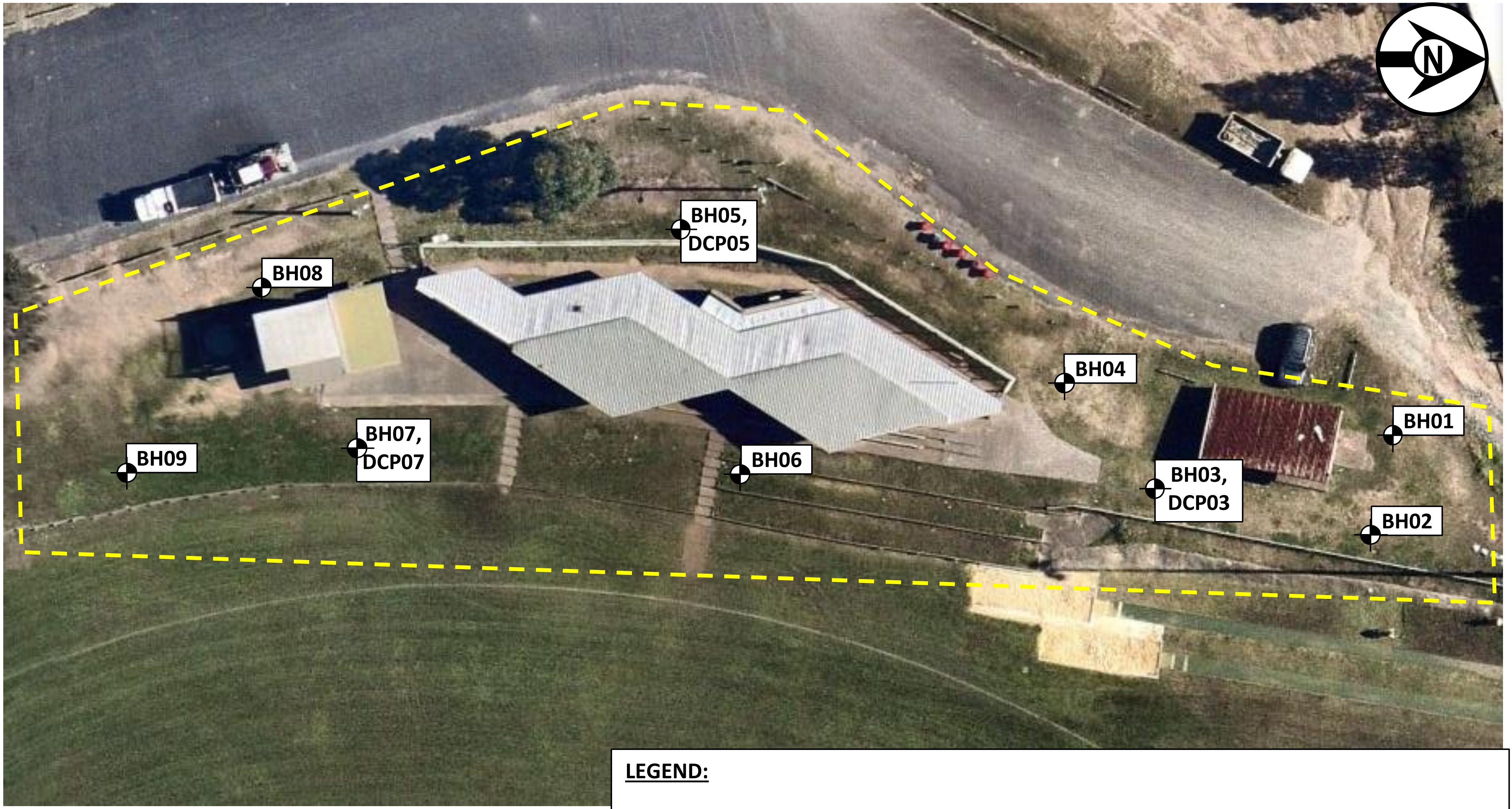
For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

Jason Lee

Jason Lee
Principal Geotechnical Engineer

FIGURE AB1:

Site Plan and Approximate Test Locations



Based on Aerial image provided by Nearmap.com
(image dated 14 June 2022)

LEGEND:

⊕	Approximate borehole and Dynamic Cone Penetrometer (DCP) test location
◌	Approximate extent of proposed development area

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Client:	MAITLAND CITY COUNCIL	Drawing No:	FIGURE AB1
Project:	PROPOSED SPORTS AMENITIES BUILDING	Project No:	NEW22P-0130
Location:	MAX MCMAHON OVAL, RUTHERFORD	Scale:	N.T.S.
Title:	SITE PLAN AND APPROXIMATE TEST LOCATIONS	Date:	25/08/2022

APPENDIX A:

Results of Field Investigations

Qualtest
LABORATORY (NSW) PTY LTD

ENGINEERING LOG - BOREHOLE

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: **BH01**
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BS
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m				CH	FILL-TOPSOIL: Sandy CLAY - medium to high plasticity, brown, fine to medium grained sand, root affected. 0.10m	M > W_P				FILL - TOPSOIL
						CI	FILL: Sandy CLAY - medium plasticity, brown, fine to medium grained. 0.40m					FILL
		0.40m E 0.50m		0.5		CI	Sandy CLAY - medium plasticity, brown to orange-brown, fine grained sand. Increasing sand content. 0.80m		VSt	HP HP	320 300	RESIDUAL SOIL
				1.0 1.5			Hole Terminated at 0.80 m Limit Of Required Investigation					

LEGEND:

Water

▼	Water Level (Date and time shown)
▶	Water Inflow
◀	Water Outflow

Strata Changes

— —	Gradational or transitional strata
——	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: BH02
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BS
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m			▩	SP	FILL-TOPSOIL: SAND - fine to medium grained, dark brown, with some fines of low plasticity. 0.10m	M				FILL - TOPSOIL
					▩	SC	FILL: Clayey SAND - fine to medium grained, brown, fines of low plasticity. Shoelace in fill at 0.25m. 0.30m					FILL
		0.30m E 0.40m		0.5	▨	CH	CLAY - medium to high plasticity, brown to pale brown with some pale red-brown. 0.60m	$M > W_P$	St - VSt	HP HP	190 240	RESIDUAL SOIL
					▨	CI	Sandy CLAY - medium plasticity, pale brown and pale red-brown, fine grained sand, with some silt. 0.80m	$M < W_P$	VSt	HP	380	
				1.0 1.5			Hole Terminated at 0.80 m Limit Of Required Investigation					

LEGEND:

Water

- ▼ Water Level (Date and time shown)
- ► Water Inflow
- ◄ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: **BH03**
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BB
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
E		E 0.10m				CL	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey-brown, fine to medium grained sand, trace fine grained angular gravel, root affected.	M > w_P				FILL - TOPSOIL
		0.40m				CI	0.20m FILL: Sandy CLAY - medium plasticity, pale brown, fine to coarse grained sand, with some fine to medium grained angular gravel.					FILL
		E 0.50m U50 0.70m		0.5		CH	0.40m CLAY - medium to high plasticity, red-brown, trace pale grey and pale grey-brown, with some fine to medium grained sand.		VSt	HP HP	230 300	RESIDUAL SOIL
				1.0		CI	0.75m Sandy CLAY - medium plasticity, pale brown to pale orange-brown and pale grey-brown, with some red-brown, fine to medium grained sand.			HP HP	320 250	
						SC	1.10m Clayey SAND - fine grained, pale orange-brown and pale grey-brown, fines of low plasticity.	M	D - VD			RESIDUAL SOIL / EXTREMELY WEATHERED ROCK
							1.20m Silty SANDSTONE - fine grained, pale grey and pale orange-brown, estimated low strength. 1.45m Estimated low to medium strength.	D				HIGHLY WEATHERED ROCK
				1.5			Hole Terminated at 1.45 m Practical Refusal					

LEGEND:

Water

- Water Level (Date and time shown)
- ▶— Water Inflow
- —◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density			
	V	Very Loose	Density Index <15%
	L	Loose	Density Index 15 - 35%
	MD	Medium Dense	Density Index 35 - 65%
	D	Dense	Density Index 65 - 85%
	VD	Very Dense	Density Index 85 - 100%

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW22P-0130 LOGS.GPJ <<DrawingFile>> 24/08/2022 19:57 10.03.00.09 Datgel Lab and In Situ Tool

ENGINEERING LOG - BOREHOLE

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: **BH04**
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BB
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm

SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m				SC	FILL-TOPSOIL: Silty SAND - fine to medium grained, dark grey-brown, fines of low plasticity, root affected. 0.10m	M				FILL - TOPSOIL
		0.40m				CI	FILL: Sandy CLAY - medium plasticity, dark grey-brown, with some red-brown and trace pale orange-brown and grey, fine to coarse grained sand, trace fine grained angular gravel, with some roots. 0.40m	$M > W_P$				FILL
		E 0.50m		0.5		CH	CLAY - medium to high plasticity, red-brown, with some pale brown, with some fine to medium grained sand. 0.60m		VSt	HP	300	RESIDUAL SOIL
				1.0 1.5			Hole Terminated at 0.60 m Limit Of Required Investigation					

LEGEND:

Water

- Water Level (Date and time shown)
- ▶ Water Inflow
- ◀ Water Outflow

Strata Changes

- _ _ _ Gradational or transitional strata
- ____ Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

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ENGINEERING LOG - BOREHOLE

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: **BH05**
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BB
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m			▨	CH	CLAY - medium to high plasticity, pale brown to pale orange-brown, with some pale grey, with some fine to medium grained sand.	M > W_P	VSt			RESIDUAL SOIL
		0.40m U50 0.55m		0.5	▨	CL	0.20m Sandy CLAY - low to medium plasticity, pale brown and pale grey-brown, fine grained sand.			HP HP	280 250	
					⊞	SC	0.70m Extremely weathered Silty Sandstone with soil properties: breaks down into Clayey SAND - fine to medium grained, pale brown to pale orange-brown, fines of low plasticity.	M	VD			EXTREMELY WEATHERED ROCK / RESIDUAL SOIL
				1.0	⊞		1.00m SILTY SANDSTONE - fine grained, pale brown-pale orange-brown and pale grey-brown, estimated low to medium strength. Estimated Medium strength.	D				HIGHLY WEATHERED ROCK
				1.5			1.15m Hole Terminated at 1.15 m Practical Refusal					

LEGEND:

Water

- ▼ Water Level (Date and time shown)
- ▶ Water Inflow
- ◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: **BH06**
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BS
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m				CH	FILL-TOPSOIL: Sandy CLAY - medium to high plasticity, brown and pale brown, with some dark brown, with some fine grained, sub-angular gravel, root affected. 0.10m	M > W_P				FILL - TOPSOIL
		0.40m				CH	FILL: Sandy CLAY - medium to high plasticity, brown and pale brown, with some dark brown, with some fine grained, sub-angular gravel. 0.40m					FILL
		E 0.50m		0.5		CI	Sandy CLAY - medium plasticity, pale red-brown and pale brown, fine grained. 0.55m		VSt			RESIDUAL SOIL
							SANDSTONE - fine grained, brown. 0.60m	D				HIGHLY WEATHERED SANDSTONE
				1.0 1.5			Hole Terminated at 0.60 m Limit Of Required Investigation					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH07**
CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PAGE: 1 OF 1
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
JOB NO: NEW22P-0130
LOCATION: MAX MCMAHON OVAL, RUTHERFORD
LOGGED BY: BB
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
SURFACE RL:
BOREHOLE DIAMETER: 300 mm
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
E		E 0.10m				CL	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, grey-brown to dark grey-brown, fine grained sand, root affected. Pale grey-brown to grey-brown.	M > W_P				FILL - TOPSOIL
		0.40m				CH	0.30m FILL: CLAY - medium to high plasticity, dark grey, trace fine grained sand.					FILL
		E 0.50m		0.5		CI	0.40m Gravelly Sandy CLAY - medium plasticity, pale brown and pale grey-brown, fine to medium grained (mostly fine grained) sand, fine to coarse grained (mostly fine to medium grained) angular gravel.	M ~ W_P	VSt / Fb			RESIDUAL SOIL / EXTREMELY WEATHERED ROCK
							0.50m SANDY SILTSTONE - fine grained, pale brown to pale grey-brown, estimated very low strength.	D				HIGHLY WEATHERED ROCK
							0.60m SILTY SANDSTONE - fine grained, pale brown to pale orange-brown with some pale grey, estimated low to medium strength. 0.70m Estimated medium strength.					
							Hole Terminated at 0.70 m Practical Refusal					
				1.0								
				1.5								

LEGEND:

Water

▼	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH08
PAGE: 1 OF 1
CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
JOB NO: NEW22P-0130
LOCATION: MAX MCMAHON OVAL, RUTHERFORD
LOGGED BY: BB
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
SURFACE RL:
BOREHOLE DIAMETER: 300 mm
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m				CL	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, grey-brown, fine to medium grained sand, trace fine to medium grained angular gravel, trace asphalt and glass.	M > W_P				FILL / TOPSOIL
		0.30m E 0.40m		0.5		CI	0.25m Sandy CLAY - medium plasticity, pale grey to white, with some pale brown to pale orange-brown, fine to medium grained (mostly fine grained) sand. Pale grey-white. 0.60m		VSt	HP	300	RESIDUAL SOIL
				1.0 1.5			Hole Terminated at 0.60 m Limit Of Required Investigation					

LEGEND:

Water

⊻	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— —	Gradational or transitional strata
——	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Qualtest
LABORATORY (NSW) PTY LTD

ENGINEERING LOG - BOREHOLE

CLIENT: MAITLAND CITY COUNCIL C/ EJE ARCHITECTURE
PROJECT: PROPOSED SPORTS AMENITIES BUILDING
LOCATION: MAX MCMAHON OVAL, RUTHERFORD

BOREHOLE NO: **BH09**
PAGE: 1 OF 1
JOB NO: NEW22P-0130
LOGGED BY: BB
DATE: 14/7/22

DRILL TYPE: 2.7 TONNE EXCAVATOR
BOREHOLE DIAMETER: 300 mm
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E		E 0.10m			▨	SC	FILL-TOPSOIL: Clayey SAND - fine to medium grained, brown, fines of low plasticity, with some fine to medium grained rounded to sub-rounded gravel, root affected.	M				FILL / TOPSOIL
		0.50m E 0.60m		0.5	▨	CL	0.30m Gravelly Sandy CLAY - low to medium plasticity, pale brown to brown, fine to coarse grained sand, fine to medium grained, angular to sub-angular gravel, trace asphalt.	M > W_P				FILL
		0.70m E 0.80m			▨	CL	0.70m Sandy CLAY - low to medium plasticity, pale grey-brown, fine grained sand, trace fine grained angular to sub-angular gravel. 0.80m Grading into Extremely Weathered rock. (Sandy Siltstone)	M < W_P	St / Fb			RESIDUAL SOIL / EXTREMELY WEATHERED ROCK
				1.0			Hole Terminated at 0.80 m Limit Of Required Investigation					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

QT LIB 1.1.GLB Log NON-CORED BOREHOLE - TEST PIT NEW22P-0130 LOGS.GPJ <<DrawingFile>> 24/08/2022 19:58 10.03.00.09 Datgel Lab and In Situ Tool

Qualtest
LABORATORY (NSW) PTY LTD

2 Murray Dwyer Circuit,
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E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

DYNAMIC CONE PENETROMETER - TEST REPORT

Client: MAITLAND CITY COUNCIL
Principal:
Project: PROPOSED SPORTS AMENITIES BUILDING
Location: MAX McMAHON OVAL, RUTHERFORD

Project Number: *NEW22P-0130*
Sheet No: *1 of 1*
Test Date: 14/07/2022
Tested By: BB

Test Method: AS1289 6.3.2 ☑ **Cone Tip**
Drop Height: 510 ± 5mm ☑ **Blunt Tip**

Depth Below Surface (mm)	**Test Number**								**Test Location / Comments**
	DCP03	**DCP05**	**DCP07**						
150	2	2	1						DCP locations as per attached Figure AB1.
300	4	3	3						
450	3	7	5						
600	4	14	12/50mm						
750	5	21	Refusal						
900	9	29							
1050	11	Refusal							
1200	13/120mm								
1350	Refusal								
1500									
1650									
1800									
1950									
2100									
2250									
2400									
2550									
2700									
2850									
3000									
3150									
3300									
3450									
3600									
3750									
3900									
4050									
4200									
4350									
4500									

Comments: Readings recorded in blows per 150mm increments.

APPENDIX B:

Results of Laboratory Testing

QUALTEST Laboratory (NSW) Pty Ltd (20708)
2 Murray Dwyer Circuit, Mayfield West, NSW 2304
T: 02 4968 4468
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ABN: 98 153 268 896

Report No: SSI:NEW22W-2337-S01
Issue No: 1

Shrink Swell Index Report

Client: Maitland City Council
285-287 High Street
Maitland NSW 2320

Project No.: NEW22P-0130
Project Name: Max McMahon Amenities Redevelopment
Project Location: Max McMahon Oval, Rutherford

Accredited for compliance with ISO/IEC 17025-Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Results provided relate only to the items tested or sampled.

B. Cullen

Approved Signatory: Brent Cullen
(Engineering Geologist)
NATA Accredited Laboratory Number: 18686
Date of Issue: 29/07/2022

Sample Details

Sample ID: NEW22W-2337-S01
Sampling Method: The results outlined below apply to the sample as received
Material: Clay
Source: On Site
Specification: No Specification
Sample Location: BH03 - (0.5 - 0.7m)
Date Tested: 19/07/2022
Date Sampled: 14/07/2022
Date Submitted: 15/07/2022

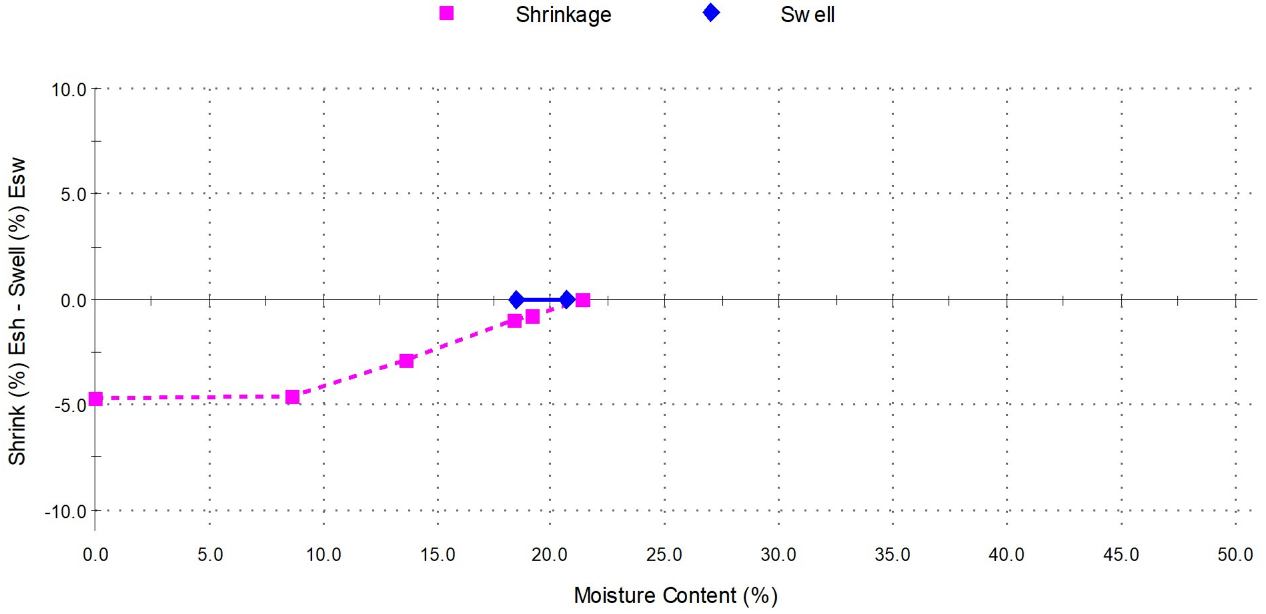
Swell Test AS 1289.7.1.1

Swell on Saturation (%):	0.0
Moisture Content before (%):	18.5
Moisture Content after (%):	20.6
Est. Unc. Comp. Strength before (kPa):	260
Est. Unc. Comp. Strength after (kPa):	160

Shrink Test AS 1289.7.1.1

Shrink on drying (%):	4.7
Shrinkage Moisture Content (%):	21.3
Est. inert material (%):	3%
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minimum

Shrink Swell



Shrink Swell Index - Iss (%): 2.6

Comments

QUALTEST Laboratory (NSW) Pty Ltd (20708)
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Report No: SSI:NEW22W-2337-S02
Issue No: 1

Shrink Swell Index Report

Client: Maitland City Council
285-287 High Street
Maitland NSW 2320

Project No.: NEW22P-0130
Project Name: Max McMahon Amenities Redevelopment
Project Location: Max McMahon Oval, Rutherford

Accredited for compliance with ISO/IEC 17025-Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Results provided relate only to the items tested or sampled.

B. Cullen
Approved Signatory: Brent Cullen
(Engineering Geologist)
NATA Accredited Laboratory Number: 18686
Date of Issue: 29/07/2022

Sample Details

Sample ID: NEW22W-2337-S02
Sampling Method: The results outlined below apply to the sample as received
Material: Sandy Clay
Date Sampled: 14/07/2022
Source: On Site
Date Submitted: 15/07/2022
Specification: No Specification
Sample Location: BH05 - (0.4 - 0.55m)
Date Tested: 19/07/2022

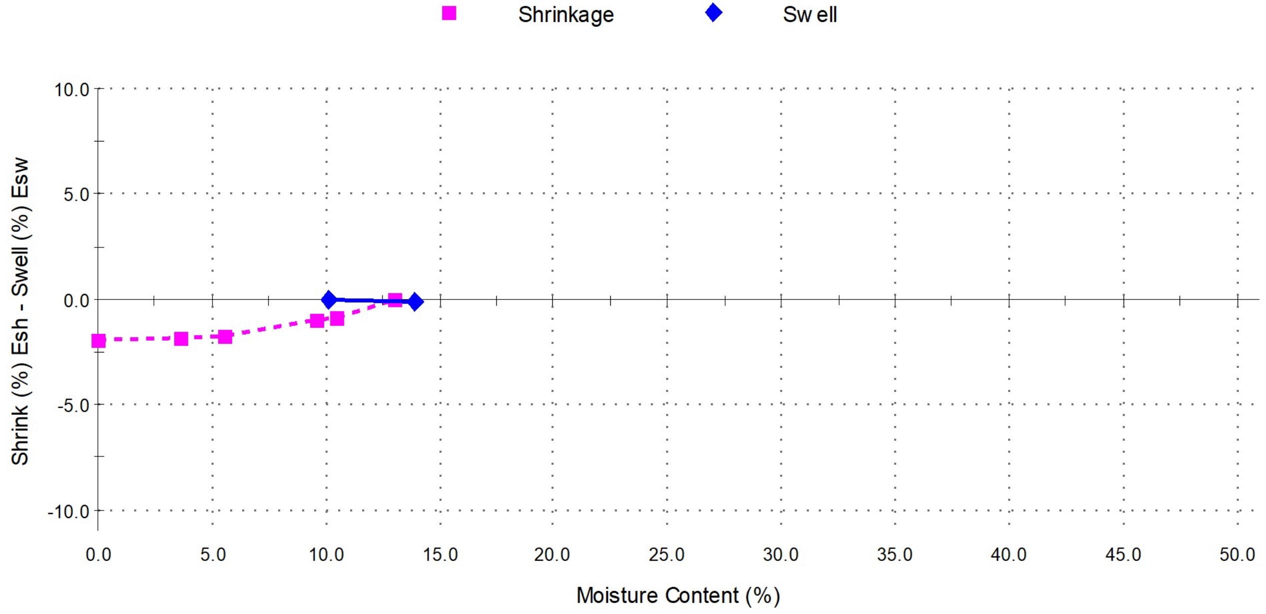
Swell Test AS 1289.7.1.1

Swell on Saturation (%):	-0.1
Moisture Content before (%):	10.1
Moisture Content after (%):	13.9
Est. Unc. Comp. Strength before (kPa):	>600
Est. Unc. Comp. Strength after (kPa):	>600

Shrink Test AS 1289.7.1.1

Shrink on drying (%):	1.9
Shrinkage Moisture Content (%):	13.0
Est. inert material (%):	1%
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 1.0

Comments

APPENDIX C:

CSIRO Sheet BTF 18

Foundation Maintenance and Footing Performance: A Homeowner's Guide

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

BTF 18
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

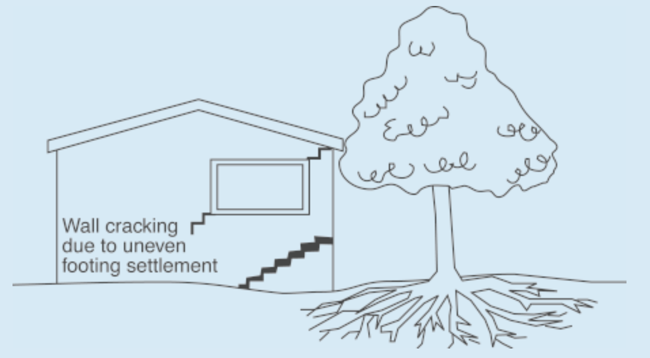
Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

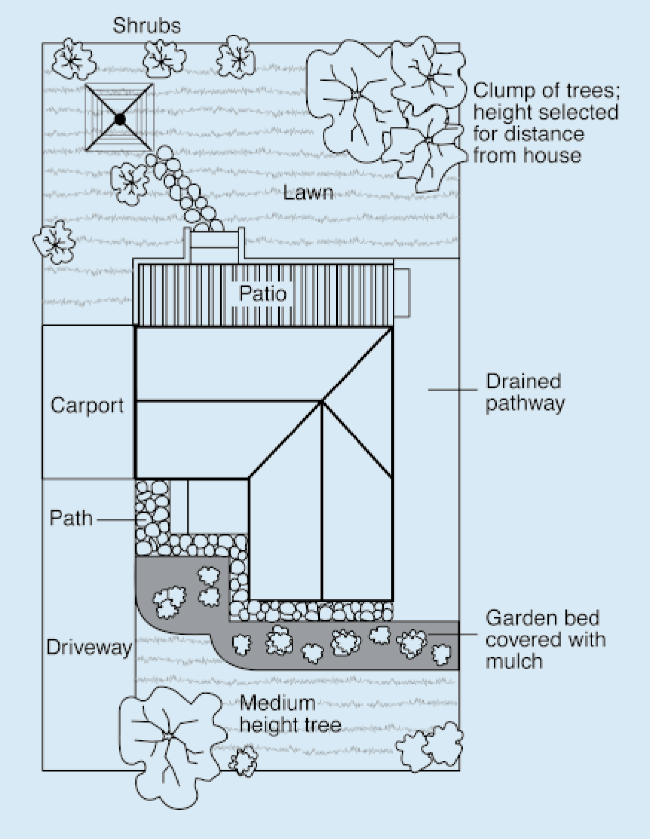
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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