GEOTECHNICAL INVESTIGATION

Proposed Piggery

553 Dick Knobels Rd MUNYABLA NSW 2658

August 2018

DM McMahon Pty Ltd
6 Jones St (PO Box 6118)
Wagga Wagga NSW 2650
t (02) **6931 0510** **www.dmmcmahon.com.au**

GEOTECHNICAL INVESTIGATION
553 Dick Knobels Rd, MUNYABLA NSW 2658

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1.0 Project brief

At the request of Robyn Tucker of Livestock Environmental and Planning (LEAP), soil sampling, analysis and reporting was carried out to assess the site for a proposed piggery development on 22 and 24 August 2018. The document provides information about the site and soil conditions from field observations and laboratory analysis.

Site identification
Address: 533 Dick Knobels Road, Munyabla NSW 2658
Real property description: Lot 1 DP 1211821 and Lot 2 DP 373967
Centre co-ordinate: 491101 6080100 MGA GDA z55
Property size: approx. 1,200ha
Owner: c/o Robyn Tucker
Local Council Area: Lockhart Shire Council
Present use: Agriculture
Development Application Reference: not known
Report identification: 5206

Certification

Name	Signed	Date	Revision Number
David McMahon **BAppSc** **GradDip WRM**		12/09/2018	0
Alexander Rudd **BSc**		12/09/2018	0

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2.0 Introduction

This report presents the results of a geotechnical investigation carried out by DM McMahon Pty Ltd (McMahon) for the proposed piggery at 553 Dick Knobels Rd, Munyabla NSW.

The geotechnical investigation was undertaken to support design and construction of the proposed piggery at Munyabla. The objectives of the investigation were to:

- Assess the subsurface conditions at the proposed site;
- Provide indicative geotechnical material characteristics for proposed design purposes; and
- Provide recommendations on backfill materials.

The geotechnical investigation work was commissioned by LEAP and was undertaken in general accordance with our proposal in an email from David McMahon to Robyn Tucker of LEAP dated 31 July 2018. The proposal was to:

- Drill four holes in the pond and compost site.
- Soil assessed for Particle Size Distribution, Atterberg Limits and Falling Head Permeability.
- Results compared to the provided standard.
- Recommendations for earthworks and compaction control.

The proposal was further revised in an email from Kym Bisset of KBM Farms dated 23 August 2018. Revisions to the proposal included:

- Updates to the draft plans providing a revised site layout and a more detailed plan of the proposed shed layout;
- Four additional boreholes to be drilled in the vicinity of the proposed sheds for the purpose of site classification as per AS2870.

3.0 Characteristics of the site

A desktop review and investigation of the topography, hydrology, soil, lithology, geology and hydrogeology of the site has been undertaken and are as follows:

3.1 Topography

The site is situated on the Pleasant Hills 1:50,000 Topographic Map sheet (8227-S). The site is located at an elevation range of approximately 196m to 200m AHD. The site slope is classed as level to very gently inclined, sloping away to the north. The landform is classed as a flat.

3.2 Vegetation

The investigated area was sown to wheat at the time of investigation, some scattered paddock trees were also present.

3.3 Weather

The mean rainfall for Yerong Creek is approximately 542.0mm per annum. The wettest months are June, July and October; however, the rainfall is spread relatively evenly throughout the year. Mean maximum monthly temperatures range from 15.1 ºC in July to 35.8 ºC in January and mean minimum monthly temperatures range from 10.8 ºC in July to 27.5 ºC in January. Historical records obtained from Yerong Creek (Fertilizer Depot) NSW AWS 074126 and Wagga Wagga AMO NSW AWS 072150, respectively (www.bom.gov.au).

3.4 Hydrology

The site is located on the drainage plains of the Murrumbidgee River system catchment area. Mittagong Creek intersects the property, along with an unnamed waterway, which is a first order tributary of the Mundawaddery Creek. Due to the relative incline of the site and relatively permeable soils, rainfall is likely to both run off and infiltrate into soil at the site.

3.5 Soil & Landform

The site lies within the mapping units **Va17** from the Digital Atlas of Australian Soils (CSIRO, 1991).

The map unit **Va17** is described as:

"Flat to gently undulating country with some swamps and broken by an occasional low gravelly or stony ridge or hillock: chief soils are hard alkaline yellow mottled soils (Dy3.43) and (Dr2.33), both containing ironstone gravel and sometimes forming soil complexes. Associated are: ridges and hillocks of (Dr2.32, Dr2.42) and (Um4.1) soils similar to unit Qc3; small flat areas of (Dr2.23); and various undescribed soils in local situations, e.g. subjacent to swamps and on stream terraces. Data are limited. Occurs on sheet(s): 3"

3.6 Geology

The site geology is distributed over two units: Cainozoic colluvium and Early Palaeozoic metasedimentary rocks.

3.7 Hydrogeology

From the Geoscience Australia hydrogeology dataset, the groundwater beneath the site is described as fractured or fissured extensive aquifers of low to moderate productivity.

4.0 Geotechnical Investigation Scope of Works

The specification for the geotechnical investigation as proposed by DM McMahon Pty Ltd are as follows, **Table 1**.

Table 1: *Scope of works*

Item	Description	
1.	Where available, review plans and other general related documents provided to us to gain a comprehensive understanding of the proposed project.	-
2.	Undertake a desktop study of local landform, geological, lithological & hydrogeological conditions.	-
3.	Conduct Dial Before You Dig search and utilise a service locator onsite (where required).	-
4.	Carry out field investigations by reference to AS1726:2017 Geotechnical Site Investigations.	Allowed 8 holes in total: - 2 holes to 6.0m - 6 holes to 1.5m
5.	Analyse soils in situ and at our NATA accredited laboratory to AS/RMS methods.	8 x Linear Shrinkage 4 x Liquid Limit 4 x Plastic Limit/Plasticity Index 4 x Particle Size Distribution 1 x Maximum Dry Density 1 x Optimum Moisture Content

		1 x Falling Head Permeability
6.	Generate laboratory reports and review results.	-
7.	Compile results in report detailing methodology, desktop study, physical conditions, field work results, test locations, bore logs, in-situ test results, laboratory results and discussion.	-
8.	Report on site classification, founding depths, subgrade preparation, backfill recommendations, trafficability and groundwater.	-

As follows is an aerial image of the site with approximate soil investigation points, **Figure 1**.

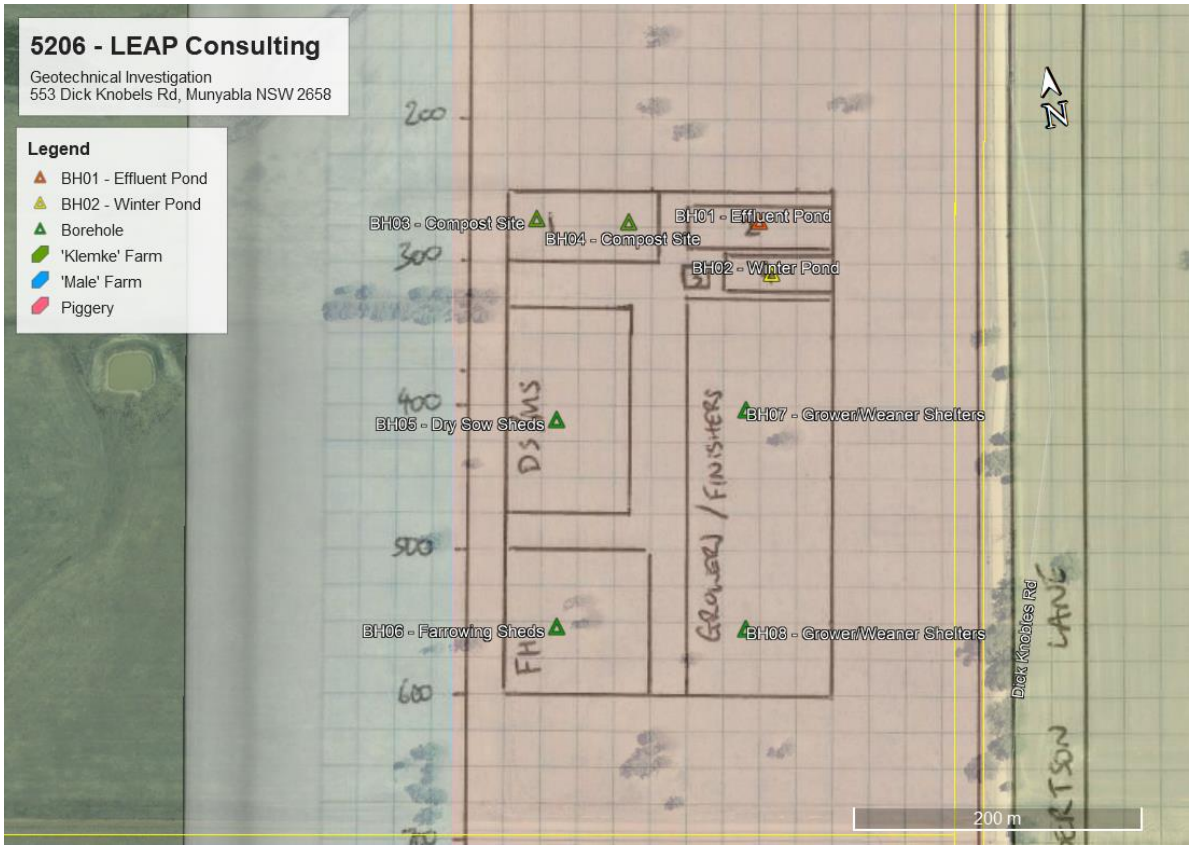

Figure 1: *Geotechnical investigation map - boreholes*

The bore logs can be seen in the attachments with the coordinates of the test locations provided in Map Grid of Australia (MGA) GDA94 Zone 55.

5.0 Subsurface Conditions

A judgemental sampling pattern was employed to assess the subsurface conditions across the site, whereby sample points were chosen on the basis of the investigator's knowledge of probable distribution of the site and utilises site history, field observations and any plans or design proposals provided by the client. As such investigation locations were selected based on revised preliminary design drawings of the proposed piggery provided by Kym Bisset. **Table 2** below outlines the selected investigation points targeting proposed on site developments.

Table 2: *Outline of investigation points*

Investigation Point	Proposed development	Investigation Point	Proposed development
BH01	Effluent Pond	BH05	Dry Sow Sheds
BH02	Winter Pond	BH06	Farrowing Sheds
BH03	Compost Site	BH07	Grower/Weaner Shelters
BH04	Compost Site	BH08	Grower/Weaner Shelters

Subsurface conditions encountered across the site were generally consistent over the investigation area. A thin topsoil covered the site to approximately 0.2m overlying brown to brownish yellow silty clays of low to medium plasticity to approximately 0.8m. Subsoils below 0.8m were yellowish brown to brownish yellow silty clays of low to medium plasticity.

Subsurface moisture conditions remained consistent across all investigation points. Topsoils were generally dry to moderately moist with subsoils being moderately moist. Beyond 2.0m to the maximum borehole depth of 6.0m, soils moisture was found to be moist. In some areas, it is expected that moisture conditioning may be required where earthworks will be carried out for the construction of access paths and driveways. Subsurface soil moisture condition has a considerable effect on soil bearing capacity determination using a dynamic cone penetrometer.

Soils types encountered on site have been classified and grouped as per AS1726: Geotechnical Site Investigations as fine or coarse grained soils for ease of identification and will be further referenced by the categories presented in **Table 3** below. Depth measurements presented in **Table 3** are the depths of the upper limit of the soil horizon from the finished level at the time of the investigation. Note that some layers are not able to be classified under the AS1726 classification system and may have been omitted from the table.

A summary of the laboratory results can be seen in the following Table 4.

Table 3: *Summary of borelogs*

Group Symbol	AS1726 Soil Category Description	BH01 (m)	BH02 (m)	BH03 (m)	BH04 (m)
OL	Organic clay of medium to high plasticity, organic silt	**0.0-0.2**	**0.0-0.2**	**0.0-0.2**	**0.0-0.2**
CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	**0.2-6.0**	**0.2-6.0**	**0.2-1.5**	**0.2-1.5**

Group Symbol	AS1726 Soil Category Description	BH05 (m)	BH06 (m)	BH07 (m)	BH08 (m)
OL	Organic clay of medium to high plasticity, organic silt	**0.0-0.2**	**0.0-0.2**	**0.0-0.25**	**0.0-0.2**
CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	**0.2-1.5**	**0.2-1.5**	**0.25-1.5**	**0.2-1.5**

Table 4: *Results summary of laboratory testing and soil physical characteristics*

Sample ID	Site	Sample Depth (m)	Field Consistency	Linear Shrinkage (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Permeability (K_{sat}) (m/sec)
5206/1.1	BH01	0.2-0.9	Firm	-	-	-	-	-
5206/1.2	BH01	0.9-2.0	Firm	-	-	-	-	-
5206/1.3	BH01	2.0-6.0	Firm	-	35	17	18	$1.83x10^{-9}$
5206/2.1	BH02	0.2-0.9	Firm	-	-	-	-	-
5206/2.2	BH02	0.9-2.0	Firm	-	-	-	-	-
5206/2.3	BH02	2.0-6.0	Firm	-	32	11	21	$1.83x10^{-9}$
5206/3.1	BH03	0.2-0.8	Firm	-	39	15	24	-
5206/3.2	BH03	0.8-1.5	Firm	-	-	-	-	-
5206/4.1	BH04	0.2-0.8	Firm	-	36	13	24	-
5206/4.2	BH04	0.8-1.5	Firm	-	-	-	-	-
5206/5.1	BH05	0.2-0.8	Firm	8.0	-	-	-	-
5206/5.2	BH05	0.8-1.5	Firm	12.0	-	-	-	-
5206/6.1	BH06	0.2-0.8	Firm	8.0	-	-	-	-
5206/6.2	BH06	0.8-1.5	Firm	12.0	-	-	-	-
5206/7.1	BH07	0.25-0.8	Firm	10.0	-	-	-	-
5206/7.2	BH07	0.8-1.5	Firm	11.0	-	-	-	-
5206/8.1	BH08	0.2-0.8	Firm	10.0	-	-	-	-
5206/8.2	BH08	0.8-1.5	Firm	11.0	-	-	-	-

6.0 Comments and Recommendations

The discussion and recommendations provided below are based on field observations and laboratory testing at discrete locations. Laboratory reports can be seen attached in the appendix.

6.01 Site Classification

For the purpose of general characteristic, the site is classified as **H1-D** which is: **Highly reactive (deep drying) clay or silt sites, which may experience high ground movement from moisture changes** by reference to AS2870:2011.

6.02 Settlement

It is expected that the total settlement of the foundations founded are likely to be in the range of 5mm to 10mm on natural clayey subsoils.

6.03 Particle Size Analysis

Four samples obtained were tested for particle size analysis under a modified RMS test method T107. Site-won materials that are excavated from below 0.9m are expected to be fine grained soils high in clay content (~60%) with some trace fine sands and silt sized particles. The site won materials from below 0.9m are well suited for use as engineered fill in construction of dam walls if found necessary.

6.04 Maximum Dry Density and Optimum Moisture Content

Laboratory Maximum Dry Density (MDD) values were obtained under standard compactive effort as per AS1289.5.1.1. The MDD of the silty CLAY material sampled between 0.9m to 2.0m was 1.592 t/m^3 at an optimum moisture content (OMC) of 22.0%, which is typical of soils high in clay content.

6.05 Permeability

One composite sample (BH01 & BH02) was tested for permeability characteristics as per AS1289.6.7.2 - Falling head permeability, returning a result of $1.83x10^{-9}$m/day. It is expected that the materials are suitable for the construction and use of the proposed clay liner if field conditions closely replicate that of the test method. As per AS1289.6.7.2, samples are to be compacted to a laboratory density ratio of 100 ±1% of Maximum Dry Density.

6.06 Earthworks Suitability

Unsuitable Material

Unsuitable Material was found as follows:

- Topsoil containing organic matter was identified on site at varying depths. It is recommended that where present, organic topsoils are removed from site to a depth at which suitable material is encountered.
- Soft natural soils (inferred CBR <1), typically soft due to high soil moisture content in areas where poor surface drainage or surface water pooling may occur.

While this report identifies the presence of unsuitable fill materials, there is the possibility of other unsuitable materials being uncovered on site upon commencement of earthworks. If any deleterious or unsuitable materials or conditions are discovered in situ upon commencement of earthworks, the material should be removed from site and replaced with suitable structural fill with a CBR equal to or greater than the specified design CBR. The replacement fill materials should also comply with AS1289 5.1.1, 5.4.1, 5.7.1 or to relevant Council specifications.

Structural Fill

Residual natural soils derived from alluvial deposition are the only materials on site that have been positively identified as being suitable for use as structural fill (CBR >4).
As previously stated, changes in moisture regime occur across the site and it is recommended that where excavation occurs, and poor soil moisture conditions are encountered, soil moisture conditioning may need to be carried out on subgrade materials prior to any construction works being carried out.

Based on the above considerations, an appropriate CBR value of 4 may be adopted as the minimum requirement for any imported structural fill materials. Furthermore, RTA Q3071 provides specifications for select fill materials. It is recommended that any imported fill material be of similar quality to that specified in RMS Q3071 for select fill materials to be used as structural fill.

7.0 Site Preparation and Earthworks

New fill for the preparation of pavement subgrade should be placed, compacted and tested to an engineering specification in general accordance with recommendations outlined in AS3798-2007, ‘Guidelines on Earthworks for Commercial and Residential Developments’ or to Council specification. The following general procedure is recommended as a guide for site preparation and the placement of controlled fill:

- Remove existing topsoil, uncontrolled fill, vegetation, root affected or other potentially deleterious materials from proposed fill area;
- Earthworks are ideally carried out in dry weather conditions;
- Provisions are made for effective surface water diversion away from outside the pavement works site;
- It is possible that site preparation could expose wet subgrade material, particularly if excavation is carried out after a prolonged period of rainfall. Trafficability in the low to

medium plasticity clay material for wheeled vehicles can be expected to be slightly difficult during and following rainfall. If material wets up during construction, it should be scarified, dried and re-compacted;

- The exposed natural soils should then be scarified to a depth of about 200mm, moisture conditioned to within ±2% of Standard Optimum Moisture Content (SOMC) and then re-compacted to a standard maximum dry density (SMDD) of 98% in accordance with AS1289 5.1.1, 5.4.1 or 5.7.1 or to Council specifications;
- Any soft or weak areas identified during the compaction process that do not respond to further compaction should be removed and replaced with suitable site materials in layers not exceeding 250mm thickness and should be compacted to the above criteria.
- If required, the subgrade should be stabilised as recommended; and
- Subsequent layers of fill should be placed in uniform layers as specified, moisture conditioned and compacted to a minimum of 100% SMDD for base and 98% SMDD for sub-base and select fill or to council specification. The compacted layers are to be tested by a relevant NATA accredited facility.

The backfilling of the service trenches should be undertaken carefully. The bedding materials and materials immediately around the services should be placed and compacted as per AS3725 or other relevant standards. The general backfill above the pipe should be compacted to the following criteria:

- When backfilling service trenches with sand or aggregate, compaction to a density index of at least 70% should be used;
- When backfilling service trenches the cohesive materials (e.g. clays, sandy clays) should be moisture conditioned to within ±2% of standard optimum moisture content and then compacted to a minimum dry density of 95% standard in accordance with AS1289 5.1.1, 5.4.1 or 5.7.1;
- The earthworks at the site should be inspected and tested as per the requirements of AS3798-2007 and should be carried out during dry weather conditions; and
- Provision should be made for effective diversion of surface water from outside the site. The surface runoff from the site should be treated to remove sediments before discharge.

8.0 Notes relating to results

Groundwater

A standing groundwater level or seepage was not observed within the boreholes during fieldwork. A groundwater table or seepage may be present at other times and fluctuations in groundwater levels and seepage could occur due to rainfall, change in temperature and other factors.

Bore hole / test pit logging

The information supplied in the log sheets is based on visual and tactile assessment based on field conditions at the time of testing. The log sheets can include inferred data based on the experience of the geotechnician as well as factual data from in situ testing.

Log Column		Symbol	Definition
Soil Origin		TOPSOIL	Mantle of surface and/or near-surface soil often but not always defined by high levels of organic material, both dead and living. Remnant topsoils are topsoils that subsequently been buried by other transported soils. Roots of trees may extend significantly into otherwise unaltered soil and the presence of roots is not a sufficient reason for describing a material as topsoil.
		FILL	Any material which has been placed by anthropogenic processes
		Alluvial	Deposited by streams and rivers
		Colluvial	Soil and rock debris transported down slope by gravity, with or without the assistance of flowing water and generally deposited in gullies or at the base of slopes. Colluvium is often used to refer to thicker deposits such as those formed from landslides, whereas the term 'slopewash' may be used for thinner and more widespread deposits that accumulate gradually over longer geological timeframes.
		Extremely weathered material	Formed directly from in situ weathering of geological formations. Although this material is of soil strength, it retains the structure and/or fabric of the parent rock material.
		Residual	Formed directly from in situ weathering of geological formations. These soils no longer retain any visible structure or fabric of the parent soil or rock material
Class (AS1726-2017)	Coarse grained soils	GW	Gravel and gravel-sand mixtures, little to no fines
		GP	Gravel and gravel-sand mixtures, little to no fines, uniform gravels
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures
		SW	Sand and gravel-sand mixtures, little to no fines
		SP	Sand and gravel-sand mixtures, little to no fines
		SM	Sand-silt mixtures
		SC	Sand-clay mixtures
	Fine grained soils	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity
		CL, CI	Inorganic clays of low to medium plasticity, gravelly clay, sandy clay
		OL	Organic silt
		MH	Inorganic silt
		CH	Inorganic clays of high plasticity
		OH	Organic clay of medium to high plasticity, organic silt
		Pt	Peat, highly organic soil
Soil Name/ Description		SAND	Coarse grained soil
		SILT	Fine grained soil – low dry strength, low wet toughness and dilatancy
		CLAY	Fine grained soil – high dry strength, high wet toughness and plasticity
Grain Size		Coarse	>2mm
		Medium	0.06 – 2mm
		Fine	<0.06mm
Moisture		D	Dry
		T	Moist
		M	Moderately Moist
		W	Wet
Plasticity		Non-plastic	Not applicable
		Low	Only slight pressure is required to roll the thread of soil near the plastic limit. The thread and lump are weak and soft. The dry specimen crumbles into powder with some finger pressure.
		Medium	Medium pressure is required to roll the thread of soil to near the plastic limit. The thread and lump have medium stiffness. The dry specimen breaks into pieces or crumbles with considerable finger pressure.
		High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness. The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.
Consistency		Very Soft (VS)	Exudes between fingers when squeezed in hand
		Soft (S)	Can be moulded by light finger pressure
		Firm (F)	Can be moulded by strong finger pressure
		Stiff (St)	Cannot be moulded by fingers
		Very Stiff (VSt)	Can be indented by thumb nail
		Hard (H)	Can be indented by thumb nail with difficulty
		Friable (Fr)	Can be easily crumbled or broken into small pieces by hand

9.0 Disclaimer

The information contained in this report has been extracted from field and laboratory sources believed to be reliable and accurate. DM McMahon Pty Ltd will not assume any responsibility for the misinterpretation of information supplied in this report. The accuracy and reliability of recommendations identified in this report need to be evaluated with due care according to individual circumstances. It should be noted that the recommendations and findings in this report are based solely upon the said site location and the ground level conditions at the time of testing. The results of the said investigations undertaken are an overall representation of the conditions encountered. The properties of the soil within the location may change due to variations in ground conditions outside of the tested area. The author has no control or liability over site variability that may warrant further investigation that may lead to significant design changes.

10.0 Reference

Bureau of Rural Sciences after Commonwealth Scientific and Industrial Research Organisation (1991), *Digital Atlas of Australian Soils*

Geeves GW, Craze B and Hamilton GJ 2007a. Soil physical properties. In 'Soils – their properties and management'. 3rd edn. (Eds Charman PEV and Murphy BW) pp. 168-191 Oxford University Press Melbourne.

Geology information: Copyright Commonwealth of Australia (MDBC) 1999

Hazelton P and Murphy B 2007, Interpreting Soil Test Results, What do All the Numbers Mean?, NSW Dept Natural Resources.

Roads and Maritime Services, Test Method T107 - Fine particle size distribution of road construction materials, Oct 2012

Roads and Maritime Services, QA Specification R3071, Selected Materials in Formation 2013

Standards Australia AS 1289.5.1.1:2017 - Determination of the dry density/moisture content relation of a soil using standard compactive effort

Standards Australia AS 1289.5.4.1:2007 - Compaction Control Test - Dry density ratio, moisture variation and moisture ratio

Standards Australia AS 1289.5.7.1:2006 - Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)

Standards Australia AS 1289.6.1.1:2014 - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen

Standards Australia AS 1289.6.3.2:1997 - Determination of the penetration resistance of a soil - 9kg dynamic cone penetrometer test

Standards Australia AS 1726 – 2017 Geotechnical Site Investigations

Standards Australia AS 2870 – 2011 Residential Slabs and Footings

Standards Australia AS 3798 – 1996 Guidelines on earthworks for commercial and residential developments

11.0 Attachments

Attachment	Details
A. Bore logs	1 page
B. Laboratory reports 5206	3 pages

McMahon EARTH SCIENCE

DOCUMENT ATTACHMENTS

REPORT 2018

DM McMahon Pty Ltd
6 Jones Street, (PO Box 6118)
Wagga Wagga NSW 2650

t (02) 6931 0510
www.dmmcmahon.com.au

Attachment A : *Bore logs*

McMahon EARTH SCIENCE

AS1726:2017 Bore Log Page 1 of 1

Job No: 5206	**Landform:** Flat
Client: LEAP Consulting	**Slope:** Very Gently Inclined / Level
Site: 553 Dick Knobels Rd, Munyabla NSW 2658	**Vegetation/Surface:** Annual Grasses / Few scattered paddock trees
Date: 24/08/2018	**Logged By:** JB & LN

Sheet: 'Geotech Field Sheet_rev2'

Sampling Method: AS1289.1.2.1-1998: cl. [ ] 6.5.1 - Hand Excavated [ ] 6.5.2 - Hand Auger [X] 6.5.3 - Power Auger [ ] 6.5.4 - Machine Excavated Other:_____

Site Identity	Sample	Co-ordinates MGA GDA94 z55	Depth to Top of Layer (m)	Depth to Bottom of Layer	Classification (AS1726:2017 Table 9 & 10)	Soil Name (BLOCK LETTERS)	Grain Size (Fine / Coarse)	Primary Colour	Mottle Colour	Plasticity	Consistency (Cohesive soils)	Relative Density (Non-cohesive)	Moisture	Soil Origin	Comments (Coarse Fragments, Size, %, Structure (Zoning, Defects, Cementing etc.))
BH01		490743E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081609S	0.2	0.9	CI	Silty CLAY	Fine	+B	Y + R	Med	F	-	T	Alluvial	
	2		0.9	2.0	CI	Silty CLAY	Fine	YB	R	Med	F	-	T	Alluvial	with trace fine sands
	3		2.0	6.0	CI	Silty CLAY	Fine	YB	R + Y	Med	F	-	M	Alluvial	
BH02		490746E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081572S	0.2	0.9	CI	Silty CLAY	Fine	+B	Y + R	Med	F	-	T	Alluvial	
	2		0.9	2.0	CI	Silty CLAY	Fine	YB	R	Med	F	-	T	Alluvial	with trace fine sands
	3		2.0	6.0	CI	Silty CLAY	Fine	YB	R + Y	Med	F	-	M	Alluvial	
BH03		490590E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081634S	0.2	0.8	CI	Silty CLAY	Fine	+B	R	Med	F	-	T	Alluvial	with trace fine sands
	2		0.8	1.5	CI	Silty CLAY	Fine	YB	R	Med	F	-	T	Alluvial	
BH04		490653E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081622S	0.2	0.8	CI	Silty CLAY	Fine	BY	R + Y	Med	F	-	T	Alluvial	
	2		0.8	1.5	CI	Silty CLAY	Fine	YB	R	Med	F	-	T	Alluvial	with trace fine sands
BH05		490583E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081494S	0.2	0.8	CI	Silty CLAY	Fine	+B	R	Med	F	-	T	Alluvial	
	2		0.8	1.5	CI	Silty CLAY	Fine	BY	-	Med	F	-	T	Alluvial	with trace fine sands
BH06		490562E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081353S	0.2	0.8	CI	Silty CLAY	Fine	+B	R	Med	F	-	T	Alluvial	
	2		0.8	1.5	CI	Silty CLAY	Fine	BY	-	Med	F	-	T	Alluvial	with trace fine sands
BH07		490714E	0.0	0.25	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081481S	0.25	0.8	CI	Silty CLAY	Fine	+B	R	Med	F	-	T	Alluvial	
	2		0.8	1.5	CI	Silty CLAY	Fine	BY	-	Med	F	-	T	Alluvial	with trace fine sands
BH08		490691E	0.0	0.2	OL	Silty CLAY	Fine	+B	-	Low	S	-	T	TOPSOIL	Organic Horizon
	1	6081332S	0.2	0.8	CI	Silty CLAY	Fine	+B	R	Med	F	-	T	Alluvial	
	2		0.8	1.5	CI	Silty CLAY	Fine	BY	-	Med	F	-	T	Alluvial	with trace fine sands

Attachment B : *Laboratory reports 5206*

DM McMahon Pty Ltd
PO Box 6118
WAGGAWAGGA NSW 2650
Ph: 0269 310 510

TEST REPORT
FALLING HEAD PERMEABILITY
AS TEST METHOD AS 1289.6.7.2

CLIENT: LEAP Consulting
JOB DESCRIPTION: Geotechnical Investigation
LOCATION: 553 Dick Knobels Road, Munaybla

PAGE: 1
OF: 4
SUBMITTED BY: JB & LN
DATE SUBMITTED: 24/08/18
NO OF SAMPLES: 1
TEST METHODS: AS 1289.6.7.2
RMS T111
RMS T120
JOB NUMBER: 5206

MATERIAL TYPE: Soil - Clay
SURCHARGES ADDED: 2.65kg (1.0L mould)
PRESSURE APPLIED: 3kPa
NOMINAL SIEVE SIZE: 9.5mm
% RETAINED SIEVE: Nil
COMPACTION METHOD: STANDARD

Sample No.	Maximum Dry Density - MDD (t/m3)	Optimum Moisture - OMC (%)	Dry Density of Specimen (%)	Moisture Moulding (%)	% of OMC	% of MDD	Permeability m/sec
1	1.592	22.0	1.589	22.6	102.7	99.8	1.83×10^{-9}
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*

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REMARKS:

APPROVED SIGNATORY: A. Rudd

DATE: 11/09/2018

DM McMahon Pty Ltd
PO Box 6118
WAGGA WAGGA NSW 2650
Ph: 0269 310 510

SUBMITTED BY: JB & LN
DATE SUBMITTED: 24/08/18
NO OF SAMPLES: 12
SAMPLING METHOD: AS1289.1.2.1
CLAUSE: 6.5.3
SPECIFICATIONS: *

TEST REPORT

PAVEMENT MATERIALS, FILLS, SUBGRADE AND SOILS

CLIENT: LEAP Consulting
JOB DESCRIPTION: Geotechnical Investigation
553 Dick Knobels Road, Munyabla NSW 2658

MATERIAL SOURCE: In situ
PROPOSED USE: Design
MATERIAL TYPE: Soil

JOB NO.: 5206

		SAMPLE NUMBER:			BH01/3	BH02/3	BH03/1	BH04/1	BH05/1
		SITE OR CHAINAGE (m):			BH01	BH02	BH03	BH04	BH05
		DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):			2.0-6.0	2.0-6.0	0.2-0.8	0.2-0.8	0.2-0.8
		SPECIFIED LIMITS LISTED BELOW FOR:	*	*	*	*	*	*	*
TESTS		PRETREATMENT:	*	*	*	*	*	*	*
T106		PASS 75.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 53.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 37.5mm SIEVE %	*	*	*	*	*	*	*
		PASS 26.5mm SIEVE %	*	*	*	*	*	*	*
		PASS 19.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 13.2mm SIEVE %	*	*	*	*	*	*	*
		PASS 9.50mm SIEVE %	*	*	*	*	*	*	*
		PASS 6.70mm SIEVE %	*	*	*	*	*	*	*
		PASS 4.75mm SIEVE %	*	*	*	*	*	*	*
		PASS 2.36mm SIEVE %	*	*	*	*	*	*	*
T107	WHOLE	PASS 425µm SIEVE %	*	*	*	*	*	*	*
	SAMPLE	PASS 75µm SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5µm %	*	*	*	*	*	*	*
T107^	-2.36mm	PASS 212µm SIEVE %	*	*	5.0	1.4	4.0	4.3	*
(Modified)		PASS 75µm SIEVE %	*	*	31.1	36.7	46.5	66.5	*
		LESS THAN 13.5µm %	*	*	64.0	62.0	49.5	29.2	*
		OBSERVATIONS	*	*	*	*	*	*	*
RATIOS	A -	PASS 425µm %	*	*	*	*	*	*	*
	B -	PASS 75/425 µm %	*	*	*	*	*	*	*
	C -	BELOW 13.5/75µm %	*	*	*	*	*	*	*
AS1289.3.1.2		LIQUID LIMIT %	*	*	35	32	39	36	*
AS1289.3.2.1		PLASTIC LIMIT %	*	*	17	11	15	13	*
AS1289.3.3.1		PLASTICITY INDEX %	*	*	18	21	24	24	*
T113		LINEAR SHRINKAGE %	*	*	*	*	*	*	8.0
T111		MAX. DRY DENSITY t/m³	*	*	*	*	*	*	*
		OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
AS1289.3.8.1		EMERSON AGGREGATE TEST	*	*	*	*	*	*	*
T120		FIELD MOISTURE CONTENT %	*	*	*	*	*	*	*

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APPROVED SIGNATORY: DM McMahon

DATE: 11/09/18

DM McMahon Pty Ltd
PO Box 6118
WAGGA WAGGA NSW 2650
Ph: 0269 310 510

SUBMITTED BY: JB & LN
DATE SUBMITTED: 24/08/18
NO OF SAMPLES: 12
SAMPLING METHOD: AS1289.1.2.1
CLAUSE: 6.5.3
SPECIFICATIONS: *

TEST REPORT

PAVEMENT MATERIALS, FILLS, SUBGRADE AND SOILS

CLIENT: LEAP Consulting
JOB DESCRIPTION: Geotechnical Investigation
553 Dick Knobels Road, Munyabla NSW 2658

MATERIAL SOURCE: In situ
PROPOSED USE: Design
MATERIAL TYPE: Soil

JOB NO.: 5206

		SAMPLE NUMBER:			BH05/2	BH06/1	BH06/2	BH07/1	BH07/2
		SITE OR CHAINAGE (m):			BH05	BH06	BH06	BH07	BH07
		DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):			0.8-1.5	0.2-0.8	0.8-1.5	0.25-0.8	0.8-1.5
		SPECIFIED LIMITS LISTED BELOW FOR:	*	*	*	*	*	*	*
TESTS		PRETREATMENT:	*	*	*	*	*	*	*
T106		PASS 75.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 53.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 37.5mm SIEVE %	*	*	*	*	*	*	*
		PASS 26.5mm SIEVE %	*	*	*	*	*	*	*
		PASS 19.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 13.2mm SIEVE %	*	*	*	*	*	*	*
		PASS 9.50mm SIEVE %	*	*	*	*	*	*	*
		PASS 6.70mm SIEVE %	*	*	*	*	*	*	*
		PASS 4.75mm SIEVE %	*	*	*	*	*	*	*
		PASS 2.36mm SIEVE %	*	*	*	*	*	*	*
T107	WHOLE	PASS 425µm SIEVE %	*	*	*	*	*	*	*
	SAMPLE	PASS 75µm SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5µm %	*	*	*	*	*	*	*
T107^	-2.36mm	PASS 212µm SIEVE %	*	*	*	*	*	*	*
(Modified)		PASS 75µm SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5µm %	*	*	*	*	*	*	*
		OBSERVATIONS	*	*	*	*	*	*	*
RATIOS	A -	PASS 425µm %	*	*	*	*	*	*	*
	B -	PASS 75/425 µm %	*	*	*	*	*	*	*
	C -	BELOW 13.5/75µm %	*	*	*	*	*	*	*
AS1289.3.1.2		LIQUID LIMIT %	*	*	*	*	*	*	*
AS1289.3.2.1		PLASTIC LIMIT %	*	*	*	*	*	*	*
AS1289.3.3.1		PLASTICITY INDEX %	*	*	*	*	*	*	*
T113		LINEAR SHRINKAGE %	*	*	12.0	10.0	11.0	8.0	12.0
T111		MAX. DRY DENSITY t/m³	*	*	*	*	*	*	*
		OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
AS1289.3.8.1		EMERSON AGGREGATE TEST	*	*	*	*	*	*	*
T120		FIELD MOISTURE CONTENT %	*	*	*	*	*	*	*

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APPROVED SIGNATORY: DM McMahon

DATE: 11/09/18

DM McMahon Pty Ltd
PO Box 6118
WAGGA WAGGA NSW 2650
Ph: 0269 310 510

SUBMITTED BY: JB & LN
DATE SUBMITTED: 24/08/18
NO OF SAMPLES: 12
SAMPLING METHOD: AS1289.1.2.1
CLAUSE: 6.5.3
SPECIFICATIONS: *

TEST REPORT

PAVEMENT MATERIALS, FILLS, SUBGRADE AND SOILS

CLIENT: LEAP Consulting
JOB DESCRIPTION: Geotechnical Investigation
553 Dick Knobels Road, Munyabla NSW 2658

MATERIAL SOURCE: In situ
PROPOSED USE: Design
MATERIAL TYPE: Soil

JOB NO.: 5206

		SAMPLE NUMBER:			BH08/1	BH08/2	*	*	*
		SITE OR CHAINAGE (m):			BH08	BH08	*	*	*
		DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):			0.2-0.8	0.8-1.5	*	*	*
		SPECIFIED LIMITS LISTED BELOW FOR:	*	*	*	*	*	*	*
TESTS		PRETREATMENT:	*	*	*	*	*	*	*
T106		PASS 75.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 53.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 37.5mm SIEVE %	*	*	*	*	*	*	*
		PASS 26.5mm SIEVE %	*	*	*	*	*	*	*
		PASS 19.0mm SIEVE %	*	*	*	*	*	*	*
		PASS 13.2mm SIEVE %	*	*	*	*	*	*	*
		PASS 9.50mm SIEVE %	*	*	*	*	*	*	*
		PASS 6.70mm SIEVE %	*	*	*	*	*	*	*
		PASS 4.75mm SIEVE %	*	*	*	*	*	*	*
		PASS 2.36mm SIEVE %	*	*	*	*	*	*	*
T107	WHOLE	PASS 425µm SIEVE %	*	*	*	*	*	*	*
	SAMPLE	PASS 75µm SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5µm %	*	*	*	*	*	*	*
T107^	-2.36mm	PASS 212µm SIEVE %	*	*	*	*	*	*	*
(Modified)		PASS 75µm SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5µm %	*	*	*	*	*	*	*
		OBSERVATIONS	*	*	*	*	*	*	*
RATIOS	A -	PASS 425µm %	*	*	*	*	*	*	*
	B -	PASS 75/425 µm %	*	*	*	*	*	*	*
	C -	BELOW 13.5/75µm %	*	*	*	*	*	*	*
AS1289.3.1.2		LIQUID LIMIT %	*	*	*	*	*	*	*
AS1289.3.2.1		PLASTIC LIMIT %	*	*	*	*	*	*	*
AS1289.3.3.1		PLASTICITY INDEX %	*	*	*	*	*	*	*
T113		LINEAR SHRINKAGE %	*	*	10.0	11.0	*	*	*
T111		MAX. DRY DENSITY t/m³	*	*	*	*	*	*	*
		OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
AS1289.3.8.1		EMERSON AGGREGATE TEST	*	*	*	*	*	*	*
T120		FIELD MOISTURE CONTENT %	*	*	*	*	*	*	*

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