Preliminary Geotechnical Investigation Report

Prepared for Linx Constructions Pty Ltd

Proposed Residential Development

Lots 125 & 126, DP 1215199
741-755 Great Western Highway,
Werrington NSW

Project Number: DD-1260
Report Number: DD-1260_LC1
Report Date: 22nd March 2021

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1.0 INTRODUCTION

Dirt Doctors Pty Ltd (DD) has prepared this report to discuss the results of the preliminary geotechnical investigation undertaken for the proposed residential development at Lots 125 and 126 in DP 1215199, 741-755 Great Western Highway, Werrington NSW (herein referred to as the "site"). DD was engaged to provide professional assistance for this component of the project.

The geotechnical investigation included excavation of five (5) test pits with an excavator to a maximum depth of 1.8m from existing surface level at the locations shown on drawing DD-1260_SI001 Figure 1 in Appendix A. This report provides a geotechnical assessment on the existing soil conditions. It is understood that development will comprise construction of 134 residential lots.

This report is based only on the information provided at the time of this report preparation and may not be valid if changes are made to the site or to the construction method.

2.0 SITE DETAILS

The following information, presented in Table 1, describes the site.

Table 1: Summary of Site Details

Site Address	Lots 125 and 126 in DP 1215199, 741-755 GWH, Werrington NSW
Client	Linx Constructions Pty Ltd
Council Area	Penrith Council

2.1 Geology

The 1:100,000 scale Geological Series Map of the Penrith (map number 9030) region indicates that the subject site is underlain by Bringelly Shale of the Wianamatta group dating back to the Mesozoic era, from the Triassic period of the Middle Triassic epoch and generally comprises of shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff.

Geological image of the site area

2.2 Site Description

The site is legally defined as Lots 125 and 126 in Deposited Plan 1215199 and is bounded by GWH to the south, residential properties to the north and west and vacant/rural residential properties to the east. The site is irregular in shape. The site encompasses a total area of approximately 5.22ha.

Image of site location

3.0 GEOTECHNICAL INVESTIGATION

Fieldwork was undertaken on 17th March 2021 and included excavating five Test Pits (TP1 – TP5) using an excavator at locations shown on Figure 1 (DD-1260_SI001). The Test Pits were supplemented with Dynamic Cone Penetrometers for the measurement of shear strength.

Image of Site and Sample Locations

Test Pit logs and field observations are presented in Appendix B.

3.1 Soil Profiles

The Test Pits indicated that the soil profile generally comprised of the following:

- Encountered between 0mm – 200mm; UNIT 1, TOPSOIL; Clayey Silt, low plasticity, brown, moist, stiff .
- Encountered between 200mm – 700mm; UNIT 2, RESIDUAL; Silty Clay, medium to high plasticity, brown – brown red, moist, stiff to very stiff.

No groundwater was encountered at the time of our visit; however, minor seepage from surface water infiltration is likely from the soil/rock interface following periods of heavy rainfall. Some allowance should be made for minor seepage water inflow behind proposed excavation retention systems.

4.0 RECOMMENDATIONS - FOOTINGS

4.1 Site Classification

Australian Standard AS 2870-2011 establishes performance requirements and specific designs for common foundation conditions as well as providing guidance on the design of footing systems using engineering principles. Site classifications as defined on Table 2.1 and 2.3 of AS2870 are presented on Table 2 below;

Table 2: Summary of Site Classifications AS2870

Site Classification	Foundation	Characteristic Surface Movement
A	Most sand and rock sites with little or no ground movement from moisture changes	
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes	0-20mm
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes	20-40mm
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes	40-60mm
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes	60-75mm
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes	75mm+
A to P	Filled sites (refer to clause 2.4.6 of AS 2870)	
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.	

As defined in AS 2870-2011, Table 2.1 and section 2.2.3, footings founded into soil horizon unit 2 will be classified as **Class "H1"** (soft soils). Based on the geology, natural soil profile as encountered on this limited scope investigation, the site is estimated to have a Characteristic Surface Movement (ys) in the range between **40mm** and **60mm.** Footings and slabs on Bedrock material should be designed in accordance with AS2870:2011 based on a Site Classification of **Class "A".**

It must be emphasized that the soil movement (heave) mentioned and recommendations referred to in this report are based solely on the observed soil profile observed at the time of the investigation for this report, without taking into account any abnormal moisture conditions that might be created thereafter. With abnormal moisture conditions, distresses will occur and may result in non-acceptable probabilities of serviceability and safety of the building during its design life. If these distresses are not acceptable to the builder, owner or other relevant parties then further fieldwork and revised footing recommendations must be carried out.

This type of investigation (as per our commission) is not designed or capable of locating all soil conditions, (which can vary even over short distances). Therefore, it is recommended that the builder engage the service of this company (DD) to confirm the soil profile and "Site Classification" at footing excavation stage.

4.2 Footing Design

The parameters given in Table 3 may be used for the design of pad footings and bored piles. Footings should be founded through any silt, topsoil, deleterious soils or uncontrolled fill and into the firm natural residual clay or bedrock. All footings for the same structure should be founded on strata of similar stiffness and reactivity to minimise the risk of differential movements. Based on the principal geotechnical constraints, we would recommend the following Pad Footing and Pile Design Parameters in table 4 below;

Table 3 - Allowable Bearing Capacity

Soil Type	Allowable Bearing Capacity (kPa)	Ultimate Vertical End Bearing Pressure (kPa)	Ultimate Shaft Adhesion In Tension (kPa)	Elastic Modulus (MPa)
Unit 1/ Fill/ Silt Clay, stiff to hard	75	N/A	0	4
Unit 2/ Residual/ Silty Clay, stiff to very stiff	100	300	15	10

Ultimate geotechnical strengths are provided for use in limit state design. Allowable bearing pressures are provided for serviceability checks. These values have been determined to limit settlements to an acceptable level for conventional building structures, typically less than 1% of the minimum footing dmension.

The quality of the founding stratum in all footing excavations is to be assessed by a geotechnical professional to confirm that the design parameters recommended in this report are appropriate. Footing excavations are to be cleaned out and inspected by a geotechnical professional prior to concrete placement. Concrete is to be placed within 24 hours of excavation, since the weathered bedrock may deteriorate rapidly upon exposure.

Selection of footing types and founding depth will need to consider the risk of adverse differential ground movements within the foundation footprint and between high level and deeper footings. Unless an allowance for such movement is included in the design of the proposed development we recommend that all new structures found on natural materials with comparable end bearing capacities.

5.0 CONDITIONS OF THE RECOMMENDATIONS

- The advice given in this preliminary report is based on the assumption that the test results are representative of the overall subsurface conditions. However, it should be noted that actual conditions in some parts of the building site may differ from those found in the test pits. If excavations reveal soil conditions significantly different from those shown in our attached Borehole Log(s), DD must be consulted and excavations stopped immediately. DD advises that this report is not to be used for design and accepts no responsibility for damages incurred.

- The foundation depths quoted in this report are measured from the surface during our testing and may vary accordingly if any filling or excavation works are carried out. The description of the foundation material for has been provided for its easy recognition over the whole building site.

- Any sketches in this report should be considered as only an approximate pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions or slope information should not be used for any building cost calculations and/or positioning of the building. Dimensions on logs are correct.

6.0 RECOMMENDATIONS FOR FURTHER GEOTECHNICAL INVESTIGATION

The adopted investigation scope was limited by the investigation intent. Further geotechnical inspections should be carried out during construction to confirm the geotechnical and hydrogeological model. These investigations should be carried out once final design and construction details are available and should include:

- All excavated material transported off site should be classified in accordance with NSW EPA 2014 - Waste Classification Guideline Part 1; Classifying Waste.

- Dilapidation surveys should be carried out on existing structures that may be impacted by any proposed excavations, particularly where located within the zone of influence of excavations. These surveys should be carried out by a qualified structural engineer and/or geotechnical engineer prior to and following completion of construction works.

- A suitably qualified geotechnical engineer is to assess the condition of exposed material at foundation or subgrade level to assess the ability of the prepared surface to act as a foundation or as a subgrade, which includes additional site classification investigation prior to any design or construction works commencing.

- Regular inspections of battered and unsupported excavations, where proposed, to confirm geotechnical conditions and to assess the suitability of design assumptions and to provide further advice with regards to excavation retention/ support and proposed construction methodologies.

7.0 LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all ground conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall ground conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If excavations reveal ground conditions significantly different from those shown in our findings, Dirt Doctors must be consulted. No geotechnical investigation can provide a full understanding of all possible subsurface details and anomalies at a site.

The scope and the period of Dirt Doctors services are described in the report and are subject to restrictions and limitations. Dirt Doctors did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Dirt Doctors in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Dirt Doctors for incomplete or inaccurate data supplied by others.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that DD be notified of any variations and be provided with an opportunity to review the recommendations of this report

This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. DD accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Document.

8.0 REFERENCES

- *Geological Series Map of the Penrith region, scale 1:100,000*
- *Pells, P.J., Douglas, D.J., Rodway, B, Thorne, C. And Mcmahon, B.K "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal, Vol.3 1978.*
- *Pells, P.J., Mostyn, G and Walker, B.F. "Foundations on Sandstone and Shale in the Sydney Region". Australian Geomechanics Journal, Vol. No. 33, Part 3, Dec 1998.*
- *AS1726:1993, Geotechnical Site Investigations, Standards Australia.*
- *AS2159:2009, Piling – Design and Installation, Standards Australia.*
- *AS2870:2011, Residential Slabs and Footings, Standards Australia.*
- *AS3798:2007, Guidelines on Earthworks for Commercial and Residential Developments, Standards Australia*

For and on behalf of DD

Jeff Lu
M. Eng (Civil),
Geotechnical Engineer

M.Tofler
Principal

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Determination of the Penetration Resistance of Soil Using a Dynamic Cone Penetrometer

Test Method AS 1289.6.3.2 Cone 510mm Drop

Test No	1	2	3	4	5			
Location	Test Pit 1	Test Pit 2	Test Pit 3	Test Pit 4	Test Pit 5			
Start Level	Existing Surface Level							
Depth (m)	Number of Blows per 100mm							
0 – 0.1	3	2	3	20	2			
0.1 – 0.2	3	4	6	Ref	3			
0.2 – 0.3	5	6	Ref		3			
0.3 – 0.4	5	3			3			
0.4 – 0.5	4	4			4			
0.5 – 0.6	3	6			4			
0.6 – 0.7	3	8			4			
0.7 – 0.8	3	11			4			
0.8 – 0.9	2	15			3			
0.9 – 1.0	2	Ref			4			
1.0 – 1.1	3				4			
1.1 – 1.2	3				5			
1.2 – 1.3	3				7			
1.3 – 1.4	3				Ref			
1.4 – 1.5	3							
1.5 – 1.6	4							
1.6 – 1.7	6							
1.7 – 1.8	8							
1.8 – 1.9	Ref							
1.9 – 2.0								
2.0 – 2.1								
2.1 – 2.2								

Approved Signatory **Jeff Lu**
M. Eng (Civil),
Geotechnical Engineer

Date: 17/03/2021

Document Set ID: 9607345
Version: 1, Version Date: 31/05/2021

APPENDIX A

FIGURES

Figure 1: TEST PIT LOCATION PLAN

DIRT DOCTORS GEOTECHNICAL TESTING SERVICES	⊗ Test Pit and DCP Locations	Linx Constructions Pty Ltd 741-755 GWH, Werrington NSW		Job No.	DD-1260
				Drawing No.	DD-1260_SI001
		Drawn By	MT	Ref No.	DD-1260_1
		Approved By	MT	Scale	N.T.S.

APPENDIX B

TEST PIT LOGS

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.1

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
	0.5	CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	1					
	1.5					
	2	XW	Shale Bedrock, extremely weathered, low strength End 1.8m			
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.2

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
	0.5	CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	1	XW	Shale Bedrock, extremely weathered, low strength End 0.9m			
	1.5					
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.3

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
		CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	0.5	XW	Shale Bedrock, extremely weathered, low strength End 0.4m			
	1					
	1.5					
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.4

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
		XW	Shale Bedrock, extremely weathered, low strength			
			End 0.2m			
	0.5					
	1					
	1.5					
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.5

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
	0.5	CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	1					
	1.5	XW	Shale Bedrock, extremely weathered, low strength End 1.4m			
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

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DD-1260_PD1

23rd March 2021

Linx Constructions Pty Ltd

Attention: Nathan Pal

Dear Sir,

RE: Preliminary Pavement Thickness Design at 741-755 Great Western Highway, Werrington NSW.

This letter presents a geotechnical report on the inspection and testing services associated with the pavement investigation undertaken at the above project.

Should you have any questions related to this report please do not hesitate to contact the undersigned.

For and on behalf of
Dirt Doctors

Jeff Lu
B. Eng (Civil),
Geotechnical Engineer

1.0 INTRODUCTION

As requested, Dirt Doctors Pty Ltd inspected and sampled site material at 741-755 GWH, Werrington NSW on the 17th March 2021. The purpose of the inspection is to allocate an appropriate preliminary California Bearing Ratio (CBR) of the subsurface material, in order to determine the pavement thickness for construction of the pavement at the site for the proposed residential development with internal roads. Dirt Doctors was commissioned by Linx Constructions Pty Ltd to provide professional assistance for this component of the project.

The proposed subdivision is located within a parcel of land situated on the Great Western Highway, in the jurisdiction of Penrith Council (PC). It is understood that the subdivision is to comprise of 134 residential lots and associated road access. The development site is a residential development with existing residential and vacant/rural properties surrounding the site.

The objectives of the investigation were to:

• Assess the subsurface conditions along the alignment of the proposed access roads; and

• Provide advice and recommendations in relation to pavement thickness design for the proposed roads in accordance with Engineering Guide for Development and Civil Works Specification prepared by PC.

This report is based only on the information provided at the time of this report preparation and may not be valid if changes are made to the site or to the construction method.

2.0 SUBGRADE ASSESSMENT

The subgrade was sampled by a Senior Technical Officer from this office on the 17th March 2021. Five (5) CBRs were sampled from test pit excavations through the existing surface and underlying soils. Five (5) CBRs were selected and submitted to a NATA Accredited laboratory for 4 day soaked CBR testing, the samples were compacted to 100% standard compaction.

The test pit excavations indicated that the subgrade profile generally comprised of the following:

- **Intersected between 0 and 200mm**; Fill; clayey silt, low plasticity, brown, moist.
- **Intersected between 200mm and 700mm**; Residual, Silty Clay, medium to high plasticity, red brown, moist.

Based on the test pits future subgrade conditions will expose a Silty Clay.

No groundwater was encountered at the time of our visit.

2.1 Laboratory Testing

The sub-grade 4 day soaked CBR value is presented in Appendix B and is summarised below in table 1.

Table 1 – Summary of CBR result

Sample No	Test Pit	Depth	Test Results		
			OMC	MDD	CBR
1	1	0.2-0.5m	18.1	1.69	2.5
2	2	0.2-0.5m	17.6	1.76	2.0
3	3	0.1-0.3m	10.4	1.87	2.5
4	4	0.1-0.3m	13.9	1.84	2.0
5	5	0.2-0.5m	19.5	1.60	1.0

2.2 Discussion of Laboratory Results

Assessment of CBR test results in table 1 indicates that the soils at future subgrade level have achieved a minimum CBR of 1%, however a design CBR of 3% has been adopted in producing a recommended pavement thickness for the proposed road development, assuming that the site material has been lime stabilized or improved through other means. We have assumed a 95% confidence limit that the pavement will perform satisfactorily during its design life.

3.0 NOMINATED TRAFFIC LOADING

The following traffic loadings have been adopted from the Engineering Guide for Development prepared by Penrith Council. Based on the Engineering Guide, the proposed road construction can be classified as a Access Road (Residential).

Table 2 – Traffic Loadings

Road	Chainage	Design Traffic	Classification
Proposed Road	Full Length	3×10^5	Access Street

3.1 Wearing Course

With reference to Engineering Guide for Development prepared by Penrith Council;

- Asphaltic concrete pavements shall have two layers of AC10 totaling a minimum thickness of 50mm.

- The final wearing course of 25mm thickness of AC10 will be laid by Council at a later date and paid for by the Applicant as a monetary payment.

4.0 UNBOUND PAVEMENT THICKNESS

A recommended pavement thickness based on the existing sub-grade conditions has been prepared. The unbound pavement design thicknesses have been determined using figure 13.8.2 (A) from APRG report 21 (derived from ARRB Special Report 41) for traffic less than 1×10^6 ESA.

Table 3 – Recommended Pavement Thickness

Road	***Nominated Traffic Loading***	***Design Subgrade CBR (%)***	***Recommended Pavement Thickness***			
			Sub Base	***Base Course (DGB20)***	***Asphaltic Wearing Course[3,4]***	***TOTAL***
Proposed Road	3×10^5	3	300 (2 layers of 150mm)	150	50	500mm

- Assumed 40-year design life and load safety factor of 1.2,

- Adopting skid resistance techniques outlined within CA&CAA T51 “Guide to Residential Streets and Paths”,

- Concrete shoulder should have at least the same strength as the concrete base and is defined as:
    - A keyed and tied shoulder with a minimum width of 1.5 m from the edge of the trafficked lane; or
    - A 600-mm integrally cast widening of a trafficked lane (this may include integral channel or kerb and channel),

- Concrete will require slump testing during the construction phase of road construction. As a guide, the lowest slump consistent with adequate workability should be used. For fixed-form paving with manually operated vibratory equipment, slump values are in the range 50 to 60 mm. For slip-form construction with no side forms, slump values in the range of 30 to 50 mm are typical.

5.0 RECOMMENDATIONS

The proposed pavement should be constructed in accordance with good engineering principles and the following recommendations.

• CBR values used in the design of road pavements were of natural site-won material. All subgrades should be reassessed when subgrade is exposed.

• Excavate to design pavement subgrade levels.

• Compact exposed (subgrade) natural surfaces with a minimum of 7 passes of a 3wheeled self-propelled roller or other approved device acceptable to Council. Proof rolling should then be carried out as directed by Council. The roller shall have rear rollers of at least 1200mm diameter and an intensity of loading of at least 7000kg per metre width of roller, unless otherwise approved by Council.

• Excavate areas of localised heaving to a depth of 300mm and replace with suitable granular fill, such as non-reactive well graded materials (eg. crushed sandstone), with maximum particle size not exceeding 75mm, compacted to a Minimum Dry Density Ratio (MDDR) of 100% Standard, with moisture variation maintained within 3% of Standard Optimum Moisture Content (SOMC).

• The proof rolling should be supervised by a suitably qualified Geotechnical Consultant.

• On certification of proof rolling, placement of the pavement materials may proceed. The following minimum dry density ratios (AS1289 5.4.1) must be achieved during pavement construction according to local council specifications. Testing should be carried out by a NATA registered laboratory.

- Base Course 98% Modified
- Subbase 98% Modified
- Subgrade 100% Standard

• Where filling is required to reach design subgrade levels, CBR testing should be undertaken at finished subgrade level to ensure test values are consistent with design parameters outlined within table 1 of this report.

• Subgrade conditions exposing weathered bedrock material should be scarified to a depth of 300mm and re-compacted to 100% standard dry density (AS1289 5.4.1) with moisture variation maintained within 2% of Standard Optimum Moisture Content (SOMC).

• Carry out all earthworks in accordance with Civil Works Specification- prepared by PC.

6.0 CONDITIONS OF THE RECOMMENDATIONS

Differential vertical movement within the subgrade profile present across the site is inevitable beneath pavement areas. Such movement may induce pavement distortion, longitudinal cracking at pavement edges & 'rolling-out' of kerbs. Minimisation of such movements can be achieved by adopting the following measures:

• Continue subbase crushed rock at least 500mm past kerbs

• Avoid garden beds which can act as a conduit for rainfall (or watering) causing wetting of subgrade clays to adjacent paving.

• Install perimeter cut-off drains at the edge of pavements. Soils drains should penetrate to approx. 200mm below the clay interface & be connected to drainage points.

• Ensure that tree planting does not promote drying of subgrade clays to adjacent pavements. The advice given in this report is based on the assumption that the test results are representative of the overall subsurface conditions. However, it should be noted that actual conditions in some parts of the road may differ from those found in the within this report. If excavations reveal soil conditions significantly different from those shown in this report, Dirt Doctors must be consulted and excavations stopped immediately.

Please note that this is a preliminary design and should be reviewed by Penrith Council prior to implementation.

It should be noted that if significant areas of bedrock are intersected at subgrade level, an alternative pavement thickness may be discussed, however, this is subject to further inspection and reporting during the course of bulk earthworks. Pavement thickness calculations are subject to variation should changes in the subgrade become evident during construction or due to spatial variations in the subgrade. Confirmation by a suitably qualified person of preliminary subgrade conditions will be required following initial excavation. In deep cuttings, deep fills or other instances where testing of subgrade is possible only at the time of construction, a separate pavement design will be required.

8.0 LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all soil conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall soil conditions. However, it should be noted that actual conditions in some parts of the Site might differ from those found. If construction works reveal soil conditions significantly different from those shown in our findings, Dirt Doctors must be consulted.

The scope and the period of Dirt Doctors services are described in the report and are subject to restrictions and limitations. Dirt Doctors did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Dirt Doctors in regards to it.

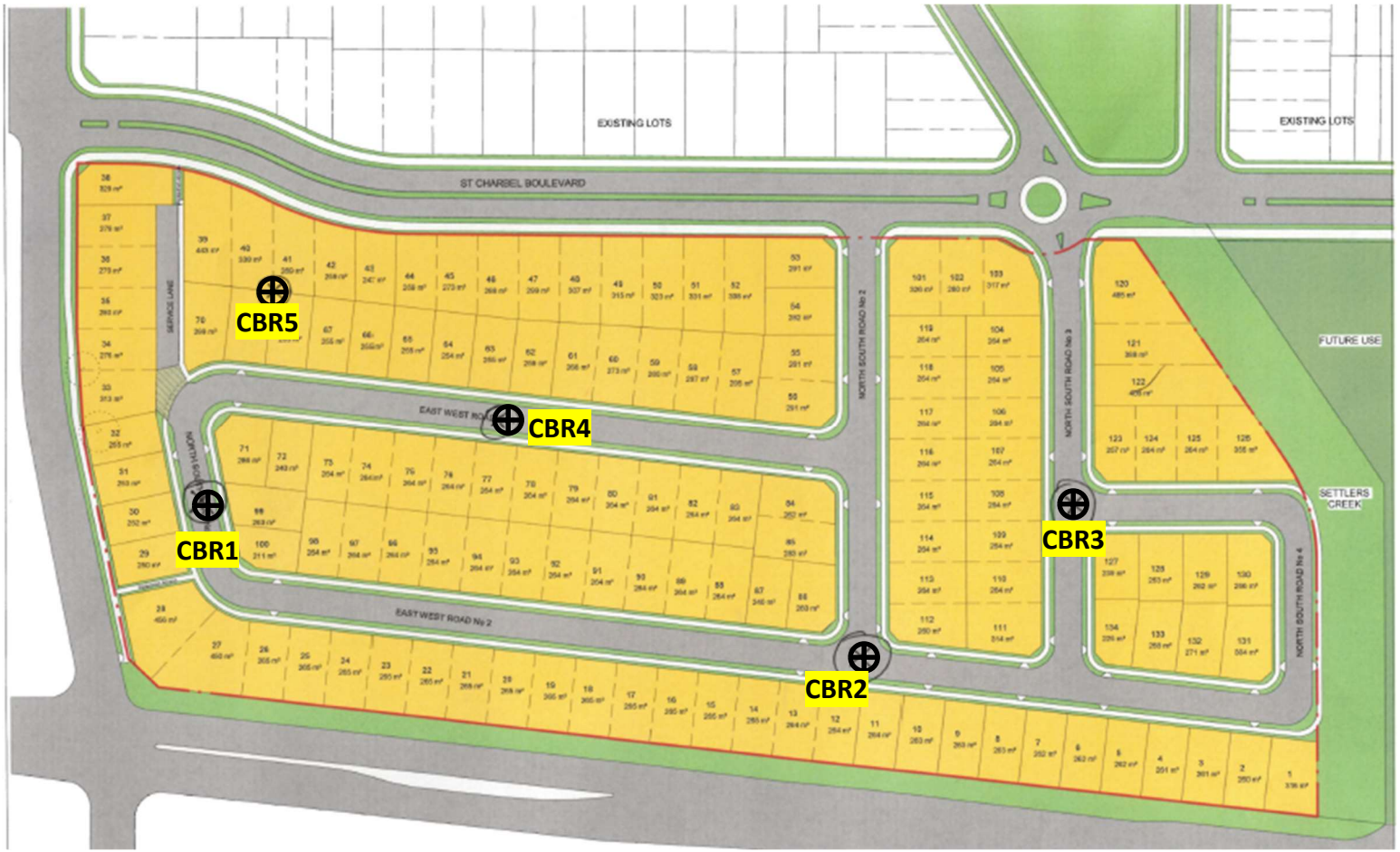
9.0 REFERENCES

- Australian Road Research Board, Special Report No. 41 – A Structural. Design Guide for Flexible Residential Street Pavements, 1989,
- New South Wales Development Design specification D2 – Pavement Design,
- New South Wales Development Design specification 242 – Flexible Pavements,
- Engineering Guide for Development - prepared by Penrith Council,
- Civil Works Specification- prepared by Penrith Council.

APPENDIX A

Figures

Figure 1: Test Site Location Plan



N	Approximate Test Location	**Linx Construction Pty Ltd** 741-755 GREAT WESTERN HIGHWAY, Werrington NSW		Job No	DE-373
				Drawing No	DE-373 Werrington 317
		Drawn By	NS	Ref No	
		Approved By	NS	Scale	Not to scale

APPENDIX B

LABORATORY TEST RESULTS

Down to Earth
Geotechnical & Environmental

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California Bearing Ratio Determination Report

Project: CBR Testing
Client: Linx Construction Pty Ltd
Address: 741-755 GREAT WESTERN HIGHWAY, Werrington NSW
Test Method: AS1289.1.2.1,AS 6.1.1,AS 5.1.1, AS 2.1.1
No. of Days Soaked: 4
Lot No. :N/A
Client Request No.: N/A
Sampling Procedure : AS1289.1.2.1, 6.5.4 Machine-excavated pit or trench

Project No.: DE373
Report No.: CBR317
Test Date: 22.03.21
Page: 1
Compactive Effort: Standard
Target Compaction (%): 100
Surcharge (Kg): 4.5

Sample No.		CBR1	CBR2	CBR3	CBR4	CBR5	
Sample Location		See Plan	See Plan	See Plan	See Plan	See Plan	
Material Description		Silty Clay, Brown	Silty Clay, Brown	Silty Clay, Brown	Silty Clay, Brown	Silty Clay, Brown	
Depth of Sample (m)		N/A	N/A	N/A	N/A	N/A	
Sample Date		17.03.21	17.03.21	17.03.21	17.03.21	17.03.21	
Oversize on Wet Basis +19mm (%)		0	0	0	0	0	
Field Moisture Content (%)		21.6	17.6	10.4	13.9	24.8	
Optimum Moisture Content (%)		18.1	17.6	10.4	13.9	19.5	
Maximum Dry Density (t/m³)		1.69	1.76	1.87	1.84	1.60	
Dry Density (t/m³)	Before Soaking	1.69	1.76	1.87	1.84	1.60	
	After Soaking	1.69	1.72	1.78	1.81	1.55	
Relative Compaction (%)	Before Soaking	100	100	100	100	100	
	After Soaking	100	98	95	98	97	
Moisture Content (%)	Before Soaking	18.1	17.6	10.4	13.9	19.5	
	After Soaking	23.2	23.6	22.1	21.4	30.2	
Method of establishing Plasticity level		Visually	Visually	Visually	Visually	Visually	
Curing time		24h	0	0	0	24h	
Moisture Ratio Before Soaking (%)		100	100	100	100	100	
Moisture Content after test (%)	Top 30mm	29.3	29	24	24.6	35.1	
	Entire Depth	19.6	20.6	20	18.3	24.9	
Swell after Soaking (%)		0.0	0.0	0.0	0.0	5.5	
CBR Value (%)		**2.5**	**2.0**	**2.5**	**2.0**	**1.0**	
Penetration (mm)		**2.5**	**2.5**	**5.0**	**5.0**	**2.5**	

Remarks: +19mm material excluded from test
Curing time:72h

RPS9 rev 3 SAug-20
Technician: JG
Signatory: N.Smith Date:29.03.21

Accredited for compliance with ISO/IEC 17025-Testing
Accreditation No. 19788

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

APPENDIX C

TEST PIT LOGS

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.1

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
	0.5	CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	1					
	1.5					
	2	XW	Shale Bedrock, extremely weathered, low strength End 1.8m			
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.2

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
	0.5	CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	1	XW	Shale Bedrock, extremely weathered, low strength End 0.9m			
	1.5					
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.3

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
		CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	0.5	XW	Shale Bedrock, extremely weathered, low strength End 0.4m			
	1					
	1.5					
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.4

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
		XW	Shale Bedrock, extremely weathered, low strength			
			End 0.2m			
	0.5					
	1					
	1.5					
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*

SITE LOCATION: 741-755 GWH, Werringtong NSW

TEST PIT No.5

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (*SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY*)	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Clayey Silt, stiff, brown, slightly moist			
	0.5	CI-CH	Silty Clay, stiff to very stiff, medium to high plasticity, brown to red brown, slightly moist			
	1					
	1.5	XW	Shale Bedrock, extremely weathered, low strength End 1.4m			
	2					
	2.5					
	3					
	3.5					

Method: Excavator
Date: 17/03/2021
Logged and Drilled by: *MT*