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Geotechnical Report
Level One Inspection and Testing

Riverwalk Estate Stage 10
Werribee

Prepared for:

Excell Gray Bruni
12 Allied Drive
Tullamarine VIC

PROJECT No 8285

03 June 2015.

Prepared by:

TERRA FIRMA LABORATORIES
Geotechnical Inspection and Testing Authority

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Geotechnical Report Level One Inspection and Testing
Riverwalk Estate Stage 10

1. Introduction

Terra Firma Laboratories was engaged by *Excell Gray Bruni* as the geotechnical inspection and testing authority to provide Level 1 supervision and testing works on the earthworks component for Riverwalk Estate Stage 10. This work was conducted over the period of 25/05/2015 to 01/06/2015.

This report presents that the allotment earthworks was carried out in accordance with *AS3798-2007 Guidelines for Earthworks for Commercial and Residential Development* and in compliance with the compaction control specifications established by the contractor.

2. Scope of Works

2.1. Areas of work

The areas of work included lot numbers 353, 354, 355, 356, 357, 358, 359, 368, 369 and 370. The site will be a residential estate.

The area on which fill was placed is shown on site plan (Appendix 1) based on drawings prepared by Dalton Consulting Engineers and provided by *Excell Gray Bruni*.

The supervision work by *Terra Firma Laboratories* involved both inspection of sub grade preparation work and full time inspection and testing of fill placement.

2.2. Specification

The placement of fill on the areas of work was to be carried out in accordance with *AS3798-2007 Guidelines for Earthworks for Commercial and Residential Development,* as directed by *Excell Gray Bruni*. At all times during placement of fill materials Terra Firma Laboratories maintained a Geotechnical Technician on site to perform the supervision and testing as required by AS3798-2007.

As referenced from AS3798-2007 (Section 5.2) establishes a specification requirement for a minimum density ratio of not less than 95% noting that soils containing more than 20% of particles coarser than 37.5mm cannot be tested for relative compaction using the procedures of AS1289.

Field density testing shall be undertaken at a frequency of not less than 3 tests per visit.

Test Rolling is required for all layers of structural fill and materials within 150mm of permanent subgrade level so as to withstand test rolling without visible deformation or springing. Corrective action is required where unstable areas exceed 20% of the area being considered by test rolling.

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3. Inspection and Testing

3.1. Sub-Grade Preparation

Subgrade preparation involved stripping the site down of topsoil and organic matter to a depth of approximately 200mm below existing levels detailed on the site plans. The sub-grade area was then proof-rolled to determine soft or otherwise unsuitable zones and such zones rectified as necessary. The sub-grade was watered and scarified prior to fill placement to aid layer bonding.

3.2. Fill materials

The materials used as fill were locally sourced and observed to generally consist of Silty Clay, sourced from stockpiled materials on site. No particles greater than 150mm were observed. The fill was nominated as clean fill by the contractor.

3.3. Fill Construction

The contractor had the following plant available on-site during the construction period for use in the fill placement:

- *Grader*
- *Roller*
- *Moxie*
- *Water Cart*

All fill was placed in layers of thicknesses not exceeding 250mm. *The work area was typically a 2 or 3 lot area on any one particular day*. At the completion of a placed layer, compaction testing was performed to confirm appropriate compaction had been achieved and supported the observations made.

It was observed that finished levels were in accordance with levels marked on site by survey. These levels are shown on site plans attached in Appendix 1.

The final 300mm of fill placed across the site was placed as a topsoil layer/ growing medium and should be considered as non structural, as it was placed in an uncontrolled manner, as allowed by specifications.

4. Compaction Control Testing

Testing comprised of a total of 20 in-situ density tests, with a summary of results included in Appendix 2. Test Reports are referenced in Appendix 3.

Test numbers 4 & 10 originally failed to meet specification. Excell Gray Bruni were notified and asked to re-work the area appropriately. Upon completion of adequate re-working Terra Firma Laboratories would conduct a re-test; this process would continue until a minimum compaction effort of 95% was achieved.

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It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed. Each lot does not necessarily require a compaction test to comply. The compaction control testing indicated that the engineered fill on all lots complied with the technical specification.

5. Uncontrolled Works

Terra Firma Laboratories cannot verify any works completed by others after the final date specified in the introduction. Uncontrolled works may include, but not limited to trenching for services, cut and fill works for slab preparation or subsequent removal of vegetation and back fill of holes.

6. Clean Fill

Terra Firma Laboratories cannot guarantee that the material used as a filling medium is free from chemical or other contamination.

7. Statement of Compliance

Inspections and testing of the fill areas at this site indicate that both sub grade preparation and fill placement have been conducted in accordance with the specification and that the completed fill areas of greater than 300mm, as shown on the site plan attached, and not any preceding the 25/05/2015 or work completed after the 01/06/2015, may be certified as being compliant with the specification.

For and on behalf of
Terra Firma Laboratories,

T Seymour

Tom Seymour
Lab Manager

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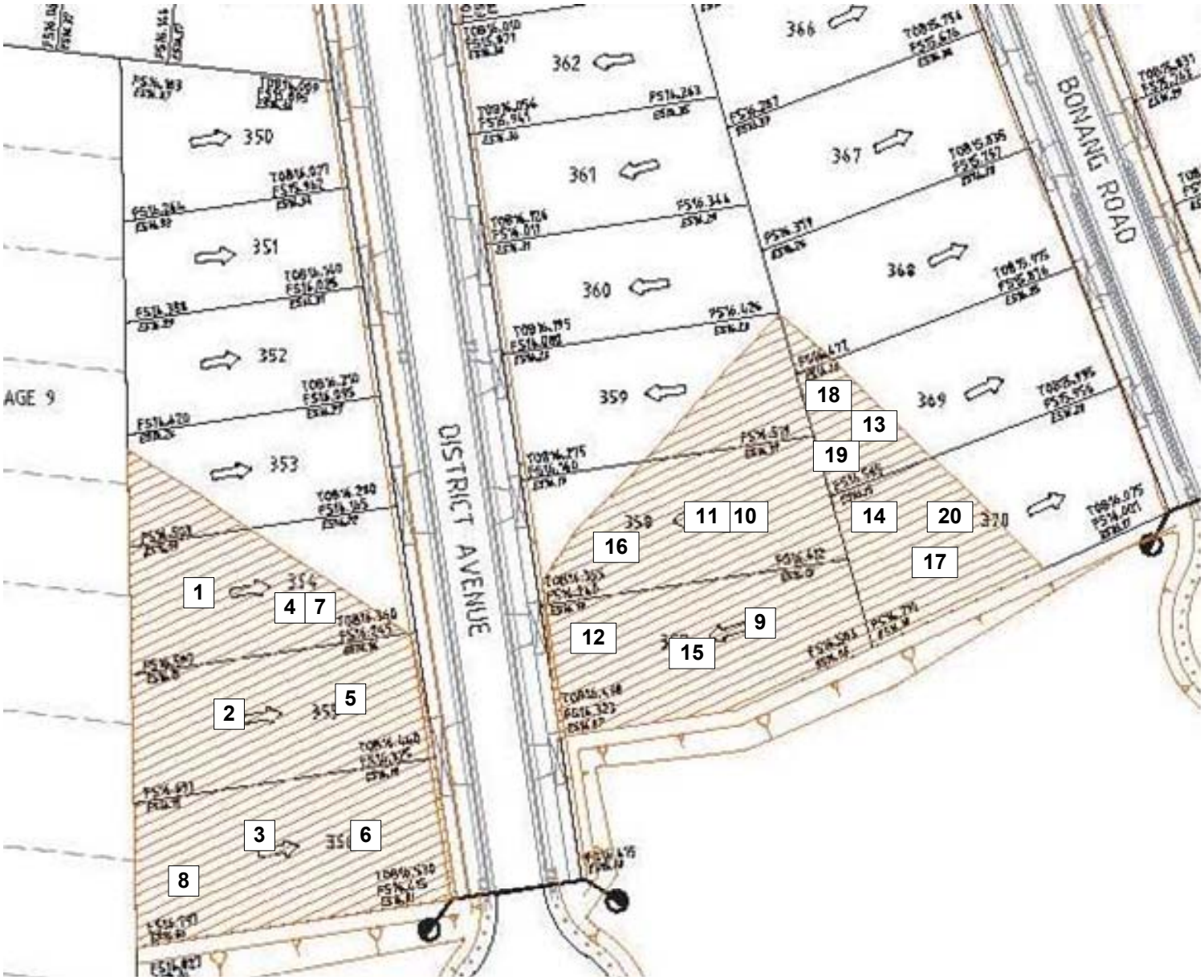
APPENDICES
Appendix 1: Site Plans
Appendix 2: Test Summary
Appendix 3: Test Reports



Client	**Excell Gray Bruni**
Project	**Riverwalk Estate Stage 10, Werribee**

terra firma laboratories

Level 1 - Supervision - Summary of Tests

Client **Excell Gray Bruni**
Project **River Walk Estate Stage 10**
Job # **8285**
Density Ratio **95%**

terra firma laboratories

Date	Test #	Retest of #	Layer	Density	Lot #	Report #	Pass/Fail
25/05/2015	1		L1	97	354	8285-1	P
25/05/2015	2		L1	102	355	8285-1	P
25/05/2015	3		L1	100	356	8285-1	P
26/05/2015	4		L2	90	354	8285-2	F
26/05/2015	5		L2	98	355	8285-2	P
26/05/2015	6		L2	97	356	8285-2	P
27/05/2015	7	4	L2	99	354	8285-3	P
27/05/2015	8		FSL	97.5	356	8285-3	P
27/05/2015	9		L1	98	357	8285-3	P
27/05/2015	10		L1	93.5	358	8285-3	F
28/05/2015	11	10	L1	99.5	358	8285-4	P
28/05/2015	12		L1	99	357	8285-4	P
28/05/2015	13		L1	97	369	8285-4	P
28/05/2015	14		L1	97	370	8285-4	P
29/05/2015	15		L2	100	357	8285-5	P
29/05/2015	16		L2	100	369	8285-5	P
29/05/2015	17		L2	100.5	370	8285-5	P
1/06/2015	18		FSL	100.5	369	8285-6	P
1/06/2015	19		FSL	101	369	8285-6	P
1/06/2015	20		FSL	99.5	370	8285-6	P

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 8285-1
date of issue 26/05/15

Client	Excell Gray Bruni
Client address	12 Allied Drive Tullamarine
Project	Riverwalk Estate Stage 10
Location	Werribee

Feature	Lot Fill
Layer thickness (mm)	250

tested by	MP
time	All Day
date	25/05/15
checked by	PJ

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**1**	**2**	**3**			
location chainage offset Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Lot Number 354	Lot Number 355	Lot Number 356			
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1			
measurement depth	mm	225	225	225			
field wet density	t/m^3	2.01	2.07	2.05			
field dry density	t/m3	1.71	1.76	1.76			
field moisture content	%	17.7	17.9	16.4			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.07	2.03	2.05			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		-0.5	-1.5	-1.5			
Moisture ratio	**%**	**97.0**	**92.5**	**91.5**			
Hilf density ratio (R_{HD})	**%**	**97.0**	**102.0**	**100.0**			

material description

Silty Clay

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards.
requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signature
P Jenke

LABORATORY ACCREDITATION No **15357**

/ersion 3 Oct 2013

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 8285-2
date of issue 27/05/15

Client	Excell Gray Bruni
Client address	12 Allied Drive Tullamarine
Project	Riverwalk Estate Stage 10
Location	Werribee

Feature	Lot Fill
Layer thickness (mm)	250

tested by	DC
time	All Day
date	26/05/15
checked by	PJ

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**4**	**5**	**6**			
location chainage offset Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Lot Number 354	Lot Number 355	Lot Number 356			
depth from F.S.L.	m	Layer 2	Layer 2	Layer 2			
measurement depth	mm	225	225	225			
field wet density	t/m^3	1.90	2.09	2.05			
field dry density	t/m3	1.61	1.76	1.72			
field moisture content	%	18.0	18.6	19.3			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.12	2.13	2.12			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		1.5	1.5	0.5			
Moisture ratio	**%**	**108.0**	**107.5**	**104.0**			
Hilf density ratio (R_{HD})	**%**	**90.0**	**98.0**	**97.0**			

material description

Silty Clay

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LABORATORY ACCREDITATION No **15357**

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 8285-3
date of issue 28/05/15

Client	Excell Gray Bruni
Client address	12 Allied Drive Tullamarine
Project	Riverwalk Estate Stage 10
Location	Werribee

Feature	Lot Fill
Layer thickness (mm)	250

tested by	DC
time	All Day
date	27/05/15
checked by	PJ

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**7**	**8**	**9**	**10**		
location chainage offset Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		ReTest 4	Lot Number 356	Lot Number 357	Lot Number 358		
depth from F.S.L.	m	Layer 2	FSL	Layer 1	Layer 1		
measurement depth	mm	225	225	225	225		
field wet density	t/m^3	2.04	2.03	2.03	1.93		
field dry density	t/m3	1.74	1.73	1.73	1.63		
field moisture content	%	17.2	17.4	17.5	18.4		
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard	standard		
oversize material retained on AS sieve	mm	19.0	19.0	19.0	19.0		
percent of oversize material	wet	0	0	0	0		
peak converted wet density	t/m^3	2.06	2.08	2.07	2.07		
adjusted peak converted wet density	t/m^3	-	-	-	-		
moisture variation from OMC (-dry,+wet)%		-1.0	-1.0	-1.0	-0.5		
Moisture ratio	**%**	**95.0**	**95.0**	**95.5**	**96.5**		
Hilf density ratio (R_{HD})	**%**	**99.0**	**97.5**	**98.0**	**93.5**		

material description

Sandy Clay

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/ersion 3 Oct 2013

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 8285-4
date of issue 01/06/15

Client	Excell Gray Bruni
Client address	12 Allied Drive Tullamarine
Project	Riverwalk Estate Stage 10
Location	Werribee

Feature	Lot Fill
Layer thickness (mm)	250

tested by	DC
time	All Day
date	28/05/15
checked by	PJ

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**11**	**12**	**13**	**14**		
location chainage offset Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Re Test 10	Lot Number 357	Lot Number 369	Lot Number 370		
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1	Layer 1		
measurement depth	mm	225	225	225	225		
field wet density	t/m^3	2.03	2.05	2.05	2.03		
field dry density	t/m3	1.75	1.77	1.73	1.71		
field moisture content	%	15.8	16.2	18.4	18.3		
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard	standard		
oversize material retained on AS sieve	mm	19.0	19.0	19.0	19.0		
percent of oversize material	wet	0	0	0	0		
peak converted wet density	t/m^3	2.04	2.07	2.11	2.09		
adjusted peak converted wet density	t/m^3	-	-	-	-		
moisture variation from OMC (-dry,+wet)%		-1.5	-1.5	-1.0	-1.0		
Moisture ratio	**%**	**90.5**	**90.5**	**95.0**	**95.0**		
Hilf density ratio (R_{HD})	**%**	**99.5**	**99.0**	**97.0**	**97.0**		

material description

Sandy Clay

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 8285-5
date of issue 01/06/15

Client	Excell Gray Bruni
Client address	12 Allied Drive Tullamarine
Project	Riverwalk Estate Stage 10
Location	Werribee

Feature	Lot Fill
Layer thickness (mm)	250

tested by	DC
time	All Day
date	29/05/15
checked by	PJ

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**15**	**16**	**17**			
location chainage offset Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Lot Number 357	Lot Number 369	Lot Number 370			
depth from F.S.L.	m	Layer 2	Layer 2	Layer 2			
measurement depth	mm	225	225	225			
field wet density	t/m^3	2.05	2.06	2.06			
field dry density	t/m3	1.75	1.76	1.75			
field moisture content	%	17.1	17.2	17.4			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.05	2.06	2.05			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		-0.5	-0.5	-0.5			
Moisture ratio	**%**	**97.5**	**96.5**	**96.0**			
Hilf density ratio (R_{HD})	**%**	**100.0**	**100.0**	**100.5**			

material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 8285-6
date of issue 02/06/15

Client	Excell Gray Bruni
Client address	12 Allied Drive Tullamarine
Project	Riverwalk Estate Stage 10
Location	Werribee

Feature	Lot Fill
Layer thickness (mm)	250

tested by	DC
time	All Day
date	01/06/15
checked by	PJ

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**18**	**19**	**20**			
location chainage offset Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Lot Number 369	Lot Number 369	Lot Number 370			
depth from F.S.L.	m	FSL	FSL	FSL			
measurement depth	mm	225	225	225			
field wet density	t/m^3	2.04	2.03	2.04			
field dry density	t/m3	1.74	1.76	1.76			
field moisture content	%	17.3	15.5	15.6			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.03	2.01	2.05			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		-2.0	-2.0	-2.0			
Moisture ratio	**%**	**90.0**	**89.5**	**89.5**			
Hilf density ratio (R_{HD})	**%**	**100.5**	**101.0**	**99.5**			

material description

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