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LEVEL 1 INSPECTION & TESTING

SAVANA ESTATE, STAGE 3, WYNDHAM VALE

Prepared for Bitu-Mill Civil Pty Ltd

Report Reference: GS4505.2 AA

Date: 1 December 2017

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PROJECT DETAILS

Project Reference	GS4505.2	Rev	AA
Project Title	Savana Estate, Stage 3		
Project Location	Wyndham Vale	State	VIC
Date	1 December 2017		

CLIENT DETAILS

Prepared For (Client)	Bitu-Mill Civil Pty Ltd
Client Address	133 Metrolink Circuit, Campbellfield, VIC 3061

DISTRIBUTION

Original Held By	Ground Science Pty Ltd
One (1) Electronic Copy	Bitu-Mill Civil Pty Ltd
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This document presents the results of the Level 1 Inspection and Testing performed by Ground Science for the aforementioned project, as the nominated project Geotechnical Inspection & Testing Authority (GITA). This report is detailed for the sole use of the intended recipient(s). Should you have any questions related to this report please do not hesitate to contact the undersigned.

AUTHOR:



Gee Singh
Senior Geotechnical Engineer

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1. INTRODUCTION

This report presents the results of the inspection activities, compaction control and laboratory testing services performed by Ground Science Pty Ltd for the Savana Estate, Stage 3, in Wyndham Vale, Victoria (the site). Authorisation to proceed was provided by Bitu-Mill Civil Pty Ltd (the Client).

2. PROJECT UNDERSTANDING

It is understood that the project involved site cuts on the northern boundary of allotments Lot 334 to 340, with the resulting exposed material requiring to be ripped, reworked and recompacted, as instructed by the project foreman. As detailed by the project contractor, no fill placement was undertaken. The area of works is shown on the supplied site plans prepared by Cardno (CG151018-CI-1050 REV C).

The reworking and recompacting works were required to comply to Level 1 Inspection & Testing, as defined in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments'. Ground Science performed the role of the project Geotechnical Inspection & Testing Authority (GITA) with all Level 1 Inspection and Testing services described in this report undertaken by an experienced GITA site representative.

3. SCOPE OF WORK

3.1 AREAS OF WORK

Ground Science provided Level 1 Inspection and Testing services for the re-compaction and reworking of the previously cut zones on the northern boundary of the allotments within Stage 3 as is shown on the site plan, Figure 1, in Appendix A. The areas of work generally measured approximately 5m x 90m. The works commenced and were completed on 25th November 2017. It should be noted that the reworking/re-compaction works encroached onto Stages 2 and 4, with the findings of the other reports presented separately.

3.2 PLACEMENT METHODOLOGY

A technical specification for the works was not provided and the works were carried out using the following process, as guided by AS3798 (2007):

- The areas of cut were inspected to ensure any existing loose surficial fill, topsoil, soft material, vegetation and materials containing significant organic matter were removed;
- The reworked material was compacted to achieve a target Dry Density Ratio of at least 95% Standard Compaction (AS 1289: 5.1.1, 5.4.1 or 5.7.1), based on our understanding that future building loads would be similar to residential type structures (i.e. non-commercial structural loading);
- The material was moisture conditioned to within 85% – 115% of the standard optimum moisture content;
- The material was inspected during the reworking process to ensure no particles greater than 20% by volume, particles coarser than 37.5mm and no particle over 200mm in any dimension was present;
- The frequency of field density testing adopted for the project was as follows:
 - 1 test per layer or 200mm per 2500m²;
 - 1 test per 500m³ distributed reasonably evenly throughout the full depth and area; or
 - 3 tests per site visit; whichever requires the most tests.

4. INSPECTION AND TESTING

4.1 INSPECTION OF CUT ZONES

Site stripping was undertaken prior to Ground Science's attendance on site, with the areas of work found to comprise of gravelly clay, medium to high plasticity. The soils were noted to be dry of the inferred optimum moisture

content. No surface vegetation, topsoil, construction waste or other deleterious matter was observed. An inspection was also undertaken to ensure the following material properties:

- Material suitability as an engineering property;
- Cohesiveness;
- Free of building debris and vegetative matter;
- Free of oversize rock particles.

Minor gravel and cobble inclusions were observed throughout the fill material. In general, the material was considered suitable to be reworked and recompacted.

4.2 CONSTRUCTION PROCESS

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

- Padfoot Roller;
- Grader;
- Water cart.

At the time of the works, the weather conditions were typically sunny with temperatures typically ranging from 25 to 35 degrees Celsius.

The construction process involved the watercart moisture conditioning the work zones, working simultaneously with the grader to ensure the reworked material achieved a uniform moisture condition. A padfoot roller was used to compact the fill material, applying a minimum of 7 passes. At the completion of the reworking process, field density testing was undertaken by the GITA site representative. The reworked/recompacted area measured up to 200mm in thickness.

It is considered that a 100mm to 150mm thick layer of topsoil would be spread at the completion of all works, which does not form part of this report. In addition, any fill placed as part of newly constructed drainage, sewer works or similar does not form part of this report.

4.3 RESULTS OF COMPACTION CONTROL TESTING

A total of 3 field density tests were performed at the completion of the works. The field density tests were performed using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289 5.8.1) with 3 Rapid HILF Compaction tests (AS1289 5.7.1) performed in Ground Science's NATA accredited testing facility. Field density and compaction control testing report sheets are presented in Appendix C. It should be noted that the tests support the assessment of the works completed.

All tests achieved the target density ratio of 95% Standard Compaction. The moisture conditioning was found to be within the recommended moisture ratio of 85% to 115% within tests #2 and #3. A moisture ratio of 83% was achieved in Test #1 however deemed acceptable, with instructions provided to further moisture condition the material on site. Retesting was not deemed necessary.

4.4 FINAL SURFACE LEVELS

The project foreman provided instruction to the Ground Science GITA representative that filling had been complete up to the nominated finished levels.

5. COMPLIANCE

Ground Science Staff have undertaken Level 1 Inspection and Testing services of the reworking, moisture conditioning and re-compaction of the areas designed on Figure 1. Based on observations made by Ground

Science staff and the results of density tests, we consider that the works comply with the guidelines provided by AS3798 (2007) and AS2870 (2011).

It should be noted that the final layers may be subjected to adverse weather conditions resulting in either surface softening or drying and cracking over time; regardless of the compactive efforts and moisture conditioning applied during the works. The integrity of the top 200mm to 300mm of the finished fill level (prior to topsoiling) will deteriorate with time and should be taken into account by the foundation engineer prior to the construction of dwellings or buildings.

6. UNDERSTANDING LEVEL 1 INSPECTION & TESTING

The purpose of performing Level 1 Inspection and Testing is to ensure compliance of the works with the intended specification. The engagement of a Geotechnical Inspection Testing Authority (GITA) allows the contractor to perform their role in the construction of the filling, reworking and/or recompaction operations while the GITA monitors the quality control process works.

While AS3798 (2007) is a guideline on the minimum requirements of filling on commercial and residential developments, some projects require a more detailed project specification to reflect site specific issues. While moisture conditioning of fill sources aids in the ease with which compaction is achieved, it is not necessarily a physical characteristic that determines if the placed fill is acceptable. In some situations, the moisture requirement is an extremely important function of the final constructed product. In these situations, a specific project specification should apply to the project as detailed by the designing geotechnical engineer. These are typical of clay liners for wetlands, dams, landfill liners and capping and an array of other engineering situations. Creating a consolidated platform of which is similar to equivalent surrounding natural conditions is the primary aim of Level 1 processes, preventing the occurrence of differential ground movements to footing structures.

Level 1 Inspection & Testing requires full time inspection and testing of the fill placement undertaken on a site. Ground Science (project GITA), are notified daily (or at the completion of each day's work) by the project foreman where subsequent days of fill placement under Level 1 is to occur. On projects that rely upon the importation of a fill source, there can be delays in the receipt of sufficient materials to warrant fill placement works which may result in periods of time where a GITA representative is not required on site. It is the contractor's responsibility to notify the GITA when works proceed and their attendance on site is required again. A GITA relies upon the integrity of the contractor to advise when site attendance is required and makes all reasonable visual attempts to assess if the works are the same as the previous days attendance.

**For & on behalf of
Ground Science Pty Ltd**



**Gee Singh
Senior Geotechnical Engineer**



7. 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 further sampling reveals soil conditions significantly different from those shown in our findings, Ground Science must be consulted. Maintenance and upkeep of finished fill placement must be regularly monitored as exposure to extended weather periods/other elements may cause surface drying which may lead to cracking. Conversely, excessive exposure to moisture may cause heaving/softening in the soils.

It is recognised that the passage of time affects the information and assessment provided in this document. Ground Science's assessment is based on information that existed at the time of the preparation of this document. It is understood that the services provided allowed Ground Science to form no more than an opinion of the actual site conditions observed during sampling and observations of the site visit and cannot be used to assess the effects of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

The scope and the period of Ground Science services are described in the proposal and are subject to restrictions and limitations. Ground Science 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 Ground Science 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 Ground Science 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.

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8. REFERENCES

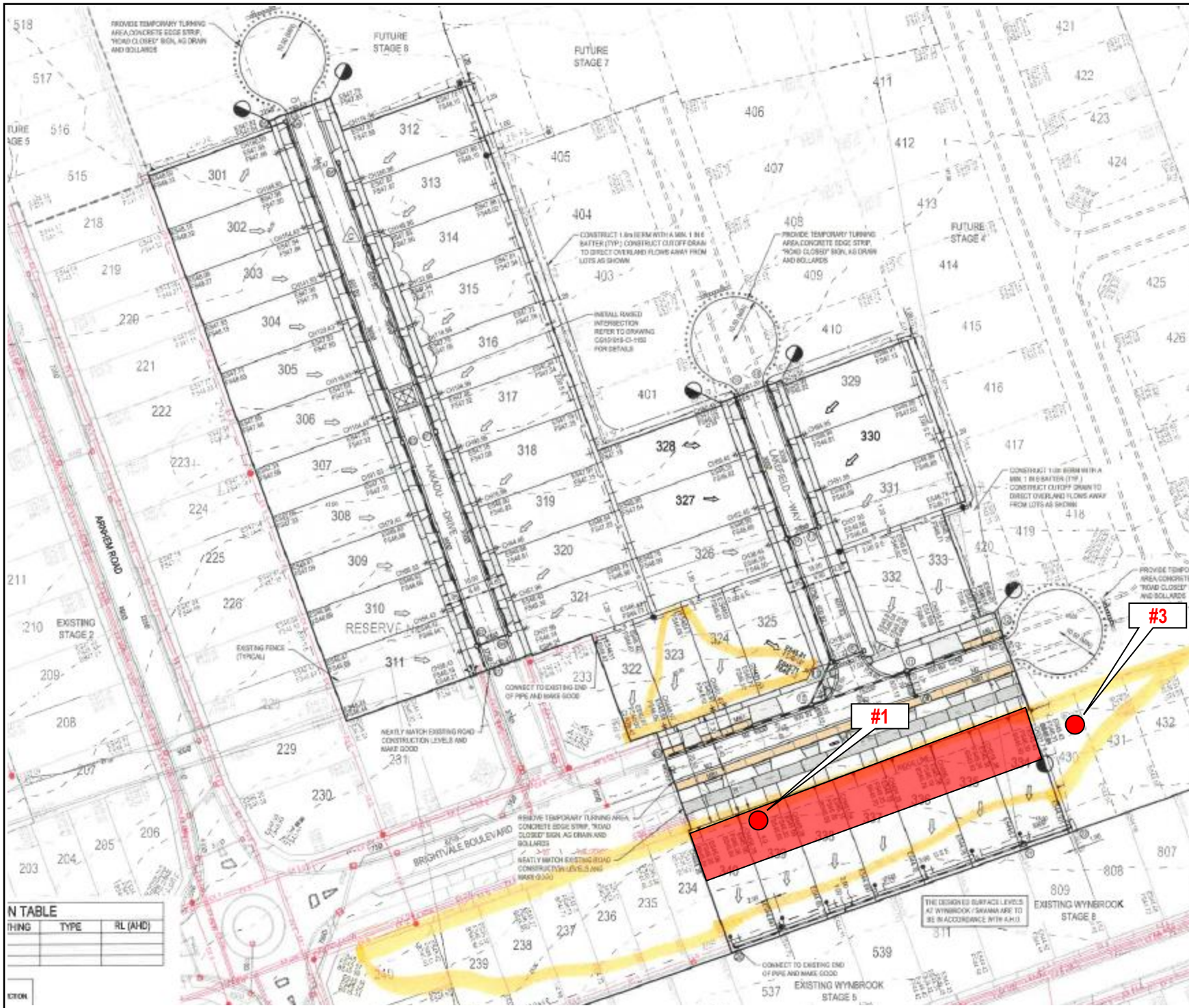
- AS3798 (2007) Guidelines on Earthworks for Residential and Commercial Developments.
- AS1289 Methods of Testing Soils for Engineering Purposes.
- AS1726 (1993): Geotechnical Site Investigations

APPENDIX A

Figure 1: Site Layout & Test Location Plan

FIGURE 1

**Savana Estate, Wyndham Vale
Site and Test Location Plan**



N TABLE

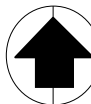
THING	TYPE	RL (AHD)

LEGEND

● Field Density Test

Note: Test #3 performed on Stage 4 (Refer to GS4505.3)

JOB NO: G4505.2 AA
DATE: 1 DECEMBER 2017
DRAWN: GS
CHECKED:



GroundScience

APPENDIX B

Field Density Test Report Sheets



field density test results

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client :	BITU-MILL CIVIL PTY LTD (CAMPBELLFIELD)	job No:	GS4505/1
project :	SAVANA ESTATE - STAGE 2, 3, 4 (LEVEL 1)	report No.	AA
location :	WYNDHAM VALE	test date:	25-Nov-17

Test Number		1	2	3		
Test location taken from		Lot 339	Lot 237	Lot 430		
North West Corner of Lots		4m East	5m East	6m East		
		4m South	3m South	4m South		
Layer Number		Layer 1 (F.S.L)	Layer 1 (F.S.L)	Layer 1 (F.S.L)		
Time of tests		12:00:00	12:10:00	12:20:00		
Depth of Layer	mm	200	200	200		
Depth of Test	mm	175	175	175		
Field Wet Density	um ³	1.75	1.87	1.84		
*Field Moisture Content	%	24.0	18.5	18.5		

Oversize Material	Wet %	0	0	0		
Sieve Size	mm	19.0	19.0	19.0		
Peak Converted Wet Density	um ³	1.749	1.885	1.754		
*Optimum Moisture Content	%	29.0	21.5	21.5		
Compactive Effort Used	std / mod	STD	STD	STD		

Moisture Ratio	%	83	86	86		
Moisture Variation	%	-5.0	-3.0	-3.0		
Moisture Variation		DRY	DRY	DRY		
Density Ratio	%	100.5	99.5	105.0		

Specification Requirements 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description gravelly CLAY (Fill)

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

<p>ACCREDITED FOR TECHNICAL COMPETENCE</p>	<p>NATA Accredited Laboratory No. 15055 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</p>	<p>Tim Senserrick Approved Signatory Date</p>	<p>28-Nov-17</p>