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LEVEL 1 INSPECTION & TESTING
SAVANA – STAGE 1A
WYNDHAM VALE

Prepared for Bitu-Mill Civil Pty Ltd

Report Reference: GS4450.1 AA

Date: 20 October 2017

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PROJECT DETAILS

Project Reference	GS4450.1	Rev	AA
Project Title	Savana – Stage 1A		
Project Location	Wyndham Vale	State	VIC
Date	20 October 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

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:

Jason Menzies
Engineering Geologist

REVIEW & AUTHORISED BY:

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 project identified as the Savana Estate – Stage 1, located at 50 Hobbs Road in Wyndham Vale, Victoria (the site).

2. PROJECT UNDERSTANDING

Ground Science was engaged to provide Level 1 Inspection and Testing services for these components of the project. Authorisation to proceed was provided by Bitu-Mill Civil Pty Ltd (the 'Client'). Level 1 Inspection & Testing, as defined in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments' provides for full time inspection of the construction of controlled fill and compaction testing in accordance with AS1289 'Methods of Testing Soils for Engineering Purposes' and AS1726 (1993) 'Geotechnical Site Investigations'. 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 placement of controlled fill as part of the backfill process within allotment 149 and nearby easement. The areas requiring Level 1 Inspection & Testing are shown on the site plans, Figure 1, in Appendix A, which are based on plans prepared by Cardno (Drawing Number: CG150545-CI-1050 Revision: G dated 7/09/2017).

This report details the Level 1 earthworks process performed on 12th October 2017 which required 1 half day of filling operations.

3.2 PLACEMENT METHODOLOGY

The placement of controlled fill on the abovementioned areas was carried out in accordance with AS3798 (2007) "Guidelines on Earthworks for Commercial and Residential Developments". A technical specification for the controlled fill placement was not provided. The following is a recommended specification based on the requirements of AS3798 (2007) Level 1 controlled fill;

- All existing loose surficial fill, topsoil, soft material, vegetation and materials containing significant organic matter were removed to expose the natural soil subgrade;
- Suitable fill material, sourced by the contractor and approved by Ground Science, was placed in loose horizontal layers not exceeding 250mm in thickness;
- The controlled fill 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);
- The fill was moisture conditioned to within 85% – 115% of the standard optimum moisture content;
- The fill material was sorted and mixed to eliminate particles greater than 20% by volume, particles coarser than 37.5mm and no particle over 200mm in any dimension;
- The frequency of field density testing adopted for the project was generally in line with the requirements for concentrated operations less than 500m^2 (Type 3), as detailed in AS3798 (2007), which nominates a frequency of not less than:
    - 1 test per layer per 500m^2;
    - Or 1 test per 100m^2 distributed reasonably evenly throughout full depth area;
    - Or 3 tests per visit, whichever requires the most tests.

4. INSPECTION AND TESTING

4.1 SUBGRADE INSPECTION

Fill material had already been placed on top of the prepared subgrade prior to Ground Science attending site, as such a subgrade inspection does not form part of this report.

4.2 CONSTRUCTION MATERIALS

The fill material used in this project was nominated by the on-site contractor. All fill was sourced from onsite stockpiles. The material was carted to site in dump trucks and stockpiled adjacent to the fill zones. Ground Science performed an assessment of the fill source to identify the following material characteristics:

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

Visual assessments on the above-mentioned properties were conducted on-site and the fill material used was considered acceptable for use on this project. The nominated fill products were visually assessed to comprise of silty clay, brown and dry of optimum moisture condition.

Minor gravel and cobble inclusions were observed throughout the fill material. The fill source was assessed to be dry of the optimum moisture content. All fill materials hauled to the site were however generally considered suitable for use as engineered fill.

4.3 FILL CONSTRUCTION

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

- Grader;
- Padfoot Roller.

During fill placement, the weather conditions were noted to be cool to sunny with temperatures typically ranging from 15 to 20 degrees Celsius. The filling process was generally consistent throughout the project and involved the stockpiling of approved fill sources stockpiled adjacent to the fill placement zones. The material was spread using a grader into thin loose layers. Each layer was compacted using the padfoot roller applying a minimum of 5 to 7 passes, per layer observed. The thin layers of fill were compacted to form a composite layer, measuring approximately 150mm thick, prior to undertaking the field density testing. This process was adopted for the fill placement works which comprised of approximately 0.45m of controlled fill being placed.

Throughout the filling process and/or at the completion of the day's production, compaction testing was performed to assess the achieved density ratio of each layer. Figure 1 provides a guide to the fill placement and is limited to the areas described in this report. Any fill placed as part of drainage, sewer works or similar does not form part of this Level 1 report.

4.4 RESULTS OF COMPACTION CONTROL TESTING

Level 1 Inspection and Testing was undertaken by experienced technicians from Ground Science who attended the site for the duration of the construction phase and nominated the location of the in-situ density tests. Testing comprised a total of 3 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289 5.8.1) together with 3 "Rapid HILF" Compaction tests (AS1289 5.7.1) which included associated re-tests of areas that did not achieve the target density ratio of 95% Standard Compaction.

Field density and compaction control testing report sheets are presented in Appendix B. It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed.

All tests were noted to have achieved the required target density ratio of 95% Standard compaction and with compliant moisture ratios ranging from 83% to 86%.

4.5 FINAL SURFACE LEVELS

Observations were made by a Ground Science staff member that filling had been complete up to the nominated finished levels as per confirmation provided from the contractor's site foreman. The observed final levels are the constructed finished surface levels of the controlled fill. It should be noted that the overall fill depths are estimated using onsite visual tactile methods and may not be a true representation of fill depths given that conditions on site may change over time. True fill depths should be obtained from the contractor's survey data.

5. COMPLIANCE

Ground Science Staff have undertaken Level 1 Inspection and Testing services of the construction of the controlled fill in the areas designated on Figure 1. Based on observations made by Ground Science staff and the results of density tests, we consider that the controlled fill placed has been constructed in accordance with the guidelines provided by AS3798 (2007).

It should be noted that the final fill 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 fill will deteriorate with time and should be taken into account by the foundation engineer prior to the construction of dwellings or buildings. The levels nominated in this report are a guide to amounts of fill placed and do not necessarily reflect an accurate survey of the fill levels.

6. UNDERSTANDING LEVEL 1 INSPECTION & TESTING

The purpose of performing Level 1 Inspection and Testing is to ensure compliance of the fill with the specification. The engagement of a Geotechnical Inspection Testing Authority (GITA) allows the contractor to perform their role in the construction of the filling operation while the GITA monitors the quality control process of the fill placement. The visual observations of thorough processes and work practices by the contractor allows the GITA to approve the subsequent placement of fill without having to wait for the completion of testing and the extended time it takes to get a test result back. The GITA will however, carry out random spot checks of the filling operations throughout the day's production as confirmation that the placement procedures and the fill moisture content is appropriate. At the end of a day's production the GITA will sign off the completed works as satisfactory. Any failed tests will result in that particular area of operation requiring rectification in the following mornings activities. This may be as simple as extra rolling with compaction plant if moisture conditioning is suitable. Sometimes these areas may be retested if the GITA feels it is necessary.

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 deal with 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 wet lands, dams, landfill liners and caps 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 one 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

Jason Menzies
Engineer Geologist

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.

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

Figures 1: Site Layout & Test Location Plans

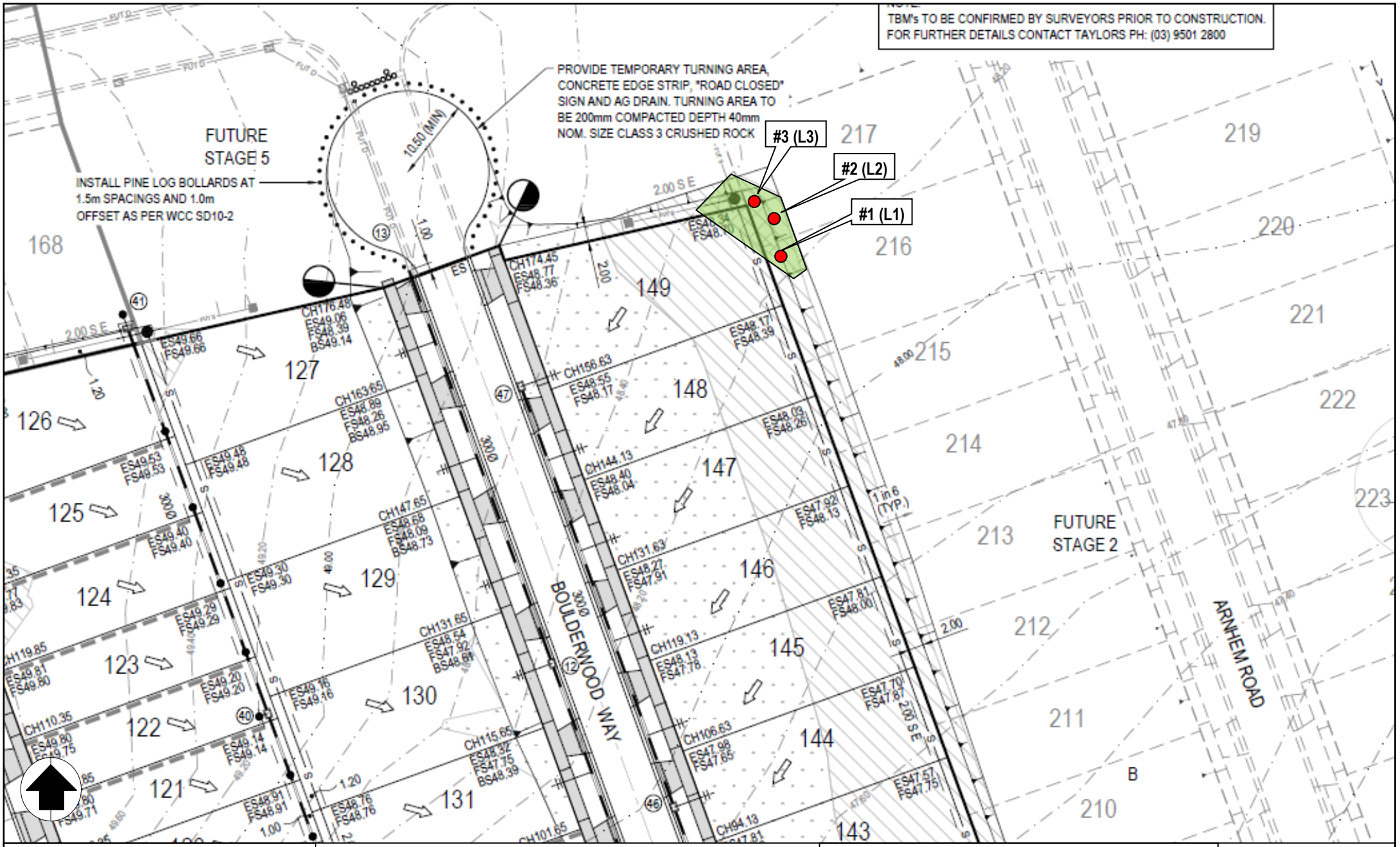

FIGURE 1
Savana – Stage 1A, Wyndham Vale
Site and Test Location Plan

LEGEND

Fill Placement (Approximate)

Density Test Location (Approximate)

JOB NO:	GS4450.1 AA
DATE:	15 DECEMBER 2016
DRAWN:	JM
CHECKED:	GS

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:	**GS4450/1**
project :	**SAVANA - STAGE 1A (LEVEL 1)**	report No.	**AA**
location :	**WYNDHAM VALE**	test date:	**12-Oct-17**

Test Number		1	2	3		
Test location taken from South West Corner		Lot 217 3m North 2m East	Lot 217 4m North 2m East	Lot 217 5m North 2m East		
Layer Number		1	2	Final Surface Layer		
Time of tests		9:15:00	9:45:00	10:15:00		
Depth of Layer	mm	150	150	150		
Depth of Test	mm	125	125	125		
Field Wet Density	t/m^3	1.75	1.81	1.81		
*Field Moisture Content	%	27.0	26.0	24.0		
Oversize Material	Wet %	0	0	0		
Sieve Size	mm	19.0	19.0	19.0		
Peak Converted Wet Density	t/m^3	1.711	1.713	1.743		
*Optimum Moisture Content	%	31.5	31.5	29.0		
Compactive Effort Used	std / mod	STD	STD	STD		
Moisture Ratio	%	**86**	**83**	**83**		
Moisture Variation	%	**-4.5**	**-5.5**	**-5.0**		
Moisture Variation		**DRY**	**DRY**	**DRY**		
Density Ratio	%	**102.5**	**105.5**	**104.0**		

Specification Requirements: 95% Standard compaction

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

Material description: CLAY, medium to high plasticity, fine, brown.

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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

Chris Senserrick
Approved Signatory
Date 13-Oct-17

APPENDIX C

Site Photographs


BOMAG
FAYAT GROUP
R201