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Report on
Preliminary Geotechnical Investigation

Proposed Residential Subdivision
(Lots 200-219) Caoura Road, Tallong

Prepared for
Presfloat Pty Ltd

Project 94080.00
September 2018

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	94080.00	Document No.	R.006.Rev0
Document title	Report on Preliminary Geotechnical Investigation Proposed Residential Subdivision		
Site address	(Lots 200-219) Caoura Road, Tallong		
Report prepared for	Presfloat Pty Ltd		
File name	94080.00.R.006.Rev0.Tallong Lots 200-219		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	M Jones	C Reid	3 September 2018

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Peter Atherton , Presfloat Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author	for M. Jones	3 September 2018
Reviewer		3 September 2018

bsi. ISO 9001 Quality Management
FS 604853

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Report on Preliminary Geotechnical Investigation
Proposed Residential Subdivision
(Lots 200-219) Caoura Road, Tallong

1. Introduction

This report presents the results of a preliminary geotechnical investigation carried out for a proposed residential subdivision (Lots 200-219) adjacent to Caoura Road, Tallong. The work was carried out at the request of Presfloat Pty Ltd, project developer.

It is understood that the project comprises the creation of 20 residential lots and the removal / backfilling of an existing dam and drainage swales as part of subdivision development. The investigation was carried out to assess the broad subsurface conditions and provide preliminary comment on site classification, site preparation, earthworks and drainage.

The investigation comprised the logging and sampling of test pits followed by laboratory testing on collected samples and preparation of an engineering report. Details of the work undertaken and the results obtained are given in the report.

Details provided by the client for the investigation included a site plan indicating the lot layout.

This report must be read in conjunction with the notes “About this Report” which are included in Appendix A.

2. Site Description

Future Lots 200 – 219 cover an irregular shaped area of about 5.3 hectares with maximum north-south and east-west dimensions of 900 m and 214 m respectively. The site is located to the west Caoura Road, north of Kettles Lane and bounded by vacant land to the west and existing development to the north.

At the time of the investigation, the site was lightly grassed with several stands and rows of trees. An existing dam was located at the rear of future Lot 202 and several drainage swales located across multiple blocks. Several areas have been disturbed from previous site works.

The overall surface levels across the investigated area fall to the north.

Figures 1 and 2 show the current site conditions

Figure 1: Looking north from Pit 10 at Pit 9. Existing dam on Lot 202 in the background

Figure 2: View from southern corner (~Lot 216 / Lot 217 boundary) looking west

3. Regional Geology

Reference to the 1:250,000 Geological Survey of NSW Statewide Geodatabase, indicates that the site is underlain by rock units of the Shoalhaven Group. This unit typically comprises sandstone, siltstone and shale.

4. Field Work Methods

The field work comprised the excavation of 11 test pits (Pits 6 – 16) using a Kobelco SK45SRX mini-excavator fitted with a 600 mm wide bucket to depths of 0.7 – 2.0 m.

Dynamic cone penetrometer tests (AS1289 6.3.2) were generally undertaken adjacent to each test pit location to provide an assessment of the in-situ strength of site soils. The test pits were logged onsite by a senior geotechnical engineer and incorporated the collection of disturbed samples to assist in strata identification and for laboratory testing.

The approximate test location coordinates provided on each test pit log were determined on site using a hand held GPS which is accurate only to about 3 – 5 m. Surface levels have been estimated from the mapping website Nearmap (www.nearmap.com.au) and must not be relied on.

The approximate test locations are shown on Drawing 1 in Appendix B.

5. Field Work Results

The test pit logs are given in Appendix C together with notes that define classification methods and descriptive terms. The test pit excavations encountered variable subsurface conditions underlying the site with the principal succession of strata broadly summarised as follows:

- TOPSOIL/TOPSOIL FILLING: silty sand with some gravel to depths of 0.1 – 0.2 m.
- FILLING (uncontrolled): silty sandy clay with timber pieces in Pit 13 to 1.2 m depth.
- SILT AND SAND: silty sand, sandy silt and sand to depths of 0.2 – 0.5 m in all pits except Pit 13 and Pit 15.
- CLAY, SILT, SAND and GRAVEL: variable mixture of clay, silt, sand and gravel to the limit of investigation of 1.6 – 2.0 m in Pits 7, 9, 11 – 14 and 16 and to depths of 0.65 – 1.6 m in Pits 6, 8, 10 and 15.
- SANDSTONE: very low to medium strength sandstone in Pits 6, 8, 10 and 15 below depths of 0.65 – 1.6 m continuing to the limit of investigation of 1.5 m and 1.7 m in Pit 8 and Pit 15 respectively and to refusal depths of 0.9 m and 0.7 m in Pit 6 and Pit 10.

It is noted that moist to wet conditions were encountered in Pit 7 below 1.8 m depth which was located downstream of the existing farm dam.

It is also noted that an old terracotta pipe was in Pit 11 below 1 m depth.

No free groundwater was observed during excavation of the test pits. However the pits were backfilled immediately following excavation precluding longer term monitoring of groundwater levels. Groundwater conditions rarely remain constant and can change seasonally due to variations in rainfall, temperature and soil permeability. For these reasons, it is noted that the moisture condition of the site soils may vary considerably from the time of the investigation compared to at the time of construction.

6. Laboratory Testing

Two samples collected from the test pits were tested in the laboratory for measurement of field moisture content and plasticity properties. The detailed laboratory report sheets are given in Appendix D and the results summarised in Table 1.

Table 1: Summary of Laboratory Testing

Pit	Depth (m)	FMC (%)	LL (%)	PI (%)	LS (%)	Field Description
7	0.9	16.2	43	26	12.0	Clayey Sand/Sandy Clay
14	1.2	29.3	100	66	15.5	Silty Clay

Where: FMC = Field Moisture Content LL = Liquid Limit
PI = Plasticity Index LS = Linear Shrinkage

The results indicate that the samples tested were of medium to high and high plasticity.

7. Proposed Development

It is understood that the proposed development of the site will comprise the following:

- the creation of 20 residential lots, and
- the removal / backfilling of an existing dam within proposed Lot 202 and existing swales across multiple lots.

Bulk earthworks to achieve design surface levels is expected to be minor, excluding the dam backfilling.

8. Comments

8.1 General

The following comments are based on the results of field mapping and limited subsurface investigation from within the development area. They have been provided as preliminary comments to assist with the construction of the subdivision. Further investigations will be required following completion of site works to provide a detailed report for each lot.

8.2 Site Preparation and Earthworks

8.2.1 Stripping

Site preparation for the construction of controlled filling and future dwellings should include the removal of vegetation, uncontrolled filling, topsoil and other deleterious materials from the proposed construction areas. Based on the results of the investigation, the depth of topsoil stripping will mostly range from 0.1 – 0.2 m. Deeper excavations (such as in gullies) must be anticipated in areas of localised deeper topsoils or unsuitable materials / filling (i.e. Pit 13: fill to a depth of 1.2 m) where encountered, or if inclement weather precedes construction or if the contractor adopts inappropriate stripping methods.

Silty and sandy soils were encountered underlying the topsoil in most parts of the site and allowance should be made for at least partial removal (0.2 – 0.3 m following topsoil stripping) of these soils. The depth of silty / sandy soil is expected to be in the range 0.3 – 0.5 m. The silty sand / sandy silt could prove to be difficult to handle and compact upon, particularly if subject to water infiltration, and would require careful moisture control.

It is recommended that inspection of stripped surfaces be undertaken by a suitably qualified geotechnical engineer in the presence of the Site Superintendent to assess the need for further removal of unsuitable material or of any other remedial measures.

8.2.2 Site Trafficability

Following periods of wet weather, the natural surface across the site is will be boggy and effectively untrafficable to all but tracked construction vehicles. Some measures that can be undertaken to reduce the impact of wet weather on the earthworks construction include:

- retain grass cover wherever possible;
- provide cut surfaces with an slight but even cross-gradient to assist surface drainage;
- “seal” exposed fill surfaces at the end of each work day by running over with a smooth-wheeled roller;
- armour temporary access roads with rockfill;
- form swale drains at upslope locations to help intercept surface and near-surface seepage water and to redirect it into existing drainage gullies or dams, or to sediment retention ponds.

8.2.3 Excavation Conditions

The silty topsoil, natural soils and extremely low to low strength bedrock could be expected to be excavated using conventional earthmoving plant and as such no difficulties are anticipated for these materials Large excavators with rock hammers, toothed buckets and/or rippers will be required to remove the low strength (or greater) weathered rock around Pits 6 and 10 should excavations proceed below the depth of the test pits in these areas. Low production rates will be experienced.

Groundwater seepages into excavations will occur from the silty / sandy mantle, from sandy soils within gully and low lying areas and/or fractures in the bedrock after periods or rain. Seepage flows should be temporary and readily controllable by gravity draining to a collection sump or pond. Consideration should be given to installation of diversion drains across the site to minimise surface and subsurface water entering into the site.

8.2.4 Excavation Batters

For permanent excavations in the topsoil, natural soils and rock, maximum gradients of 2.5H:1V (horizontal:vertical) for natural soils/extremely low to very low strength rhyodacite rock and 1H:1V in low or greater strength rock are recommended. Batters in low or greater strength rock would need to be individually inspected and assessed. It is recommended all rock batters be inspected for adequacy of the designed slope and determine if any stabilisation measures are required taking into consideration defects in the rock. To minimise surface erosion the batter should be protected with toe and spoon drains and vegetated as soon as possible after construction.

For temporary excavations, maximum gradients of 1H:1V and 0.5H:1V are suggested for natural soils / extremely low to very low strength rock and low or greater strength rock respectively.

8.2.5 Reuse of Excavated Material

The topsoil and upper silty / sandy layer (underlying the root zone) is not considered suitable for engineering applications. The non-organic silty / sandy soil could be mixed and blended in small portions (less than 20% by volume) with other suitable soil and / or rock for use as general filling in road embankments, verges or landscaped areas.

The natural soils underlying the topsoil and silty / sandy layer comprise a variable mix of sand, silt, clay and gravel. Reuse of high plasticity soils is not recommended in construction areas due to the risk of shrink/swell movements. However low and medium plasticity clays and even some medium to high plasticity clays could be blended with the low plasticity/weathered rock soils underlying the topsoil and silt/sand and re-used as general fill or as controlled filling.

The extremely low to low strength rock is considered suitable for reuse in all areas of controlled filling, embankment filling or possibly select filling.

As excavation proceeds below the level of low strength rock, it would be expected that cobble and boulder sized rock pieces would be removed, which would need to be crushed to a general maximum particle size of 75 mm prior to use within filling areas. Some rock particles, say up to 150 mm would be considered acceptable however only in a small percentage of the overall filling volume, say 5 – 10%.

8.2.6 Filling Placement and Compaction

In areas that require filling, the stripped surfaces must be test rolled in the presence of a geotechnical engineer. Any areas exhibiting significant deflections under test rolling should be treated by over-excavation and replaced with approved filling. Depending on prior weather conditions it may also be necessary to use a geofabric separation layer.

All controlled filling should be placed in horizontal layers of maximum 250 mm loose thickness. The material should be placed in accordance with the requirements of Council. Moisture content should be within the range ±2% of Standard optimum.

All constructed fill batters should be constructed no steeper than 2.5:1 (horizontal:vertical), protected against erosion by vegetating the exposed surface and construction of toe and spoon drains as a means of controlling surface water flows on the batters.

All filling placed within construction platforms should be compacted to a minimum 100% Standard maximum dry density.

To validate the filling quality, field inspections and in-situ testing of future earthworks must be undertaken.

8.3 Backfilling of Dam

In the area of the existing dam, any existing uncontrolled filling (i.e. dam embankments) and underlying topsoil must be removed and the exposed stripped surface assessed for further stripping.

In order to backfill the dam, all water and any soft sediments from within the dam would be required to be removed and the stripped surfaces test rolled in the presence of a geotechnical engineer. Any areas exhibiting significant deflections under test rolling should be treated by over-excavation and replaced with approved filling. Depending on prior weather conditions it may also be necessary to use a geofabric separation layer or a drainage layer. All controlled filling must be placed in accordance with Section 8.2.6.

8.4 Drainage

Surface and subsoil drainage should be installed and maintained to protect the developed lots. Table or swale drains should be formed upslope with an invert level at a minimum of 0.5 m depth below surface level and possibly within bedrock if subsurface flows are occuring.

8.5 Likely Site Classifications

Based on the results of the field investigation and laboratory testing, the classification of the lots are likely to range from Class M (moderately reactive) to Class H1 or H2 (highly reactive) where natural soils are encountered. If dwellings are to be located within the influence of trees, Class P conditions will also be warranted. In areas of uncontrolled filling i.e. Pit 13, a Class P (problem) site classification would be warranted. If the uncontrolled filling, (where encountered) is fully removed, it is likely the site could be reclassified. Once created, each lot should be the subject of an individual site classification assessment.

9. Limitations

Douglas Partners (DP) has prepared this report for Proposed Residential Subdivision development (Lots 200-219) Caoura Road, Tallong in accordance with DP's proposal CAN180176 dated 27 July 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Presfloat Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

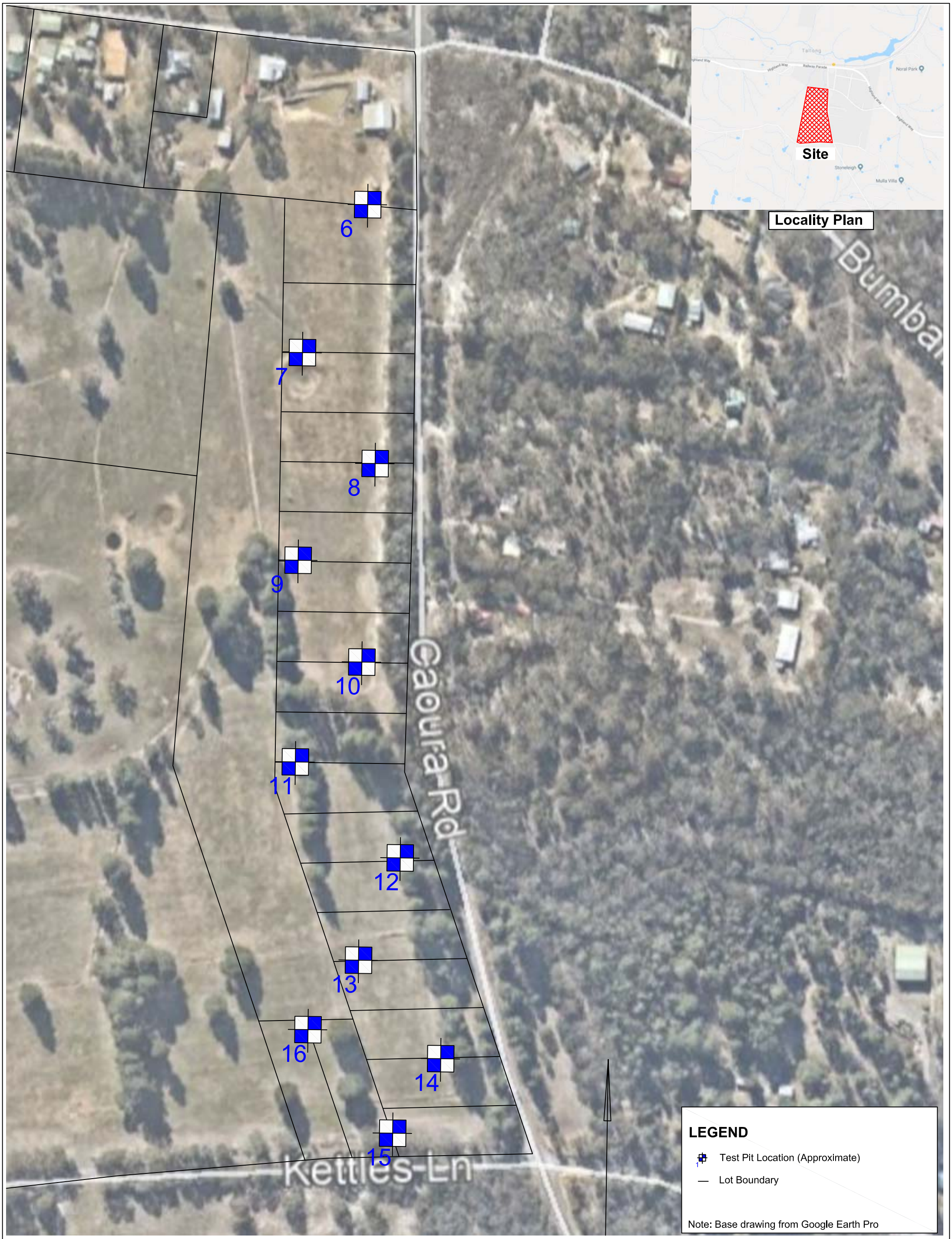
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Drawing 1 – Test Location Plan



Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: **Test Location Plan**
Proposed Residential Subdivision
(Lots 200 - 219) Caoura Road, Tallong

N

OFFICE: Canberra
DRAWN BY: SDG
DATE: 31.08.2018

CLIENT: Presfloat Pty Ltd
PROJECT No: 94080.00
DRAWING No: 1
REVISION: A
SCALE: NTS

Appendix C

Explanatory Notes
Test Pit Logs (Pits 6 – 16)

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

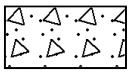
Symbols & Abbreviations

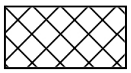
Graphic Symbols for Soil and Rock

General

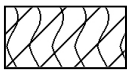

Asphalt

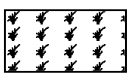

Road base

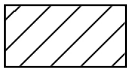

Concrete

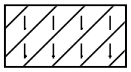

Filling

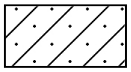
Soils


Topsoil

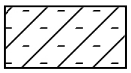

Peat

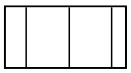

Clay

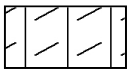

Silty clay

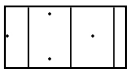

Sandy clay

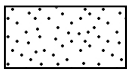

Gravelly clay

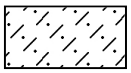

Shaly clay

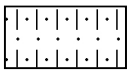

Silt


Clayey silt


Sandy silt

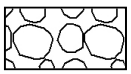

Sand

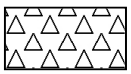

Clayey sand


Silty sand


Gravel

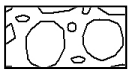

Sandy gravel


Cobbles, boulders

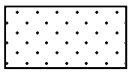

Talus

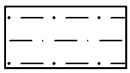
Sedimentary Rocks

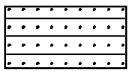

Boulder conglomerate

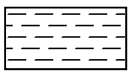

Conglomerate


Conglomeratic sandstone

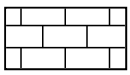

Sandstone


Siltstone

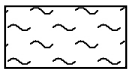

Laminite

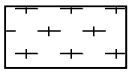

Mudstone, claystone, shale

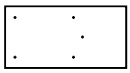

Coal


Limestone

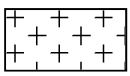
Metamorphic Rocks

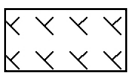

Slate, phyllite, schist

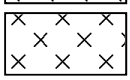

Gneiss

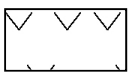

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 625.1 AHD
EASTING: 233094
NORTHING: 6153905

PIT No: 6
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
625	0.1	TOPSOIL-generally comprising dry to dry/moist, grey brown, fine to medium grained silty sand with abundant rootlets and some sub-rounded gravel							
		SILTY SAND-loose to medium dense, dry/dry to moist, grey silty sand with some sub-rounded gravel		D	0.2				
	0.3	SILTY CLAYEY SAND-medium dense, dry to moist, yellow orange, low to medium plasticity, fine to medium grained silty clayey sand		D	0.6				
	0.65	CLAYEY SANDY GRAVEL-medium dense, dry to moist, orange, medium to coarse grained sub-rounded gravel							
	0.85	SANDSTONE-medium strength, moderately weathered, light grey, fine to medium grained sandstone							
	0.9	Pit discontinued at 0.9m -refusal							
624	1								1
623	2								2

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket
LOGGED: Reid
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 625.7 AHD
EASTING: 233035
NORTHING: 6153816

PIT No: 7
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
625	0.15	TOPSOIL-generally comprising dry, dark brown, fine to medium grained silty sand with abundant rootlets							
		SILTY SAND-dense, dry to moist, grey, fine to medium grained silty sand		D	0.3				
	0.4	CLAYEY SAND/SANDY CLAY-medium dense to dense/very stiff, moist, grey mottled orange, fine to medium grained, medium plasticity clayey sand/sandy clay							
		-from 0.8m, dense/very stiff to hard		D	0.9				
624	1								1
		-from 1.8m, moist to moist/wet		D	1.8				
	2 2.0	Pit discontinued at 2.0m -limit of investigation							2
623									

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket **LOGGED:** Reid **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: downstream of existing dam

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 630.2 AHD
EASTING: 233096
NORTHING: 6153747

PIT No: 8
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
630	0.1	TOPSOIL-generally comprising dry to dry/moist, grey brown, fine to medium grained silty sand with abundant rootlets and some sub-rounded gravel							
		SILTY SAND-loose to medium dense, dry/dry to moist, grey silty sand with some sub-rounded gravel							
	0.3	SILTY CLAYEY SAND-dense, dry to moist, yellow orange, low to medium plasticity, fine to medium grained silty clayey sand		D	0.5				
		-from 0.7m, medium dense							
629	1.0	CLAYEY SANDY GRAVEL-dense, dry to moist, orange, medium to coarse grained sub-rounded gravel							
	1.15	SANDSTONE-very low to low strength, highly weathered, light grey and red, fine to coarse grained sandstone		D	1.3				
	1.5	Pit discontinued at 1.5m -limit of investigation							
628									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1; 2

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket
LOGGED: Reid
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 629.5 AHD
EASTING: 233043
NORTHING: 6153685

PIT No: 9
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
629	0.1	TOPSOIL-generally comprising dry to moist, dark grey, fine to coarse grained silty sand with abundant rootlets							
		SILTY SAND-dense, dry/dry to moist, grey, fine to medium grained silty sand with minor rootlets							
	0.5	CLAYEY SAND/SANDY CLAY-dense/very stiff to hard, dry to moist, grey mottled orange, fine to medium grained, medium plasticity clayey sand/sandy clay		D	0.8				
	1								1
	1.2	SILTY CLAY/CLAYEY SILT-hard, dry, grey brown, low plasticity silty clay/clayey silt							
628				D	1.4				
	2	2.0							2
		Pit discontinued at 2.0m -limit of investigation							
627									

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket **LOGGED:** Reid **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 633.3 AHD
EASTING: 233091
NORTHING: 6153624

PIT No: 10
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
633	0.1	TOPSOIL-generally comprising dry to moist, dark grey, fine to coarse grained silty sand with abundant rootlets							
	0.2	SILTY SAND/SAND, dense, moist , grey, fine to medium grained silty sand/sand with some gravel							
		GRAVELLY CLAYEY SAND-medium dense, moist, orange, fine to medium grained gravelly clayey sand/sand, sub-rounded gravel		D	0.4				
		-from 0.5m, grading to sandy gravel							
	0.65	SANDSTONE-medium strength, moderately weathered, light grey, fine to medium grained sandstone							
	0.7	Pit discontinued at 0.7m -refusal							
632	1								1
631	2								2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 633.3 AHD
EASTING: 233039
NORTHING: 6153565

PIT No: 11
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
633	0.1	TOPSOIL-generally comprising dry to moist, dark grey, fine to coarse grained silty sand with abundant rootlets							
		SILTY SAND-medium dense, moist, grey, fine to medium grained silty sand with roots							
	0.3	SAND-medium dense, moist, light grey brown, fine to medium grained sand, slightly silty and clayey, with minor roots		D	0.4				
	0.5	SANDY CLAY-stiff to very stiff, moist/moist to wet, orange grey, high plasticity sandy clay with some clayey sand and firm, moist to wet zones to 1m		D	0.9				
632	1								1
	2 2.0	Pit discontinued at 2.0m -limit of investigation							2
631									

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket **LOGGED:** Reid **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: a terracotta pipe encountered at 1m depth, narrow ~0.3m with backfill trench crossing pit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 637.0 AHD
EASTING: 233113
NORTHING: 6153504

PIT No: 12
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
637	0.1	TOPSOIL-generally comprising dry, grey sandy silt with rootlets							
		SANDY SILT-hard, dry, grey, fine grained sandy silt		D	0.2				
	0.4	CLAYEY SAND/SANDY CLAT-dense/hard, dry/dry to moist, grey mottled orange, fine to medium grained, medium plasticity clayey sand/sandy clay		D	0.6				
636	1			D	1.2				1
	1.6	Pit discontinued at 1.6m -slow progress							
635	2								2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 635.6 AHD
EASTING: 233080
NORTHING: 6153443

PIT No: 13
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
635	0.1	TOPSOIL FILLING-generally comprising dry, grey/brown sandy silt with abundant rootlets							
		FILLING-generally comprising (very stiff to hard), dry, grey orange brown, low to medium plasticity silty sandy clay with wood (timber) pieces		D	0.8				
	1.2	SILTY CLAY-very stiff, moist, grey mottled orange and red, high plasticity silty clay		D	1.5				
634	1.6	Pit discontinued at 1.6m -limit of investigation							
633									

5 10 15 20

1 2

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket **LOGGED:** Reid **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 640.8 AHD
EASTING: 233144
NORTHING: 6153384

PIT No: 14
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
640	0.1	TOPSOIL-generally comprising dry, grey brown sandy silt with abundant rootlets							
		SANDY SILT-medium dense, dry, light grey sandy silt with minor rootlets							
	0.25	SILTY SANDY CLAY-very stiff, dry to moist/moist, yellow orange and grey, medium plasticity silty sandy clay		D	0.5				
	1 1.0	SILTY CLAY-very stiff, dry to moist/moist, light grey mottled red, high plasticity silty clay with trace gravel		D	1.2		pp = 300		
		-from 1.4m, dry							
639	1.8	Pit discontinued at 1.8m -limit of investigation							
638	2								

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 642.1 AHD
EASTING: 233107
NORTHING: 6153336

PIT No: 15
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
642	0.2	TOPSOIL-generally comprising dry, grey sandy silt with abundant roots and rootlets							
		GRAVELLY SANDY CLAY-hard, dry, light brown, low plasticity desiccated gravelly sandy clay with sub-rounded gravel		D	0.6		pp >400		
641	1.0	SILTY CLAY-hard, dry, grey mottled orange and red, high plasticity silty clay		D	1.2		pp >400		1
	1.6	SANDSTONE-very low strength, extremely to highly weathered, orange and grey, fine to medium grained sandstone		D	1.65				
	1.7	Pit discontinued at 1.7m -limit of investigation							
640	2								2

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket
LOGGED: Reid
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Presfloat Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: (Lots 200-219) Caoura Road, Tallong

SURFACE LEVEL: 637.3 AHD
EASTING: 233053
NORTHING: 6153399

PIT No: 16
PROJECT No: 94080.00
DATE: 15/8/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
637	0.1	TOPSOIL-generally comprising dry, grey sandy silt with rootlets							
		SANDY SILT-hard, dry, grey, fine grained sandy silt							
	0.3	SANDY SILTY CLAY-very stiff to hard, dry to moist, yellow orange, medium plasticity sandy silty clay with trace sub-rounded gravel		D	0.7		pp = 350-400		
	1 1.0	SILTY CLAY-very stiff, dry to moist/moist, grey mottled orange and red, high plasticity silty clay		D	1.5		pp = 320		1
636	2 2.0	Pit discontinued at 2.0m -limit of investigation							2
635									

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: Kobelco SK45SRX (4.5 tonne) mini-excavator, 600mm bucket **LOGGED:** Reid **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Appendix D

Results of Laboratory Tests (2 pages)

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Goulburn Laboratory
1 Farquhar Street Goulburn NSW 2580
Phone: 02 4822 8395
Email: tom.gordon@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Tom Gordon
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **94080.00-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/08/2018
Client: Presfloat Pty Ltd
PO Box 555, Cronulla NSW 2230
Contact: Peter Atherton (Landline Realty)
Project Number: 94080.00
Project Name: Proposed Residential Lots
Project Location: Bumballa Road, Tallong
Work Request: 1385
Sample Number: 18-1385B
Date Sampled: 09/08/2018
Sampling Method: Sampled by Engineering Department
Sample Location: **Pit 7 (0.9 m)**
Material: Clayey Sand / Sandy Clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	43		
Plastic Limit (%)	17		
Plasticity Index (%)	**26**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	12.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	16.2

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Goulburn Laboratory
1 Farquhar Street Goulburn NSW 2580
Phone: 02 4822 8395
Email: tom.gordon@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Tom Gordon
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **94080.00-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/08/2018
Client: Presfloat Pty Ltd
PO Box 555, Cronulla NSW 2230
Contact: Peter Atherton (Landline Realty)
Project Number: 94080.00
Project Name: Proposed Residential Lots
Project Location: Bumballa Road, Tallong
Work Request: 1385
Sample Number: 18-1385C
Date Sampled: 09/08/2018
Sampling Method: Sampled by Engineering Department
Sample Location: **Pit 14 (1.2 m)**
Material: Silty Clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	100		
Plastic Limit (%)	34		
Plasticity Index (%)	**66**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	29.3