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Our Ref: PSM4503-007L REV1

06 December 2022

JBS&G
Level 1, 50 Margaret St
SYDNEY NSW 2000
SGray@jbsg.com.au

Attention: Sarah Gray

Dear Sarah

**RE: THE GABLES RESIDENTIAL DEVELOPMENT, BOX HILL GEOTECHNICAL DESKTOP STUDY**

## 1. Introduction

This letter presents the results of the geotechnical desktop study undertaken by Pells Sullivan Meynink (PSM) for the proposed "Gables" residential development at Box Hill, at the sites shown in Table 1.

This work has been undertaken in accordance with the PSM proposal (Ref. PSM4503-006L, dated 28 February 2022); i.e. Option 1 – Desktop Study. This revision includes the desktop study of 109 Old Pitt Town Road (Site 15). The update was undertaken in accordance with the PSM proposal (ref. PSM4503-008L, dated 6 October 2022).

## 2. Background

PSM has previously undertaken a geotechnical investigation in 2021 for seven (7) properties part of the Gables development (refer to Appendix C - PSM4503-003L REV1, dated 9 November 2021). This desktop study is for an additional eight (8) sites for which a geotechnical investigation has not been undertaken.

Figure 1 presents a site locality plan of the proposed development sites.

Figure 2 presents a masterplan of the proposed development.

**Table 1 – Overview of sites covered in this desktop study and sites at which PSM has undertaken a past geotechnical investigation**

| Site | Address | Lot / DP | Area (ha) | Comment |
|---|---|---|---|---|
| 1 | 151 Boundary Road | 11 / 593517 | 10.01 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |
| 2 | 1 Cataract Road/147 Boundary Road | 14 / 255616 | 10.15 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |
| 3 | 93 Old Pitt Town Road | 12 / 1557044 | 2 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |

| | | | | |
|---|---|---|---|---|
| 4 | 95 Old Pitt Town Road | 2 / 39157 | 2 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |
| 5 | 97 Old Pitt Town Road | 3 / 39157 | 2 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |
| **6** | **99 Old Pitt Town Road** | **4 / 39157** | **2** | **Covered in this desktop study** |
| **7** | **101 Old Pitt Town Road** | **5 / 39157** | **2** | **Covered in this desktop study** |
| 8 | 103 Old Pitt Town Road | 6 / 39157 | 2 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |
| 9 | 145 Boundary Road | 13 / 255616 | 11 | Refer to Appendix C - PSM4503-003L REV1 (Geotechnical investigation undertaken previously) |
| **10** | **4 Cataract Road** | **19 / 255616** | **15** | **Covered in this desktop study** |
| **11** | **2 Cataract Road** | **20 / 255616** | **10** | **Covered in this desktop study** |
| **12** | **105 Old Pitt Town Road** | **2 / 1213569** | **2** | **Covered in this desktop study** |
| **13** | **111 Old Pitt Town Road** | **21 / 609902** | **2.1** | **Covered in this desktop study** |
| **14** | **113 Old Pitt Town Road** | **10A / 39157** | **2.7** | **Covered in this desktop study** |
| **15** | **109 Old Pitt Town Road** | **20 / 609902** | **2.1** | **Covered in this desktop study** |

Based on the information provided and PSM's observations whilst on-site in 2021, we understand the following:

- The sites are currently rural residential properties which typically comprised a dwelling and associated shed, grassed areas, gravel driveways, vegetated areas, small dams, and on some of the sites small fill stockpiles
- Stockland is proposing to develop the sites into a new residential development, "The Gables". At this stage, details of the proposed development (building layouts, earthworks, etc.) are not known to PSM.

## 3. Review of Historical Aerial Photographs

A review of historical aerial photographs from the NSW Government's Historical Imagery database and Nearmap was undertaken to assess the historical land use of each site, in particular, evidence of past excavations and filling. A summary of the historical changes at the site is outlined below. Appendix A presents a compilation of historical aerial photographs between 1947 and 2021 for each of the sites.

**Sites 6, 7, 13, 14, 15 (Property Lots 4, 5, 21, 10A, 20)**

- 1947: Open farmland
- 1965 to 2005: Small dams and structures (buildings) constructed on each site
- 2005: Increase in trees and vegetation.

The site does not appear to have changed significantly since 2005. They are still mostly "greenfield" sites.

**Sites 12 – Lot 2 (two sub-divided areas separated by Valetta Drive)**

- 1947: Open farmland

- 1965 to 2005: Small dams and structures (buildings) constructed on the site
- February 2016: Bulk earthworks appear to have begun in the eastern area
- July 2016: Bulk earthworks had occurred in both the western and eastern areas. The dam located between the two sub-divided areas has been filled
- December 2016: Pavement has been placed on Valletta Drive
- July 2018: Bulk earthworks activity appears to have been completed.

The site does not appear to have changed significantly since July 2018. Details of the bulk earthworks (e.g. fill depths, fill placement, specification, etc.) are not known to PSM.

**Site 10 – Lot 19**

- 1947: Open farmland with small structures (buildings) and a dam located in the north western corner of the site
- 1965: The dam in the north western corner has increased in extent. A large dam has been constructed in the north eastern corner of the site. Small structures (buildings) constructed on the site
- 1975: The dam in the north eastern corner of the site has increased in extent. Small structures (buildings) constructed on the site
- 2004: The small structures (buildings) in the centre of the site have been demolished
- 2009: New small structures (buildings) have been constructed in the centre of the site
- 2021 January: Bulk earthworks appears to have occurred in the eastern neighbouring sites. The dam in the north eastern corner of the site has been partially backfilled
- 2021 April: The dam in the north eastern corner of the site has been completely backfilled.

The site does not appear to have changed significantly since April 2021. Details of the bulk earthworks (e.g. fill depths, fill placement, specification, etc.) are not known to PSM.

**Site 11 – Lot 20**

- 1947: Open farmland
- 1965: One small dam has been constructed in the western portion of the site
- 1975 to 2004: Small structures (buildings) constructed on the site.

The site does not appear to have changed significantly since 2004. It is still mostly a “greenfield” site.

## 4. Review of Geological Map

The 1:100,000 Penrith Geological map (1991) indicates that:

- Sites 6, 7 and 12 are primarily underlain by the Wianamatta Group formation (Minchinbury Sandstone – Rwm) comprising fine to medium-grained quartz-lithic sandstone.
- Sites 10, 11, 13, 14 and 15 are underlain by the:
  - Wianamatta Group formation (Minchinbury Sandstone – Rwm) comprising fine to medium-grained quartz-lithic sandstone and
  - Wianamatta Group formation (Ashfield Shale – Rwa) comprising dark-grey to black claystone-siltstone and fine sandstone-siltstone laminite.


**Inset 1: Geological map of the proposed development sites**

## 5. Site with Geotechnical Investigation Data (Site 1 to 5, 8 and 9)

### 5.1 Overview – Geotechnical Investigation 2021

PSM has previously undertaken a geotechnical investigation in 2021 for seven (7) properties part of the Gables development (refer to Appendix C - PSM4503-003L REV1, dated 9 November 2021).

The fieldwork for the seven sites (Sites 1 to 5, 8 and 9) was undertaken on the following dates:

- 12 to 16 July 2021
- 2, 4 and 5 August 2021, and
- 20 to 21 October 2021.

Across the seven properties investigated, a total of 50 test pits were excavated and logged by PSM to depths of between 0.4 m and 2.9 m (referred to here-in as PSM test pits). JBS&G completed additional test pits to shallower depths of generally 0.4 m (referred to here-in as JBS&G test pits). Dynamic Cone Penetrometer (DCP) testing was undertaken at each of the PSM test pit locations. Table 2 presents a summary of the fieldwork undertaken by PSM.

**Table 2 – Test pits Excavated at Each Site**

| Site | Date of Fieldwork | Number of Test Pits Logged by PSM | Depth (m) |
|---|---|---|---|
| 1 | 04/08/2021 and 05/08/2021 | 11 | 0.4 – 2.2 |
| 2 | 16/07/2021 and 02/08/2021 | 10 | 0.6 – 2.9 |
| 3 | 12/07/2021 | 5 | 1.0 – 2.4 |
| 4 | 13/07/2021 | 5 | 1.0 – 2.0 |
| 5 | 14/07/2021 | 4 | 1.0 – 1.5 |
| 8 | 15/07/2021 | 5 | 0.8 – 1.5 |
| 9 | 20/10/2021 and 21/10/2021 | 10 | 1.0 – 2.8 |

The locations of the PSM test pits are presented in Figures 3 to 6.

Refer to Appendix C - PSM4503-003L REV1 for tabulated test pit logs including photographs of the PSM test pits and the results of the DCP testing undertaken at these test pit locations.

## 5.2 Laboratory Testing

As part of the past geotechnical investigation undertaken, soil samples across the seven sites investigated were sent to a geotechnical laboratory for the following testing:

- Shrink-Swell index tests on undisturbed U50 tube samples
- California Bearing Ratio (CBR): Tests were undertaken on 4 day soaked samples compacted to 98% MDD at OMC, with a 4.5 kg surcharge.

Table 3 and Table 4 present a summary of the CBR and Shrink-Swell index test results respectively. Refer to Appendix C - PSM4503-003L REV1 for the CBR and Shrink-Swell index laboratory reports.

**Table 3 – Summary of CBR Test Results**

| Site | PSM TP ID | Depth (m) | Material Description | Soaked CBR (%) | OMC (%) | Standard Maximum Dry Density ($t/m^3$) | Swell (%) |
|---|---|---|---|---|---|---|---|
| Site 1 | TP11_3 | 0.5 – 1.0 | CLAY | 3.5* | 30.9 | 1.41 | 1.5 |
| | TP11_5 | 0.5 – 1.0 | CLAY | 5.0* | 16.4 | 1.86 | 0.0 |
| | TP11_6 | 0.5 – 1.0 | CLAY | 1.5* | 21.6 | 1.67 | 2.5 |
| | TP11_9 | 0.5 – 1.0 | CLAY | 4.0* | 17.9 | 1.75 | 0.5 |
| Site 2 | TP14_1 | 0.4 – 0.6 | CLAY | 1.5* | 17.8 | 1.74 | 2.5 |
| | TP14_5 | 0.5 – 1.0 | CLAY | 4.5* | 20.3 | 1.73 | 1.0 |
| | TP14_8 | 0.5 – 1.0 | Silty CLAY | 3.5* | 19.3 | 1.75 | 2.0 |
| | TP14_10 | 0.5 – 1.0 | Silty CLAY trace gravel, gravelly CLAY | 4.0* | 17.3 | 1.83 | 0.0 |
| Site 3 | TP12_2 | 0.45 – 1.0 | CLAY | 2.0* | 16.5 | 1.56 | 2.5 |
| | TP12_3 | 0.5 – 1.0 | CLAY | 0.5* | 13.3 | 1.64 | 3.5 |

| Site | PSM TP ID | Depth (m) | Material Description | Soaked CBR (%) | OMC (%) | Standard Maximum Dry Density (t/m$^3$) | Swell (%) |
|---|---|---|---|---|---|---|---|
| Site 4 | TP2_1 | 0.5 – 1.0 | CLAY trace gravel | 3.5* | 19.0 | 1.77 | 1.0 |
| | TP2_3 | 0.5 – 1.0 | CLAY | 6.0* | 23.8 | 1.58 | 1.5 |
| Site 5 | TP3_2 | 0.45 – 1.0 | CLAY | 0.5* | 21.2 | 1.50 | 4.5 |
| | TP3_4 | 0.5 – 1.0 | CLAY | 2.0** | 22.5 | 1.63 | 1.5 |
| Site 8 | TP6_2 | 0.5 – 1.0 | CLAY trace gravel | 4.0* | 19.5 | 1.73 | 2.5 |
| | TP6_5 | 0.5 – 1.0 | CLAY | 1.5** | 19.7 | 1.72 | 3.0 |
| Site 9 | TP13_1 | 0.5 – 1.0 | CLAY | 3.5* | 18.8 | 1.70 | 1.5 |
| | TP13_3 | 0.5 – 1.0 | CLAY | 7.0* | 19.1 | 1.64 | 1.5 |
| | TP13_5 | 0.5 – 1.0 | CLAY with gravel | 3.5* | 15.9 | 1.81 | 1.0 |
| | TP13_9 | 0.5 – 1.0 | CLAY | 1.0* | 14.1 | 1.87 | 3.0 |

Notes: * Indicates Soaked CBR value at 2.5 mm penetration

** Indicates Soaked CBR value at 5.0 mm penetration

**Table 4 – Summary of Shrink-Swell Index Test Results**

| Lot | PSM TP ID | Depth (m) | Material Description | Swell on Saturation (%) | Shrinkage (%) | Shrink Swell Index (%/pF) |
|---|---|---|---|---|---|---|
| Site 1 | TP11_3 | 0.5 – 0.95 | CLAY | 0.0 | 5.7 | 3.19 |
| | TP11_5 | 0.5 – 0.95 | CLAY | 0.0 | 2.1 | 1.16 |
| | TP11_6 | 0.5 – 0.95 | CLAY | 1.9 | 3.0 | 2.21 |
| Site 2 | TP14_5 | 0.5 – 0.95 | CLAY | 1.1 | 4.7 | 2.92 |
| | TP14_8 | 0.5 – 0.95 | Silty CLAY | 0.0 | 1.0 | 0.55 |
| Site 3 | TP12_2 | 0.45 – 0.90 | CLAY | 6.6 | 2.2 | 3.07 |
| | TP12_3 | 0.5 – 0.95 | CLAY | 6.9 | 2.1 | 3.10 |
| Site 4 | TP2_1 | 0.5 – 0.95 | CLAY trace gravel | 0.1 | 2.5 | 1.41 |
| | TP2_3 | 0.5 – 0.95 | CLAY | 4.4 | 2.5 | 2.60 |
| Site 5 | TP3_2 | 0.45 – 0.90 | CLAY | 1.1 | 3.2 | 2.12 |
| | TP3_4 | 0.5 – 0.95 | CLAY | 8.6 | 2.1 | 3.55 |
| Site 8 | TP6_2 | 0.5 – 0.95 | CLAY trace gravel | 1.2 | 3.8 | 2.46 |
| | TP6_5 | 0.5 – 0.95 | CLAY | 1.0 | 3.7 | 2.31 |
| Site 9 | TP13_3 | 0.6 – 1.05 | CLAY | 0.2 | 1.6 | 0.97 |
| | TP13_5 | 0.5 – 0.95 | CLAY with gravel | 0.0 | 2.0 | 1.09 |
| | TP13_9 | 0.5 – 0.95 | CLAY | 1.3 | 2.3 | 1.63 |

## 6. Sites without Geotechnical Investigation Data (Sites 10, 11 and Sites 6, 7, 12, 13, 14 and 15)

In this section, we provide discussion on the expected subsurface conditions for the sites with no geotechnical investigation data.

### 6.1 Site 10 (Lot 19) and Site 11 (Lot 20)

Sites 10 and 11 are located between Sites 1 and 2 which previously had a geotechnical investigation undertaken. Based on the subsurface conditions encountered within the PSM test pits in Sites 1 and 2, the inferred subsurface conditions at Sites 10 and 11 are summarised in Table 5. Refer to Appendix C - PSM4503-003L REV1 for tabulated test pit logs of the PSM test pits at Sites 1 and 2.

**Table 5 – Summary of Inferred Subsurface Conditions at Sites 10 and 11**

| Inferred Unit | Material Description |
|---|---|
| TOPSOIL | Silty CLAY to Silty CLAY trace gravel; low to high plasticity, dark brown; fine to medium gravel, sub-angular to sub-rounded, up to 10 mm; dry to moist, soft to firm, rootlets<br><br>Clayey SILT; low plasticity, dark brown; dry to moist, soft to stiff, rootlets |
| FILL | Based on the available aerial photos, the existing fill will be mostly associated with the existing residential development, access road and dams.<br><br>The investigation data from the neighbouring sites indicates the unit may comprise:<br>• Silty CLAY to CLAY trace gravel; medium to high plasticity, dark brown to grey; fine gravel, sub-angular to sub-rounded shale fragments; dry to moist<br>• Gravelly CLAY; medium to high plasticity, dark grey; fine gravel, sub-rounded; moist, soft to firm. |
| NATURAL SOIL | CLAY to Silty CLAY; medium to high plasticity, red, brown, and grey; dry to moist, typically stiff to hard, rootlets |
| BEDROCK | The BEDROCK unit would be typically between 0.5 m and 2.5 below surface.<br><br>SHALE; extremely to highly weathered, red, grey, and orange, very low to low strength<br><br>SANDSTONE. |

### 6.2 Sites 6, 7, 13, 14 and 15 (Lots 4, 5, 21, 10A and 20)

Sites 6, 7, 13, 14 and 15 are located near Sites 3 to 5 and 8 which previously had a geotechnical investigation undertaken. Based on the subsurface conditions encountered within the PSM test pits in Sites 3 to 5 and 8, the inferred subsurface conditions at Sites 6, 7, 13, 14 and 15 are summarised in Table 6. Refer to Appendix C - PSM4503-003L REV1 for tabulated test pit logs of the PSM test pits at Sites 3 to 5 and 8.

**Table 6 – Summary of Inferred Subsurface Conditions at Sites 6, 7, 13, 14 and 15**

| Inferred unit | Material Description |
|---|---|
| TOPSOIL | Silty CLAY to Silty CLAY trace Gravel; low to high plasticity, dark brown; fine to medium gravel, sub-rounded, up to 25 mm; dry to moist, soft to stiff, rootlets |

| Inferred unit | Material Description |
|---|---|
| | Sandy Silty CLAY; low to medium plasticity, dark brown; sand fine grained; dry, firm, rootlets |
| FILL | Based on the available aerial photos, the existing fill will be mostly associated with the existing residential, access road, and dams.<br>The investigation data from the neighbouring sites indicates the unit may comprise:<br>• Silty GRAVEL; dark brown, gravel medium to coarse, sub-angular, dry, medium dense<br>• Silty to Sandy CLAY; medium to high plasticity, dark brown; sand fine to coarse grained; moist<br>• Gravelly CLAY; medium plasticity, brown; medium gravel, sub-angular; trace cobbles, predominantly shale; moist, firm, rootlets. |
| NATURAL SOIL | CLAY to CLAY trace gravel; low to high plasticity, dark brown, red, and grey, fine to medium gravel, sub-angular to sub-rounded, up to 10 mm; trace cobble up to 140 mm, dry to moist, firm to stiff, rootlets, occasional tree roots |
| BEDROCK | The BEDROCK unit would be typically between 1 m and 2.5 m below surface.<br><br>SHALE; extremely weathered, grey, red and brown, very low to low strength<br><br>SANDSTONE; fine grained, extremely weathered, grey, brown, and orange, very low to low strength. |

### 6.3 Site 12 (Lot 2)

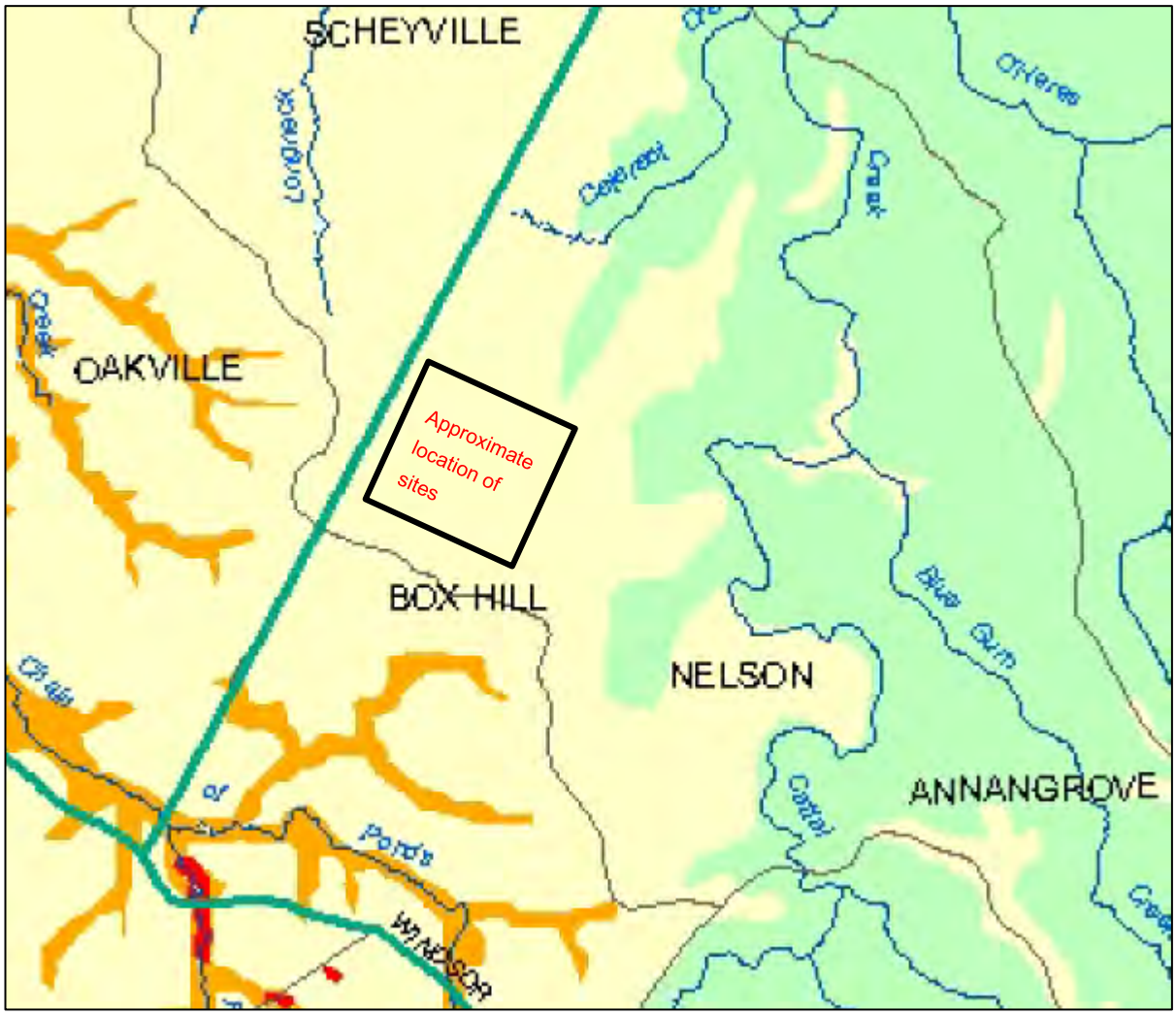
We note that bulk earthworks has occurred at Site 12 between February 2016 and July 2018, as indicated by historical aerial photographs. However, the fill materials, depth of fill and the manner in which it was placed is not known to PSM.

## 7. Review of Salinity (Western Sydney) Map

A review of the Salinity Potential in Western Sydney Map (2002) indicates that the sites are located in an area of moderate salinity potential.

**MODERATE SALINITY POTENTIAL**

Areas on Wianamatta Group Shales and Tertiary Alluvial Terraces. Scattered areas of scalding and indicator vegetation have been noted but no concentrations have been mapped. Saline areas may occur in this zone, which have not yet been identified or may occur if risk factors change adversely.




## 8. Geotechnical Risks

### 8.1 Greenfield Sites (Sites 6, 7, 13, 14, 15, 11)

We note based on our desktop study:

- No earthworks had been undertaken for Sites 6, 7, 13, 14, 15 and 11.

These sites are considered greenfield sites.

We consider the following to be geotechnical risks in these areas.

- Earthworks:

  It is important that any earthworks on site (including subgrade preparation, and filling) are undertaken appropriately and in accordance with a proper earthworks specification.

  We have prepared an earthworks specification detailing requirements for subgrade, material requirements, fill testing and placement. Please refer to Section 9 of this report.

  Our specification generally comprises more stringent requirements than Council's requirements (e.g. lot testing, more survey, etc.). While it could be more expensive to undertake, it reduces the risk of poor earthworks performance. We note however depending on the actual consent conditions of the proposed subdivision and the Council requirements, the proposed earthworks could have other requirements. Upon confirmation of the Consent Conditions, we can update PSM specification to meet both consent conditions and our design advice if requested.
- Existing dams and basins:

  We note there are a few existing basins that would need to be backfilled as part of the bulk earthworks. It is important that following dewatering, any soft sediments within the base of the existing basins be removed to expose appropriate natural subgrade prior to filling. Our specification provides the details. Reuse of the soft sediments can be difficult and would typically require drying and blending with better material or use as landscaping in park areas.
- Existing fill (uncontrolled fill):

  Any bunds and raise platforms including those in the vicinity of existing basins/dams and within the existing residence are likely to comprise fill with variable conditions from uncompacted to poorly compacted.

  It is PSM's experience that uncontrolled FILL can be managed through an effective Bulk Earthworks Specification or be removed. We have prepared a bulk earthworks specification for the proposed development. Please refer to Section 9 of this report and Appendix B.

## 8.2 Brownfield Sites (Site 12 and Site 10)

We note based on our desktop study:

- Bulk earthworks had been undertaken for Site 12 and Site 10.

These sites are considered brownfield sites.

With regards to the earthworks, the following is not known to PSM:

- The bulk earthworks requirements/specification
- Details of the bulk earthworks that have been undertaken to date (i.e. earthworks documentation, compaction, density testing results, construction records, etc).

We have not sighted any earthworks documents including the construction records and the specification for these works.

We have not also sighted any relevant civil drawings relating to the earthworks showing depths, etc.

We consider the following to be geotechnical risks at this stage:

- Performance of the earthworks for residential lots
- We have not sighted the earthworks documentation and therefore cannot provide an opinion if the fill can be considered as Controlled Fill as defined in AS2870-2011 "Residential Slab and Footings Classification". This could:
  - Result in the residential lots having to be classified as Class P, which would then require the footings for the dwellings to be designed by engineering principles
  - Result in ground movements other than reactive soil movements affecting the long term behaviour of the dwellings constructed on these Lots
  - Result in settlements affecting the roads and utilities.

Risk Mitigations:

- The Client (JBS&G's client) to request the Vendor to:
  - Advise what specification has been adopted for the Earthworks
  - Confirm Level 1 Testing (GITA) has been undertaken
  - Provide GITA certification/report confirming the earthworks comply with the requirements of a specification and drawings and as per AS3798 that setting out inspections, sampling and testing the GITA has carried out, and the locations and results thereof.
- PSM review the documentation provided to confirm reliability and advise on residual geotechnical risks associated with the earthworks
- The Client to ensure the Vendor warrants the future performance of the existing completed earthworks
- Further investigation may be required in order to classify the Fill.

## 9. Bulk Earthworks

A separate bulk earthworks specification has been prepared (ref. PSM4503-004S REV1) which sets out clearly the roles and responsibilities of the earthworks contractor and its Geotechnical Inspection and Testing Authority (GITA). The Specification complies with the intent of AS 3798-2007 "*Guidelines on earthworks for commercial and residential developments*".

Our specification generally comprises more stringent requirements than Council's requirements (e.g., lot testing, more survey, etc.). It reduces the risk of poor earthworks performance. We note however depending on the actual consent conditions of the proposed subdivision and The Hills Shire council requirements, the proposed earthworks could have other requirements. Upon confirmation of the Consent Conditions, we can update PSM specification to meet both consent conditions and our design advice if requested.

## 10. Interim Geotechnical Design Advice

### 10.1 General

We note that details of the proposed earthworks (e.g., depth of fill) are not known to PSM. The design advice provided in the following sections has been prepared on the following basis:

- The subsurface conditions are as described in Section 6
- The earthworks are to be completed in accordance with the PSM bulk earthworks specification (**the Specification)** (ref. PSM4503-004S REV1).

### 10.2 Site Classification

We understand that it is proposed to develop the sites as part of a larger residential development. Based on the laboratory testing and field observations from the past geotechnical investigation, and the inferred geotechnical units, we have classified the site in accordance with AS2870-2011 "Residential slabs and footings".

We advise the following:

1. In cut areas within the NATURAL SOIL unit, structures that are within the scope of AS2870-2011 be designed for a site classification of Class "H1" in accordance with Table 2.1 of AS2870-2011.
2. In fill areas, further assessment of the site classification would be required and will depend on the fill materials, depth of fill and the manner in which it was placed.
   a. Where existing fill is present and there is no earthworks documentation (records), the fill cannot be considered as "controlled fill" and thus the site is classified as Class P in accordance with AS2870-2011. Further detailed investigation and assessment should be undertaken to allow for reclassification.

b. Where new fill will be placed in accordance with PSM bulk earthworks specification (Ref. PSM4503-004S REV1), the site can be reclassified from Class P to Class H2, provided the following are satisfied:
    i. The fill is placed strictly in accordance with PSM bulk earthworks specification
    ii. PSM undertake review of the GITA weekly reports, interim/final certificates as described in the earthworks specification
    iii. PSM undertake inspection during and at the completion of the bulk earthworks.

The civil and structural engineers should consider likely heave/settlement due to the effect of climatic actors in their design.

We recommend that all structures and services be detailed such that they preclude any local wetting up or drying out of the subgrade after initial equilibrium is reached following the construction of the slab and that the subgrade be within specification at the time of construction of the slab. We note that normal mounding or sagging away from the perimeter of covered areas will still occur and perimeters, or open joints, will still respond to environmental changes.

## 10.3 Foundations

It is expected that the foundations used as part of the proposed development at the sites would typically include strip, pad, or other shallow footings.

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 7. Further advice should be sought if the footings are located adjacent to a batter or wall.

We note that an allowable bearing pressure (ABP) is not a soil property. It depends on many factors such as the size of the footings, the embedment depth, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FOS), as well as the soil properties. As footings get bigger or deeper the capacity increases rapidly, and as the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements in the NATURAL SOIL unit can be estimated using the elastic moduli provided in Table 7.

When assessing the settlement of the shallow footings, the designer needs to consider the additional ground settlement due to the total building load on both shallow and deeper units. The differential settlement due to the building load shall also be assessed.

Foundation conditions at the proposed shallow pad footing locations should be inspected by a suitably qualified geotechnical engineer prior to the pouring of concrete.

**Table 7 – Foundation Parameters of Inferred Geotechnical Units**

| Inferred Unit | Bulk Unit Weight ($kN/m^3$) | Soil Effective Strength Parameters | | Ultimate Bearing Pressure under Vertical Centric Loading (kPa) | Allowable Bearing Pressure (ABP) under Vertical Centric Loading (kPa) | Elastic Parameters | |
|---|---|---|---|---|---|---|---|
| | | c' (kPa) | $\varphi$' (deg) | | | Long Term Youngs Modulus (MPa) | Poisson's Ratio |
| ENGINEERED FILL / NATURAL SOIL | 18 | 0 | 30 | 420 | 100 [1] | 10 | 0.3 |
| BEDROCK | 22 | N/A | N/A | 3,000 [2] | 700 [3] | 100 | 0.25 |

1 Pad footings (for ABP of 100 kPa) should have a minimum horizontal dimension of 0.5 m and a minimum embedment depth of 0.5 m

2 Ultimate values occur at large settlements (>5% of minimum footing)

3 ABP is an end bearing pressure to cause settlement of <1% of minimum footing)

## 10.4 Permanent and Temporary Slopes

The batter slope angles shown in Table 8 are recommended for the design of batters up to 3 m height and above the groundwater table; subject to the following recommendations:

1. The batters shall be protected from erosion.
2. Permanent batters shall be drained.
3. Temporary batters shall not be left unsupported for more than 1 month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events.
4. Where loads are imposed or structures/services are located within batter height of the crest of the batter, further advice should be sought.

Steeper batters may be possible subject to further advice, typically including inspection during construction.

**Table 8 – Design Batter Slope Angles**

| Unit | Temporary | Permanent |
|---|---|---|
| SOIL UNITS, e.g., ENGINEERED FILL, NATURAL SOIL | 2H : 1V | 2.5H : 1V |

## 10.5 Pavements

Subgrade CBR for pavement design depends on the material at the finished subgrade levels. The CBR tests undertaken by PSM (refer to Table 3) indicate a CBR value between 0.5% and 7.0%.

A CBR of 1.5% can be adopted for subgrade and fill formed in bulk earthworks constructed in accordance with the Specification.

Subgrade CBR for pavement design depends on the material at the finished subgrade levels.

We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised. CBR testing shall be undertaken for any new imported material within the pavement subgrade (e.g. within 1 m below pavement).

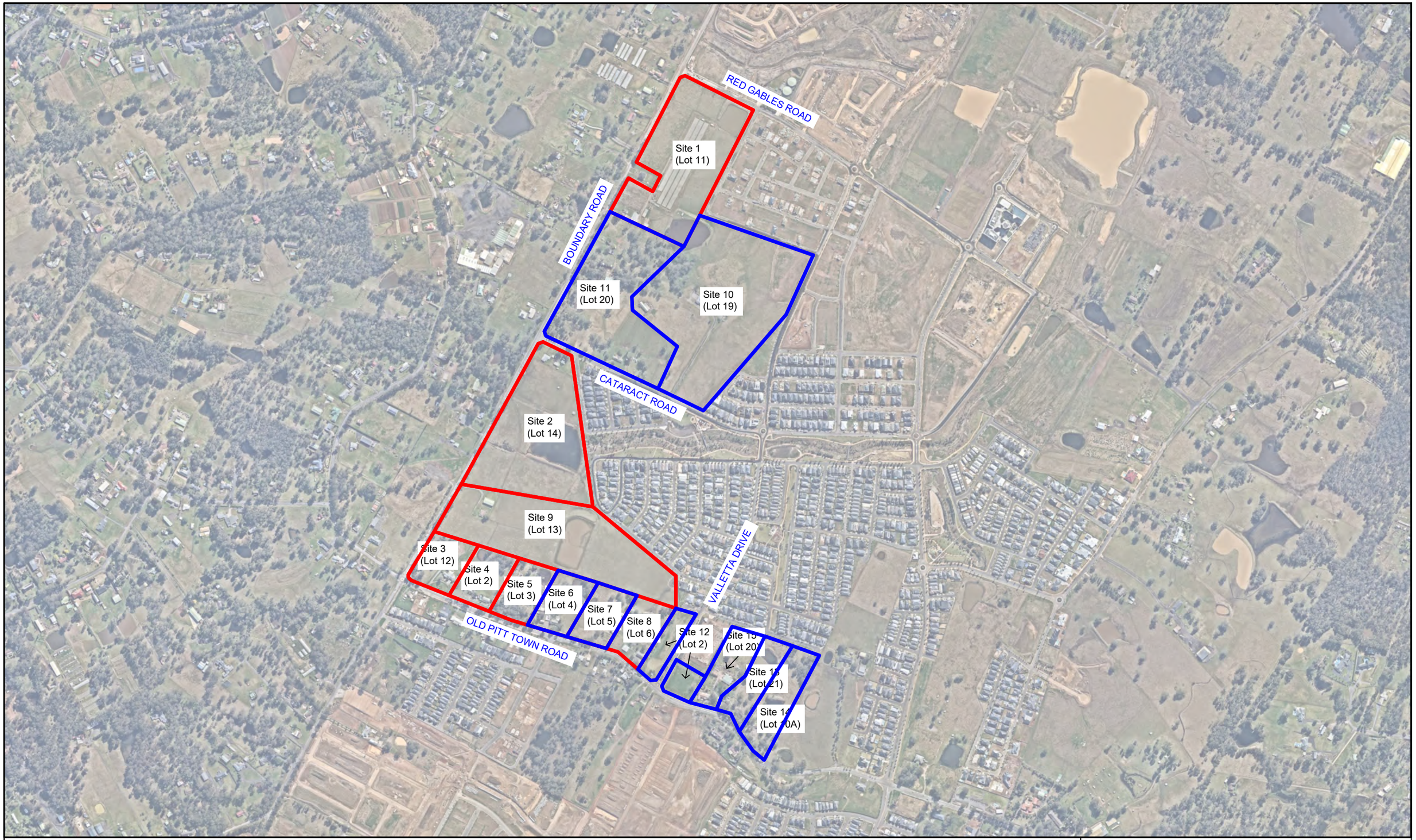
Should there be any queries, do not hesitate to contact the undersigned.

**Yours Sincerely**

**JANE SHEN**
**GEOTECHNICAL ENGINEER**

**AGUSTRIA SALIM**
**PRINCIPAL**

| | | |
|---|---|---|
| **Encl**. | Figure 1 | Site Locality Plan |
| | Figure 2 | West Gable Development Masterplan |
| | Figures 3 to 6 | PSM Test Pit Location Plan |
| | Appendix A | Historical Aerial Photographs |
| | Appendix B | Bulk Earthworks Specification (PSM4503-004S REV1) |
| | Appendix C | PSM4503-003L REV1 |




## LEGEND

- Geotechnical investigation already undertaken (refer to PSM4503-003L REV1)
- Sites covered in the current desktop study (PSM4503-007L REV 1)

NEARMAP AERIAL IMAGE DATED 24 AUGUST 2022

N

50 0 50 100 150 200m

1 : 10000 FULL SIZE A3

JBS&G

The Gables Residential Development

Box Hill

Site Locality Plan

PSM4503-007L REV1 | Figure 1

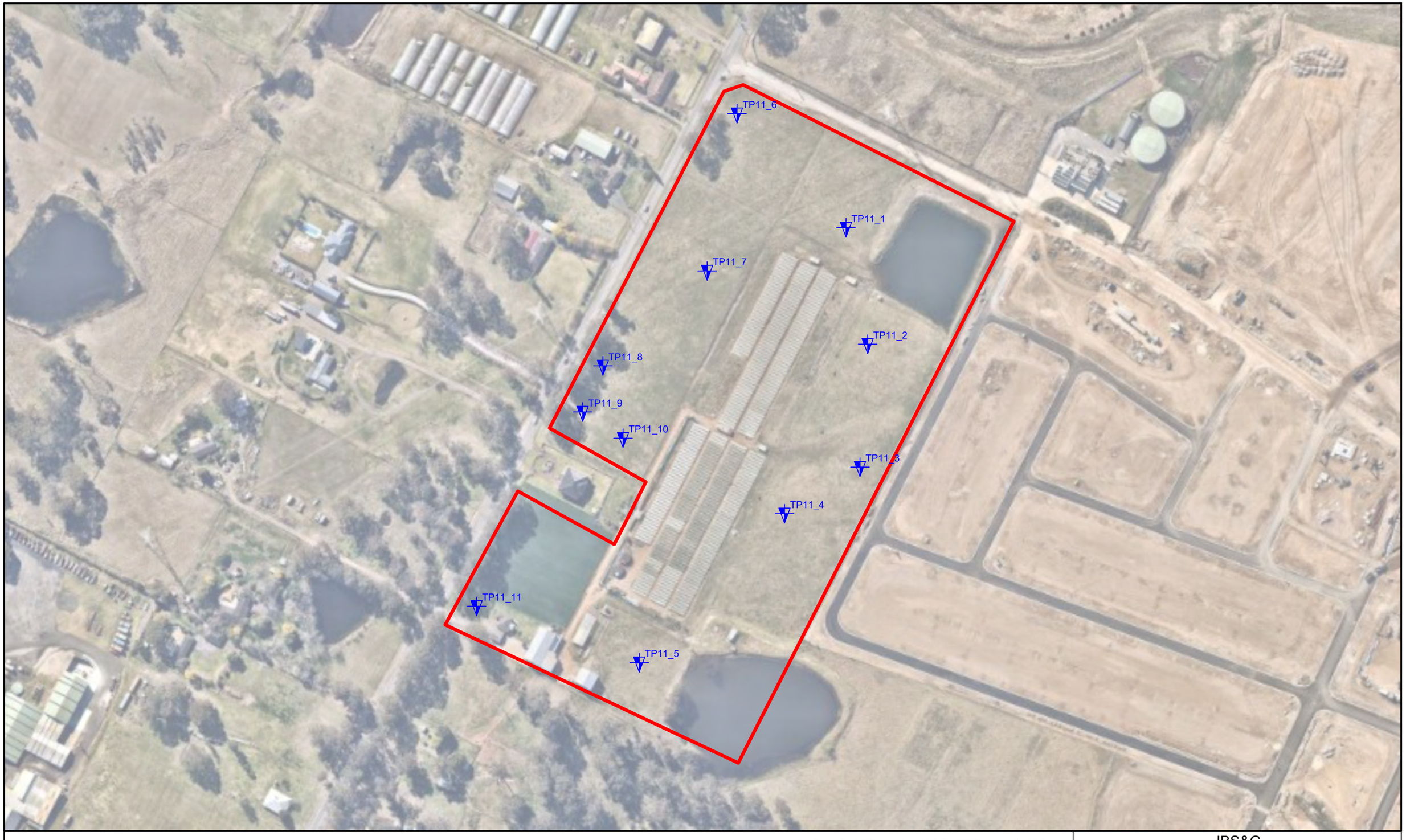
# Figure 2 - West Gable Development Masterplan


URBIS

**WEST GABLE**
**ILLUSTRAVITIE CONCEPT PLAN**

1:10,000 @ A4

0 100 200 300 400 500




## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Site 1 (Lot 11) - 151 Boundary Road

PSM4503-007L REV1 | Figure 3


## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

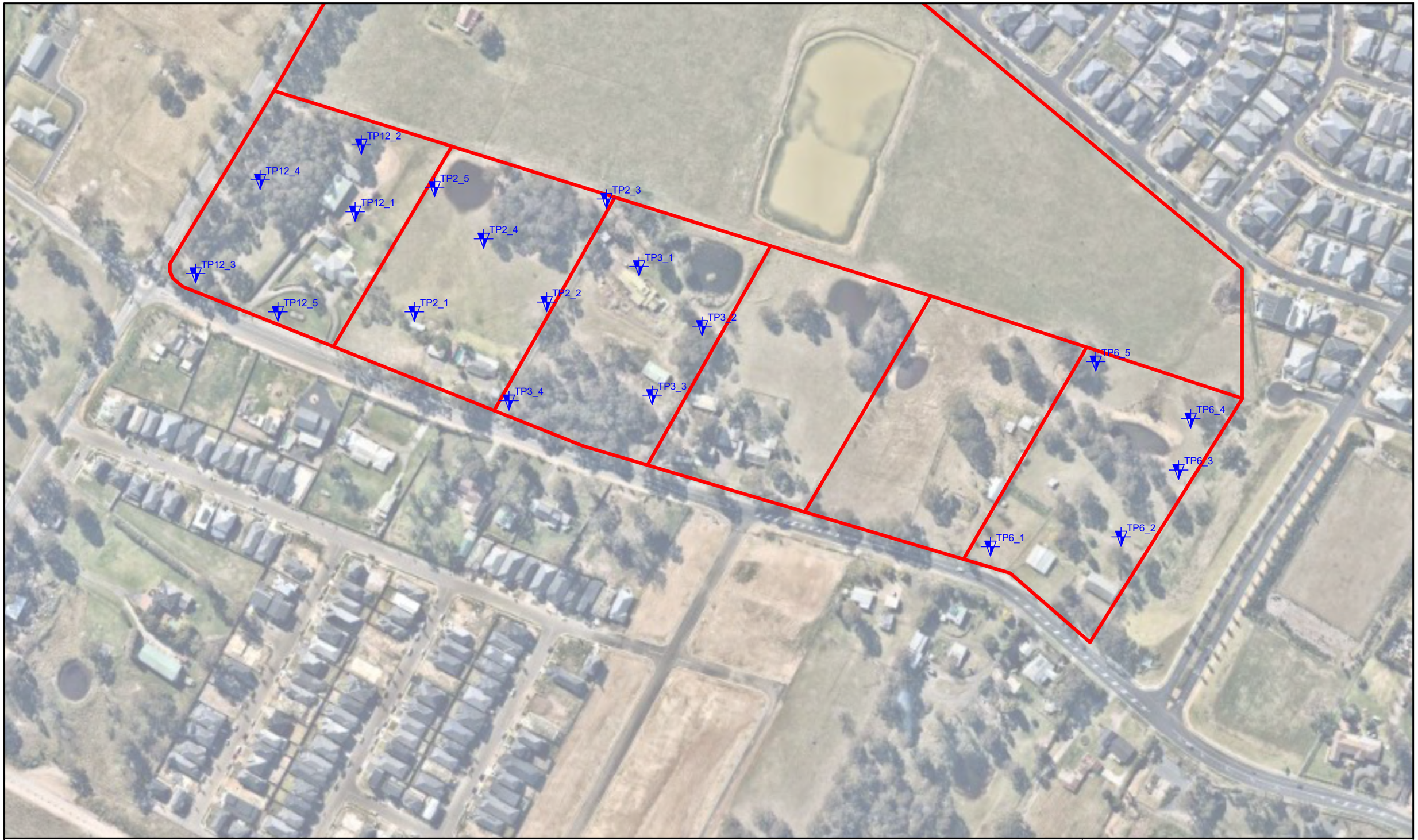
12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-007L REV1 | Figure 4 |
|---|---|




## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Sites 3 (Lot 12), 4 (Lot 2), 5 (Lot 3) and 8 (Lot 6)

PSM4503-007L REV1 | Figure 5


## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

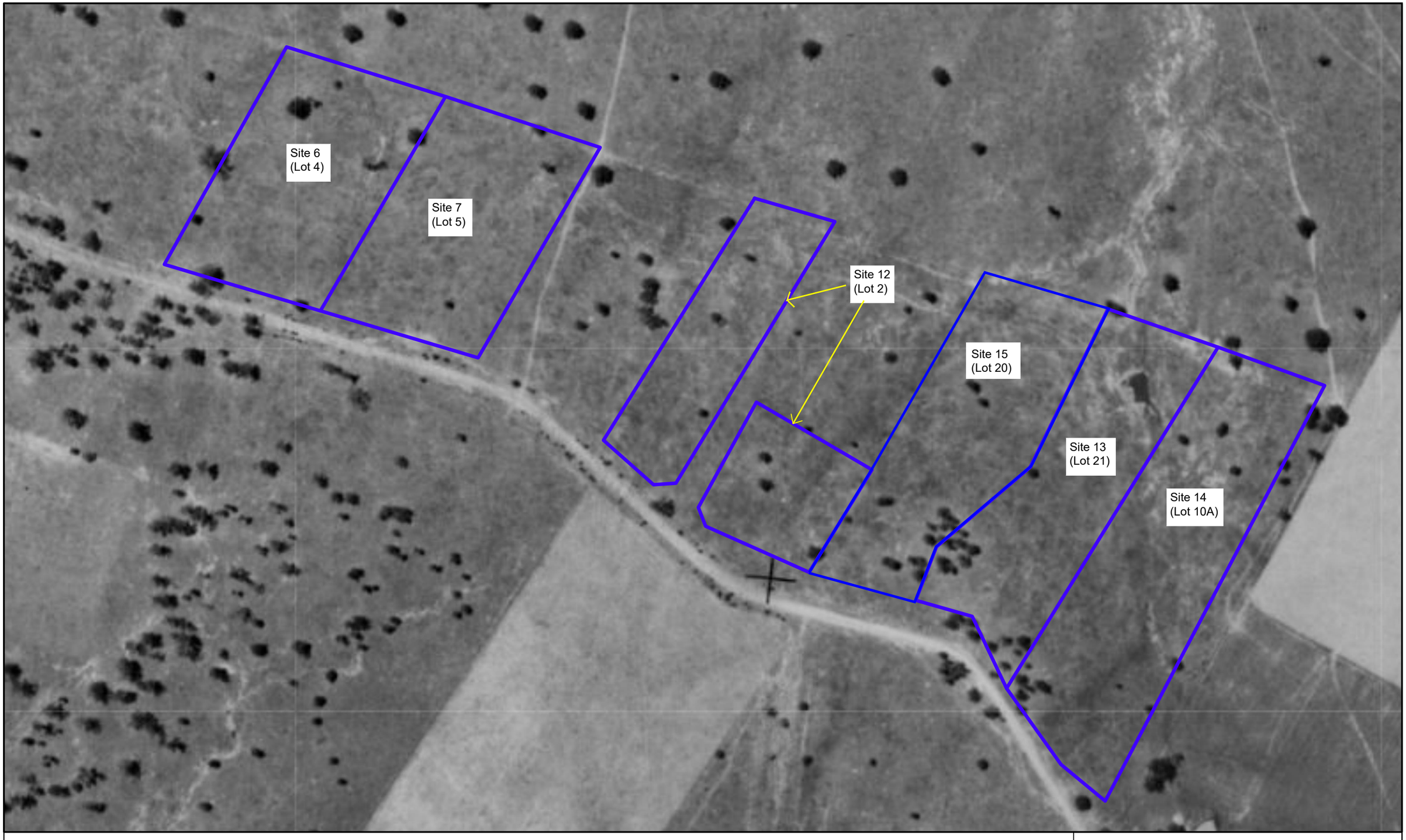
1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Site 9 (Lot 13) - 145 Boundary Road

| PSM4503-007L REV1 | Figure 6 |
|---|---|

# Appendix A
# Historical Aerial Photographs




## LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1947
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1984
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 2005
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

PSM4503-007L REV 1 | Appendix A


## LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 24 February 2016
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

| PSM4503-007L REV 1 | Appendix A |
|---|---|


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 18 July 2016
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 2 December 2016
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

| PSM4503-007L REV 1 | Appendix A |
|---|---|


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 30 July 2018
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 21 April 2022
Sites 6, 7, 12, 13, 14, 15 (Lots 4, 5, 2, 21, 10A, 20)

| PSM4503-007L REV 1 | Appendix A |
|---|---|


LEGEND

Approximate site boundary

N

12.5 0 25 50m

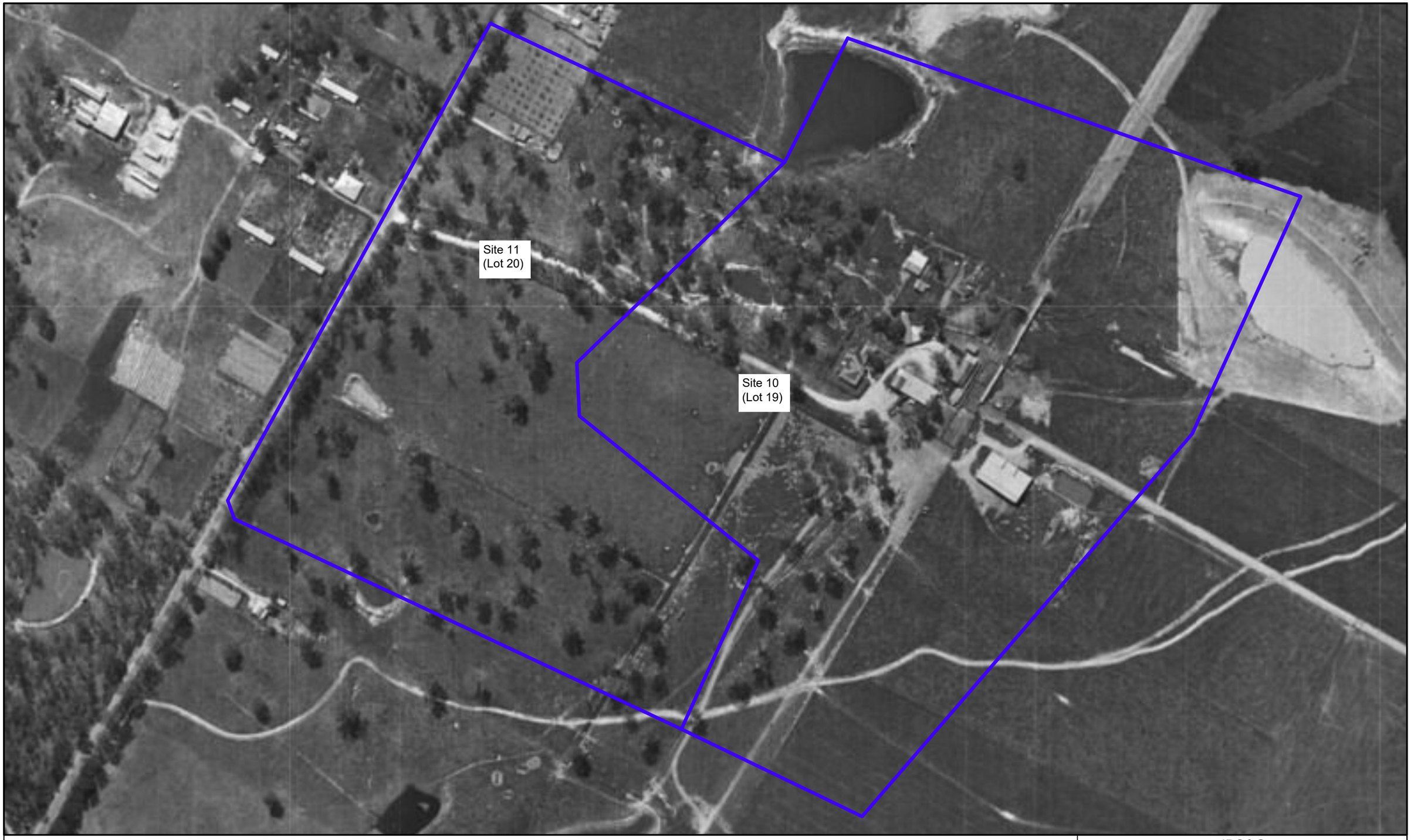
1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1947
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A




LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1965
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1975
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1991
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1998
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 2004
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 20 October 2009
Sites 10, 11 (Lots 19, 20)

| PSM4503-007L REV 1 | Appendix A |
|---|---|


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 24 January 2021
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 10 April 2021
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A


LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 21 April 2022
Sites 10, 11 (Lots 19, 20)

PSM4503-007L REV 1 | Appendix A

# Appendix B
# Bulk Earthworks Specification (PSM4503-004S REV1)

# The Gables Residential Development

## Bulk Earthworks Specification Filling, Cutting and Testing

PSM4503-004S REV1 12 May 2022

# Table of Contents



# List of Appendices

# 1. Scope

This specification details the requirements for the bulk earthworks to be undertaken at The Gables residential development, Box Hill. The area where this specification is applicable is shown in Figure 1. This includes areas where material is filled to bulk earthworks level (BEL) within the site.

Fill placed in accordance with this specification is denoted as Engineered Fill.

This specification does not address any environmental, contamination or erosion issues with respect to the fill material.

There is a HOLD POINT on placing fill in Section 2.4 of this specification.

# 2. Filling Works

## 2.1 Subgrade Preparation

The condition of the subgrade should be assessed immediately prior to the commencement of filling.

All Engineered Fill is to be placed on one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Engineered compacted fill placed in accordance with this or other approved specifications for which the Geotechnical Inspection and Testing Authority (GITA) has a Level 1 certificate certifying compliance with that approved specification AND of at least stiff consistency.
4. Existing fill and other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM. PSM may also direct a bridging layer of Engineered Fill be placed and compacted to a Dry or Hilf Density Ratio (Standard Compaction) of between 95% and 102%. Any such layer shall be a Lot under Clause 5.3.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be moisture conditioned and compacted to be in accordance with Clauses 2.5 and 2.6 of this specification.

Engineered Fill shall be placed only on subgrade approved by the GITA as being in accordance with this specification.

## 2.2 Base Geometry and Permanent Batters

The slope of any buried batter shall be less than 2H:1V unless otherwise directed by PSM.

The contractor shall remove or flatten any geometrical obstructions (e.g., protrusions or holes) such that subsequent Engineered Fill can be placed to achieve the requirements of this specification.

Engineered Fill shall be placed only on areas where the base geometry has been approved by the GITA.

Permanent batters in fill shall be built by overfilling then cut back to the final slopes as shown in the bulk earthworks drawings, e.g., 2H:1V, or other method as approved by PSM.

## 2.3 Material

### 2.3.1 Imported Fill

Imported Engineered Fill is to conform to one of the following definitions:

1. “Virgin excavated natural material” (**VENM**) as defined by the Protection of the Environment Operations Act 1997 No 156, Schedule 1, on Page 209:

   *“Virgin excavated natural material (e.g., clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:*

a. *has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphide ores or soils, or.*

b. *consists of excavated natural materials that meet such criteria as may be approved by the EPA".*

2. "Excavated natural material" (**ENM**) as defined under Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014:

*"Excavated natural material is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:*

a. *been excavated from the ground, and.*

b. *contains at least 98% (by weight) natural material, and.*

c. *does not meet the definition of Virgin Excavated Natural Material in the Act.*

*Excavated Natural Material does not include material that has been located in a hotspot; that has been processed; or that contains asbestos, Acid Sulphate Soils (ASS), Potential Acid Sulphate soils (PASS) or sulfidic ores."*

### 2.3.2 Site Won Material

Site won material shall comprise material won from excavations on site including natural and existing fill. Material needs to satisfy Clause 2.3.3

### 2.3.3 All Fill

The Engineered Fill shall be approved by the GITA as suitable for use in a structural fill.

Engineered Fill shall not comprise unsuitable material as defined by Clause 4.3 of AS3798-2007 "Guidelines on earthworks for commercial and residential developments" as:

a. *"organic soils, such as many topsoils, severely root-affected subsoils and peat.*

b. *materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture.*

c. *materials containing substances which can be dissolved or leached out in the presence of moisture (e.g.: gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g.: some shales and sandstones), unless these matters are specifically addressed in the design.*

d. *silts, or materials that have the deleterious engineering properties of silt.*

e. *other materials with properties that are unsuitable for the forming of structural fill, and.*

f. *fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient proportions to affect the required performance of the fill."*

The GITA shall assess that the proportion of deleterious material in each Lot is not greater than 1% by weight. Deleterious material is defined by Table 3015.3 of the RTA QA Specification 3051 (Edition 5 June 1998) as:

*"Type III: Rubber, Plastic, Bitumen, Paper, Cloth, Paint, Wood and Other Vegetable Matter".*

If the GITA is not able to visually assess the above criterion, the GITA shall arrange appropriate testing.

All Engineered Fill particles shall be able to be incorporated within a single layer. Further, less than 30% of particles shall be retained on the 37.5 mm sieve.

Engineered Fill shall be able to be tested in accordance with the Standard Compaction method (AS1289.5.4.1) or Hilf test method (AS1289.5.7.1). These methods require less than 20% retained on the 37.5 mm sieve. Where between 20% and 30% of particles are retained on the 37.5 mm sieve the above test methods shall still be adopted and test reports annotated appropriately.

These requirements should be met by the material after placement and compaction.

Only material approved by the GITA shall be placed as Engineered Fill.

## 2.4 Fill Zonation and Placement

| HOLD POINT | |
|---|---|
| Process Held | Placement of Fill |
| Submission detail | The Contractor / GITA submit to PSM a Weekly Certificate as defined in Clause 6.2.1 of this specification for the earthworks completed to the previous Saturday no later than 5 pm of the subsequent Wednesday. |
| Release of Hold Point | PSM to confirm receipt of Weekly Certificate and recommend release of Hold Point if initial assessment of the Weekly Certificate indicates it complies with requirements of this specification. The contract superintendent should then release the Hold Point if it considers appropriate. |

Engineered Fill shall be placed in accordance with the following requirements:

1. In near horizontal, laterally extensive layers of uniform material and thickness, deposited systematically across the work area as determined by the GITA.
2. The compacted thickness of each layer shall be equal to or less than 250 mm.

Engineered Fill shall only be placed on subgrade in accordance with this specification and approved by the GITA.

## 2.5 Compaction

Engineered Fill shall be placed and compacted to a Dry or Hilf Density Ratios (Standard Compaction) of:

- between 98% and 103% below 0.5 m of BEL
- between 100% and 103% within the upper 0.5 m of BEL.

The insitu density shall be measured over the full depth of each layer placed.

## 2.6 Moisture Control

The placement moisture variation or Hilf moisture variation shall be controlled to be between 2% dry of optimum and 2% wet of optimum.

Placement moisture content of the Engineered Fill shall be measured.

# 3. Cutting

## 3.1 Subgrade Condition

The subgrade is to comprise one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Existing fill and other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be excavated and filled to the BEL in accordance with this specification.

# 4. Survey

## 4.1 Filling Areas

The survey requirements are as follows:

1. Any approved subgrade shall be surveyed prior to first filling such that subgrade levels are established to within ± 0.1 m. The area subject to approval shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
2. The Lot boundaries shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
3. The location of the field density tests shall be assessed and shown on the Lot boundary plan drawing to an accuracy of at least +/-5 m in plan.
4. The elevation of the field density tests shall be surveyed to an accuracy of +/-0.05 m.

The plan drawing shall show at the boundaries of the site and other identifiable site features, so as to allow the location of the lots and the test to be recoverable.

## 4.2 Cutting Areas

Any approved subgrade for cut areas shall be surveyed such that subgrade levels are established to within ± 0.1 m.

# 5. Inspection and Testing

## 5.1 Role of the GITA

The Geotechnical Inspection and Testing Authority (GITA) shall be contracted to document and certify that the works undertaken by the contractor has been completed in accordance with the relevant design and specifications.

## 5.2 Level 1 Control

The GITA shall adopt Level 1 responsibility as described in Section 8.2 of AS 3798-2007 "Guidelines on earthworks for commercial and residential developments":

> *"The primary objective of Level 1 Inspection and Testing is for the geotechnical inspection and testing authority (GITA) to be able to express an opinion on the compliance of the work. The GITA is responsible for ensuring that the inspection and testing are sufficient for this purpose.*
>
> *The geotechnical inspection and testing authority need to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include:*
>
> - *Completion of removal of topsoil*
> - *Placing of imported or cut material*
> - *Compaction and adding/removal of moisture*
> - *Trenching and backfilling*
> - *Test rolling*
> - *Testing.*
>
> *The superintendent should agree a suitable inspection and testing plan prior to commencement of the works.*
>
> *On completion of the earthworks, the GITA will usually be required to provide a report setting out the inspections, sampling and testing it has carried out, and the locations and results thereof. Unless very unusual conditions apply, the GITA should also be able to express an opinion that the works (as far as it has been able to determine) comply with the requirements of the specification and drawings."*

For this particular contract, Level 1 responsibility includes:

1. Lot testing as per Clause 5.3 of this specification.
2. A frequency of compaction testing not less than that specified in Clause 5.4 of this specification.
3. The GITA documenting and reporting its activity in the terms required by Clause 6 of this specification.
4. The GITA undertaking adequate inspections and testing to comply with the above requirements and to be able to certify the fill in the terms required by Clause6 of this specification.

## 5.3 Lot Testing

This specification requires lot testing to be undertaken.

A Lot is defined as a single layer of Engineered Fill consisting of uniform material which has undergone similar treatment.

Lot testing comprises the following:

1. A Lot shall be identified by the Contractor or the GITA with a Lot Number and presented for testing.
2. A Lot shall be deemed to be in accordance with the specification if all the tests undertaken within the Lot are in accordance with the specification, i.e., "a none to fail basis".
3. If any one test undertaken within a Lot fails, the whole of the Lot shall be reworked and retested.

Any portion of the placed Engineered Fill must be part of a single lot and all Lots will require approval by the GITA.

## 5.4 Testing Frequency (Compaction Testing)

The frequency of compaction testing for each lot shall not be less than the greater of:

1. For lot less than 50 $m^{3.}$
   a. 1 test per lot.
2. For lot between 50 $m^3$ and 100 $m^{3.}$
   a. 2 tests per lot.
3. For lot greater than 100 $m^{3.}$
   a. 1 test per 500 $m^3$ of material placed.
   b. 3 tests per lot.

A laboratory moisture content test shall be undertaken for each field density test.

## 5.5 Proof Rolling and Plate Load Testing

Proof rolling, together with minor boxing out and refilling, of the upper surface of the bulk earthworks will be undertaken as directed by PSM. The plant to be adopted depends upon the design loads adopted by the structural engineers for each section of the site. Any remediation of soft spots identified during proof rolling shall be undertaken in accordance with this Specification (Cl 2.5 and 2.6).

Plate load testing shall be undertaken at the direction of PSM at the following stages:

1. At final bulk earthworks level (BEL). Expected test frequency is approximately a day of testing for each building pad.

The contractor is to make a suitable reaction (e.g., 20 tonne excavator) available for the tests.

## 5.6 Inspection and Testing

The GITA shall at least undertake the following tasks:

<u>Cut areas</u>

1. Identify the subgrade as one of the three (3) subgrade types listed in Clause 3.1 of this specification and assess that the subgrade condition of cut areas is in accordance with the subgrade condition requirements

of Clause 3.1 of this specification. If the cut subgrade has been approved by PSM, the GITA will be required to reference the approval in its weekly report.

2. Should Engineered Fill be required to fill overcut areas, assess that filling has been placed in accordance with this specification.

Fill areas

3. For fill areas, identify the subgrade as one of the four (4) subgrade types listed in Clause 2.1 of this specification and assess that the subgrade condition of any area prior to placement of fill material is in accordance with the subgrade preparation requirements of Clause 2.1 of this specification. For the following subgrade types, GITA needs to include / refer to PSM approval in its weekly report:
   a. Existing fill and other materials as approved by PSM.
4. Assess that the base geometry of any area prior to placement of fill material is in accordance with the base geometry requirements of Clause 2.2 of this specification.
5. For each Lot, identify the material as either Site Won or Imported fill as defined in Clause 2.3 of this specification and assess that the material placed is in accordance with the fill material requirements of Clause 2.3 of this Specification.
6. Assess the proportion of deleterious material is in accordance with the requirements of Clause 2.3.3 of this Specification.
7. Assess that the Engineered Fill has been placed in accordance with the requirements for fill zonation and placement of Clause 2.4 of this specification.
8. Assess that each Lot as presented for approval by the contractor is in accordance with the requirements for Lot definition of Clause 5.3 of this specification.
9. Ensure that the survey requirements in Clause 5 of this specification have been completed.
10. Estimate the approximate volume of Engineered Fill placed in each Lot presented for approval.
11. Conduct Lot testing in accordance with the construction control testing requirements of Clauses 5.3 and 5.4 of this specification.
12. Assess that the compaction of each Lot is in accordance with the requirements of Clause 2.5 of this specification. The GITA shall select a depth of insitu density tests that allows the density of the full layer to be assessed.
13. Assess that the moisture variation of each Lot is in accordance with the requirements for moisture control in Clause 2.6 of this specification.
14. Conduct material property testing in accordance with the material testing requirements in this specification.

# 6. Reporting and Certification

## 6.1 Reporting

The GITA shall produce at least the following reports:

1. *VENM / ENM Validation Reports*. Such a report shall transmit the VENM or ENM validation certificates for the fill imported to site.
2. *Subgrade Approval Reports* (a sample is attached). Such a report shall:
   – Document assessments undertaken for tasks 1 and task 3 of Clause 5.6 including reporting the subgrade type
   – Document the subgrade survey that has been undertaken
   – Approve or reject the subgrade condition and base geometry for filling, based on tasks 3 and 4 of Clause 5.6
   – Approve or reject the subgrade condition for cut areas based on task 1.
3. *Lot Approval Reports* (a sample is attached). Such a report shall:
   – Document assessments, testing and survey undertaken for tasks 3 to 14 of Clause 5.6
   – Report material identification undertaken for task 5 of Clause 5.6

- Report the assessed proportion of deleterious material for task 6 of Clause 5.6
- Report the results of testing undertaken for task 11 of Clause 5.6
- Approve or reject lots based on tasks 12 and 13 of Clause 5.6.

4. Material Testing Reports. Such a report shall:
   - Report the results of material property testing undertaken for task 14 of Clause 5.6.
5. *Daily Reports* (a sample is attached). Such a report shall be completed daily and shall:
   - Document time spent on site by the GITA personnel
   - List subgrade assessments and approvals undertaken each day with reference to relevant Subgrade Approval Report(s)
   - List Lots presented, accepted and approved or rejected each day, with reference to relevant Lot Approval Report(s)
   - List survey undertaken each day as for task 9 of Clause 5.6 and not already documented in the Subgrade or Lot Approval Reports
   - Document other relevant activities undertaken on site that day (site instructions, breakdowns, compaction equipment used, etc.).

## 6.2 Certification

### 6.2.1 Weekly Certificate

The GITA shall produce a Weekly Certificate for any week in which earthworks are undertaken in accordance with this specification. The Weekly Certificate will cover all works from the previous Weekly Certificate until the end of work on a Saturday.

The Weekly Certificate shall transmit the following:

- Copy or reference to the complete specification document(s)
- Subgrade Approval Reports
- Lot Approval Reports
- Material property testing reports
- Daily Reports
- Survey of subgrade geometry prior to filling or in cut areas
- Plan survey drawing showing lot boundaries and location of density tests
- Survey documenting filling undertaken to date and showing location of testing
- Provide an Excel spreadsheet presenting the results of the week's acceptance testing completed by the GITA.

And certify that:

*"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM4503-004S Rev XX dated XXX)."*

### 6.2.2 Interim or Final Filling Certificate

At the completion of the bulk earthworks, or as requested by the Client, the GITA shall provide an Interim or Final Filling Certificate which shall:

1. Transmit a reference list of the Weekly Certificates.
2. Provide an Excel spreadsheet presenting the results of all the acceptance testing completed by the GITA.
3. Certify that *"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM4503-004S Rev XX dated XXX)."*

**Brisbane**

6A, Level 6
500 Queen St
Bowen Hills QLD 4006
+61 7 3220 8300

**Sydney**

G3-56 Delhi Road
North Ryde NSW 2113
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**Perth**

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West Perth WA 6005
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# Appendix A
# Figure 1


## LEGEND

- Approximate site boundary

NEARMAP AERIAL IMAGE DATED 24 AUGUST 2022

N

50 0 50 100 150 200m

1 : 10000 FULL SIZE A3

P S M

JBS&G

The Gables Residential Development

Box Hill

Site Locality Plan

PSM4503-004S REV 1 | Figure 1

# Appendix B
# Subgrade Approval Report

## GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

**NATA accreditation number**

# SUBGRADE APPROVAL REPORT

| | |
|---|---|
| Client: | Contractor: |
| Job number: | Report number: |
| Project: | Technician: |

Subgrade areas assessed:

| Area ID | Date | Approximate extent | Subgrade description | Geometry summary | Specification reference | Compliance (Pass/Fail) | Survey reference | Approved (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

COMMENTS:

Signed: Date:

# Appendix C
# Lot Approval Report

# GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

**NATA accreditation number**

## LOT APPROVAL REPORT

| | |
|---|---|
| Client: | Report number: |
| Job number: | Report date: |
| Project: | Technician: |
| Contractor: | Test methods: |

| | |
|---|---|
| **LOT ID:** | **Sheet of** |
| Retest (Yes/No) | Original test report number: |
| Specification reference | |
| Location: | |
| Lot boundary survey reference/location: | |
| Materials description: | *(MATERIAL TYPE, colour, minor components, maximum particle size)* |
| Material identification: | *(Identify the material as defined in Clause 2.3.1, Clause 2.3.2 or Clause 2.3.3 of the Specification )* |
| Deleterious material assessment: | *(Report proportion of deleterious material)* |
| Layer thickness: | |
| Accepted as Lot: (Yes/No) | Date: |
| Approximate volume (m3) | Number of tests required: |

| **Test ID No.** | | | | |
|---|---|---|---|---|
| Test soil description | | | | |
| Date tested: | | | | |
| Grid reference | | | | |
| Surveyed test locations (RL,E,N) | | | | |
| Test depth (mm) | | | | |
| Max size (mm) | | | | |
| % Oversize material (wet) | | | | |
| Field wet density ($t/m^3$) | | | | |
| Field moisture content (%) | | | | |
| PWCD ($t/m^3$) | | | | |
| Compactive effort | | | | |
| Moisture variation (%) | | | | |
| HILF density ratio (%) | | | | |
| TEST (Pass/Fail) | | | | |

| | | | |
|---|---|---|---|
| **LOT APPROVAL** | (Pass/Fail) | Signed: | Date: |

# Appendix D
# Daily Report

# GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

**NATA accreditation number**

## DAILY REPORT

| | |
|---|---|
| Client: | Report number: |
| Job number: | Report date: |
| Project: | |
| Location: | Level of testing: Level 1 |
| Contractor | Technician: |
| Time on site: | |
| Time off site: | |

### 1. Subgrade Approval

| Areas ID | Subgrade Approval Report No: | Comments |
|---|---|---|
| | | |

### 2. Lot Approval

| Lot ID | Lot Approval Report No: | Comments |
|---|---|---|
| | | |

### 3. Survey

| Type of survey | Survey undertaken by: | Reference |
|---|---|---|
| | | |

### 4. Instructions received on site

### 5. Instructions given on site

**COMMENTS:**

| | |
|---|---|
| Signed: | Date: |

# Appendix E
# Certification Letter (Sample Only)

Our Ref:

Date:

Addressed to: Earthwork Contractor

Attention: Earthwork Contractor Representative

Dear

**RE: SAMPLE INTERIM (OR FINAL) FILLING CERTIFICATE**
**INDUSTRIAL DEVELOPMENT, BULK EARTHWORKS**
**CERTIFICATION OF EARTHWORKS**
**BETWEEN [DATE OF COMMENCEMENT] AND [DATE OF COMPLETION]**

In the period between [date start] and [date finish] the contractor has undertaken earthworks in areas XXX and XXX.

During the above period:

- The GITA has prepared the following Subgrade Approval Reports:

1. Subgrade Approval Report No 1
2. ……

- The GITA has prepared the following Lot Approval Reports:

1. Lot Approval Report No 1
2. ……

- The GITA has prepared the following Daily Reports:

1. Daily Report No 1……
2. ……

- The following subgrade survey was undertaken:

1. Subgrade Survey reference……
2. ……

- The following weekly survey was undertaken:

1. Weekly survey of week ending …….reference……..
2. ……

Copies of all the above documents are attached.

The GITA certifies that all the earthworks undertaken in the above stated period are documented in the above reports and have been undertaken in accordance with the Specifications (ref. PSM4503-004S, dated XXX) a copy of which is attached, with the exception of:

1. List outstanding issues (not approved subgrade, lots, unsuitable material, failed tests etc.)
2. ……..

Signed

GITA

# Appendix C
# PSM4503-003L REV1

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E mailbox@psm.com.au
www.psm.com.au

Our Ref: PSM4503-003L REV1

9 November 2021

JBS&G
Level 1, 50 Margaret St
SYDNEY NSW 2000
SGray@jbsg.com.au

Attention: Sarah Gray

Dear Sarah

**RE: THE GABLES RESIDENTIAL DEVELOPMENT, BOX HILL GEOTECHNICAL INVESTIGATION**

## 1. Introduction

This letter presents the results of the geotechnical investigation undertaken by Pells Sullivan Meynink (PSM) for the proposed "Gables" residential development at Box Hill, at the sites listed in Table 1. This work has been undertaken in accordance with the PSM proposal (Ref. PSM4503-001L) dated 6 July 2021. This letter has been updated to include the results of the geotechnical investigation undertaken at Lot 13, 145 Boundary Road, Box Hill in accordance with the PSM proposal (ref. PSM4503-005L) dated 18 October 2021.

The geotechnical investigations were undertaken on the following dates:

- 12 to 16 July 2021,
- 2, 4 and 5 August 2021, and
- 20 to 21 October 2021.

**Table 1 – Details of properties for which a geotechnical investigation was undertaken**

| Site | Address | Lot | DP | Area (ha) | Comment |
|---|---|---|---|---|---|
| 1 | 151 Boundary Road | 11 | 593517 | 10.01 | |
| 2 | 1 Cataract Road/147 Boundary Road | 14 | 255616 | 10.15 | |
| 3 | 93 Old Pitt Town Road | 12 | 1557044 | 2 | |
| 4 | 95 Old Pitt Town Road | 2 | 39157 | 2 | |
| 5 | 97 Old Pitt Town Road | 3 | 39157 | 2 | |
| 6 | 99 Old Pitt Town Road | 4 | 39157 | 2 | Investigation not undertaken |
| 7 | 101 Old Pitt Town Road | 5 | 39157 | 2 | Investigation not undertaken |
| 8 | 103 Old Pitt Town Road | 6 | 39157 | 2 | |
| 9 | 145 Boundary Road | 13 | 255616 | 11 | |

At this stage the fieldwork for Site 6 and 7 has not been completed. This report can be updated if the fieldwork for these two sites is completed.

Based on the information provided and PSM's observations whilst on-site, we understand the following:

- The sites are currently rural residential properties which typically comprised a dwelling and associated shed, grassed areas, gravel driveways, vegetated areas, small dams, and on some of the sites small fill stockpiles.
- Stockland is proposing to develop the sites into a new residential development, "The Gables". At this stage, details of the proposed development (building layouts, earthworks, etc.) are not known to PSM.

Figure 1 presents a site locality plan of the proposed development sites.

## 2. Historical Aerial Photographs

A review of historical aerial photographs from the NSW Government's Historical Imagery database and Nearmap was undertaken to assess the historical land use of each site, in particular, evidence of past excavations and filling. A summary of the historical changes at the site is outlined below. Appendix A presents a compilation of historical aerial photographs between 1947 and 2021 for each of the sites.

**Site 1 – Lot 11**

- 1947: Open farmland with small dam in the south-eastern corner of the site
- 1965: Small dam in the south-eastern corner has increased in extent. Small buildings have been constructed in the south-western corner of the site.
- 1986: Dam constructed in the north-eastern corner of the site
- 2005: Small structures (for agricultural purposes) constructed in the centre of the site.

The site does not appear to have changed significantly since 2005.

**Site 2 – Lot 14**

- 1947: Open farmland with a small creek draining from west to east through the middle of the site.
- 1965: Existing creek line was dammed to form a large dam. Small buildings have been constructed at the northern end of the site.
- 1975: The above-mentioned dam has increased in extent
- 1991: The above-mentioned dam appears to have been divided into two smaller dams due to subdivision of the land. The dam on Site 2 has been formed into a rectangular dam.

The site does not appear to have changed significantly since 1991.

**Sites 3, 4, 5, 8 – Lots 12, 2, 3, 6**

- 1947: Open farmland
- 1965 to 2005: Small dams and structures (buildings) constructed on each site
- 2005: Increase in trees and vegetation.

The site does not appear to have changed significantly since 2005.

**Site 9 – Lot 13**

- 1947: Open farmland
- 1965: Two dams have been constructed; a large one in the centre of the site (referred to as the central dam) and a smaller dam in the western portion of the site (referred to as the western dam). Several structures (buildings) have been constructed in the western portion of the site.
- 1975: A small dam has been constructed at the eastern end of the site (referred to as the eastern dam).
- 1984: The western dam has been backfilled, the central dam has been reduced in size to form a rectangular dam, and eastern dam has reduced in size.

The site does not appear to have changed significantly since 1984.

## 3. Geotechnical Investigation - 2021

### 3.1 Fieldwork

The fieldwork for seven of the sites (Sites 1 to 5, Site 8 and Site 9) was undertaken on the following dates:

- 12 to 16 July 2021,
- 2, 4 and 5 August 2021, and
- 20 to 21 October 2021 .

The geotechnical investigations were undertaken concurrently with JBS&G environmental investigation. The fieldwork for the remaining two sites (i.e., Site 6 and 7) were not undertaken because access to the properties was not provided by the client (i.e. Stockland). The geotechnical scope of works was undertaken under the fulltime supervision of a PSM Geotechnical Engineer, who undertook the following tasks:

- Preparing field logs of material encountered
- Undertaking DCP testing at each of the PSM test pit locations
- Collecting soil samples for laboratory testing.

Across the seven properties investigated, a total of 50 test pits were excavated and logged by PSM to depths of between 0.4 m and 2.9 m (referred to here-in as PSM test pits). JBS&G completed additional test pits to shallower depths of generally 0.4 m (referred to here-in as JBS&G test pits). Table 2 presents a summary of the fieldwork undertaken by PSM.

**Table 2 – Test pits Excavated at Each Site**

| Site | Date of Fieldwork | Number of Test Pits Logged by PSM | Depth (m) |
|---|---|---|---|
| 1 | 04/08/2021 and 05/08/2021 | 11 | 0.4 – 2.2 |
| 2 | 16/07/2021 and 02/08/2021 | 10 | 0.6 – 2.9 |
| 3 | 12/07/2021 | 5 | 1.0 – 2.4 |
| 4 | 13/07/2021 | 5 | 1.0 – 2.0 |
| 5 | 14/07/2021 | 4 | 1.0 – 1.5 |
| 8 | 15/07/2021 | 5 | 0.8 – 1.5 |
| 9 | 20/10/2021 and 21/10/2021 | 10 | 1.0 – 2.8 |

Test pits were excavated with a Terex 880 Elite Backhoe (8.2 tonne) in July, a Yanmar ViO50 Backhoe in August and a Takeuchi Backhoe in October.

At the completion of the fieldwork, the test pits were backfilled with excavated spoil and lightly tamped with the excavator bucket.

The locations of the PSM test pits are presented in Figures 2 to 5. Selected site photographs from the geotechnical investigation are presented in Figures 6 to 16.

Appendix B presents tabulated test pit logs including photographs of the PSM test pits and Appendix C presents the results of the Dynamic Cone Penetrometer (DCP) testing undertaken at these test pit locations.

### 3.2 Laboratory testing

Soil samples from 24 PSM test pits across the seven sites investigated were sent to a geotechnical laboratory for the following testing:

- Shrink-Swell index tests on undisturbed U50 tube samples
- California Bearing Ratio (CBR): Tests were undertaken on 4 day soaked samples compacted to 98% MDD at OMC, with a 4.5 kg surcharge.

The following testing was undertaken:

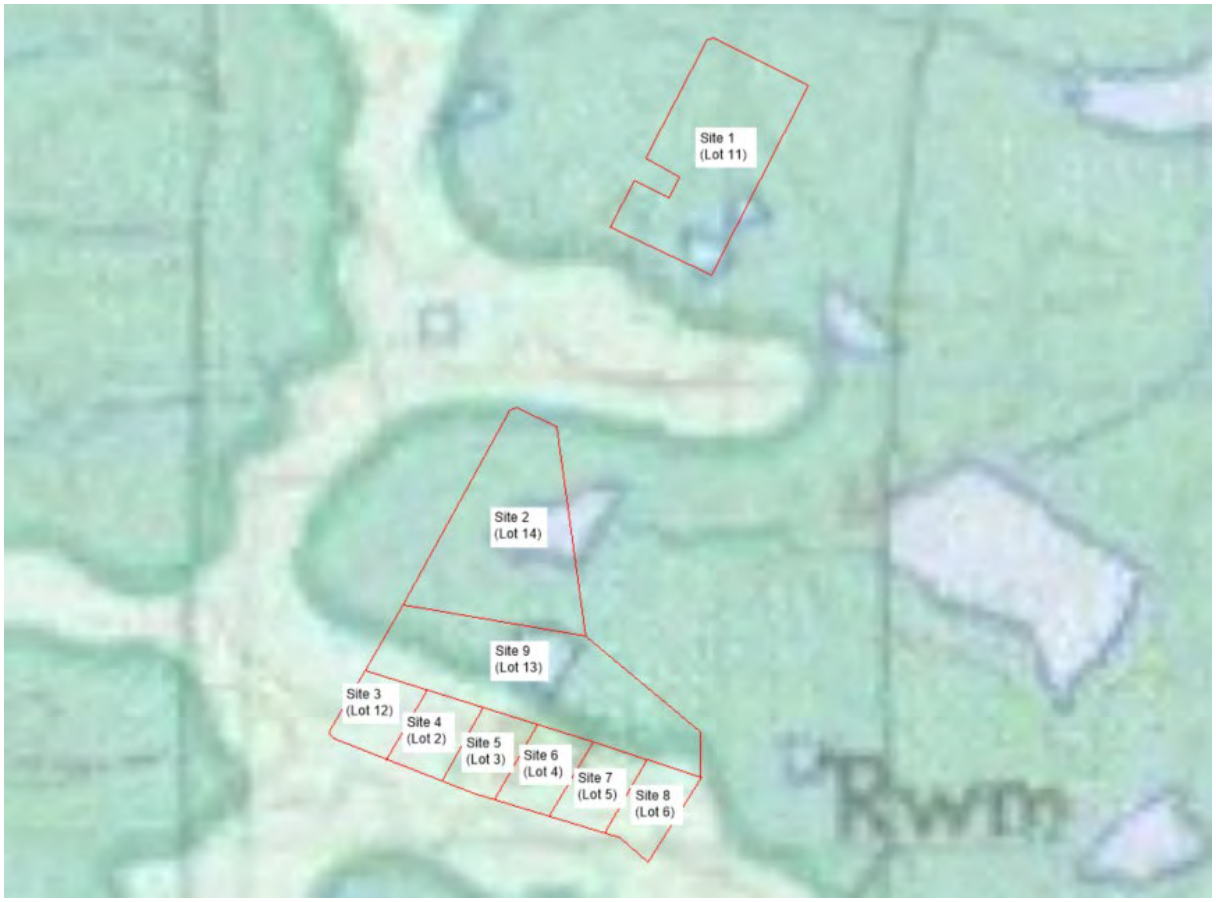
- Larger 10 ha sites (Site 1, Site 2 and Site 9)
  - 4 x CBR and
  - 3 x Shrink-Swell index tests.
- Smaller 2 ha sites (Site 3 to 5 and Site 8)
  - 2 x CBR and
  - 2 x Shrink-Swell index tests.

## 4. Site Conditions

### 4.1 Geological Setting

The 1:100,000 Penrith Geological map (1991) indicates that:

- Sites 1, 2 and 9 are primarily underlain by the Wianamatta Group formation (Ashfield Shale – Rwa) comprising dark-grey to black claystone-siltstone and fine sandstone-siltstone laminite.
- Sites 3 to 8 are primarily underlain by the Wianamatta Group formation (Minchinbury Sandstone – Rwm) comprising fine to medium-grained quartz-lithic sandstone.




**Inset 1: Geological map of the proposed development sites**

## 4.2 Surface Conditions

The seven sites investigated are existing rural residential properties, which typically comprised a dwelling and associated shed, grassed areas, gravel driveways, vegetated areas, small dams, and on some of the sites small fill stockpiles.

Site 1 has an undulating grassed landscape. During the investigation, the surface conditions were relatively dry. Dams were located in the north-eastern and south-eastern corners of the site.

Site 2 has an undulating grassed landscape with the surface elevation slightly lower at the centre of the site and then gradually increasing to the north and south. During the investigation, the ground was observed to be slightly muddy near the northern boundary of the site. The surface conditions in the other areas of the site were relatively dry. A dam was located at the centre of the site.

Site 1 to 5 and Site 8 typically slope gently down from the southern boundary of the site to the north.

- During the investigation of Site 3, the ground was observed to be slightly muddy in the north-eastern corner of the site. The surface conditions in the other areas of the site were relatively dry. The ground was built up underneath the northernmost shed.
- During the investigation of Site 4, the surface conditions were relatively dry. The ground was built up around the perimeter of the dam.
- During the investigation of Site 5, the surface conditions were relatively dry. Small fill stockpiles were observed south of the main residence.
- During the investigation of Site 8, the ground was observed to be relatively dry across the majority of the site except for the dam spill way. The ground was built up around the perimeter of the dam.
- Site 9 has an undulating grassed landscape. During the investigation, the surface conditions were relatively dry. A large dam was located at the centre of the site and a smaller one near the eastern boundary of the site. The ground was built up around the perimeter of the central dam and small fill stockpiles were observed adjacent to the western side of the central dam.

## 4.3 Subsurface Conditions

The subsurface conditions encountered within the PSM test pits are summarised in Table 3 to Table 6. Tabulated test pit logs are provided in Appendix B.

**Table 3 – Summary of Inferred Subsurface Conditions Encountered in PSM Test Pits at Site 1**

| Inferred Unit | Depth to Top Of Inferred Unit (m) | Material Description |
|---|---|---|
| TOPSOIL | 0.0 | Silty CLAY; low to high plasticity, brown; moist to dry, firm, rootlets<br><br>Clayey SILT; low plasticity, brown; dry, firm to stiff, rootlets |
| FILL | 0.0 – 0.2 | Silty CLAY trace gravel; low to medium plasticity, brown; fine to coarse gravel, sub-angular, up to 60 mm, shale fragments; dry to moist, firm to stiff, rootlets |
| NATURAL SOIL | 0.2 – 0.7 | CLAY; medium to high plasticity, red, brown and grey; dry to moist, stiff to hard<br><br>CLAY trace gravel; high plasticity, red, orange and brown; coarse gravel, sub-angular, up to 40 mm, shale fragments; moist, stiff |
| BEDROCK | 0.3 – 1.8 | SHALE; extremely to highly weathered, grey, red and brown; very low to low strength |

**Table 4 – Summary of Inferred Subsurface Conditions Encountered in PSM Test Pits at Site 2**

| Inferred Unit | Depth to Top of Inferred unit (m) | Material Description |
|---|---|---|
| TOPSOIL | 0.0 | Silty CLAY to Silty CLAY trace gravel; low to high plasticity, dark brown; fine to medium gravel, sub-angular to sub-rounded, up to 10 mm; moist, soft to firm, rootlets<br><br>Clayey SILT; low plasticity, dark brown; moist, soft to firm, rootlets |
| FILL | 0.0 – 0.3 | Silty CLAY to CLAY trace gravel; medium to high plasticity, dark brown to grey; fine gravel, sub-angular to sub-rounded, up to 5 mm; moist, soft to firm<br><br>Gravelly CLAY; medium to high plasticity, dark grey; fine gravel, sub-rounded up to 3 mm; moist, soft to firm |
| NATURAL SOIL | 0.2 – 1.3 | CLAY to Silty CLAY; medium to high plasticity, red, brown, and grey; moist, stiff to very stiff, rootlets<br><br>CLAY trace Gravel to Gravelly CLAY; medium to high plasticity, red, brown, and grey; fine to coarse gravel, sub-angular to sub-rounded up to 40 mm; dry to moist, firm to very stiff, rootlets |
| BEDROCK | 0.55 – 2.25 | SHALE; extremely weathered, red, grey, and orange, very low to low strength |

**Table 5 – Summary of Inferred Subsurface Conditions Encountered in PSM Test Tits at Site 3 to 5 and Site 8**

| Inferred unit | Depth to Top of Inferred Unit (m) | Material Description |
|---|---|---|
| TOPSOIL | 0.0 | Silty CLAY to Silty CLAY trace Gravel; low to high plasticity, dark brown; fine to medium gravel, sub-rounded, up to 25 mm; dry to moist, soft to stiff, rootlets<br><br>Sandy Silty CLAY; low to medium plasticity, dark brown; sand fine grained; dry, firm, rootlets |
| FILL | 0.0 – 0.05 | Silty GRAVEL; dark brown, gravel medium to coarse, sub-angular, up to 60 mm; dry, medium dense<br><br>Silty to Sandy CLAY; medium to high plasticity, dark brown; sand fine to coarse grained; moist, soft to firm, rootlets<br><br>Gravelly CLAY; medium plasticity, brown; medium gravel, sub-angular, up to 20 mm; trace cobbles up to 180 mm, predominantly shale; moist, firm, rootlets |
| NATURAL SOIL | 0.15 – 0.5 | CLAY to CLAY trace gravel; low to high plasticity, dark brown, red, and grey, fine to medium gravel, sub-angular to sub-rounded, up to |

| Inferred unit | Depth to Top of Inferred Unit (m) | Material Description |
|---|---|---|
| | | 10 mm; trace cobble up to 140 mm, dry to moist, firm to stiff, rootlets, occasional tree roots |
| BEDROCK | 0.75 – 2.39 | SHALE; extremely weathered, grey, red and brown, very low to low strength<br><br>SANDSTONE; fine grained, extremely weathered, grey, brown, and orange, very low to low strength |

**Table 6 – Summary of Inferred Subsurface Conditions Encountered in PSM Test Pits at Site 9**

| Inferred Unit | Depth to Top of Inferred Unit (m) | Material Description |
|---|---|---|
| TOPSOIL | 0.0 | Clayey SILT to SILT; light brown, dark brown, rootlets; dry, very stiff<br><br>CLAY trace sand; high plasticity, dark brown; fine sand, rootlets; dry, stiff<br><br>Silty CLAY to Silty CLAY trace gravel; medium to high plasticity, dark brown; sub-angular gravel up to 20 mm, rootlets; dry, firm to very stiff |
| FILL | 0.0 – 0.3 | CLAY to CLAY with gravel; high plasticity, red, grey; sub-angular gravel up to 20 mm, trace cobbles up to 250 mm; dry to moist, firm to stiff, ash/charcoal observed, pipe observed<br><br>Silty CLAY; medium to high plasticity, dark brown, light brown, rootlets; dry, stiff to very stiff<br><br>CLAY trace cobble; high plasticity, red, orange, grey, shale fragments up to 100 mm observed; dry, very stiff<br><br>LIME; white, pipe observed; dry, stiff, pp 300 – 310 kPa, rootlets. Observed in a small stockpile on the western side of the central dam (TP13_6) |
| NATURAL SOIL | 0.3 – 1.9 | CLAY to CLAY with gravel; high plasticity, red, dark brown, grey; sub-rounded to sub-angular gravel up to 5 mm; dry to wet, stiff to hard |
| BEDROCK | 1.0 – 2.8 | SHALE; grey, red, dry to moist, very low to low strength, extremely weathered |

The thickness of each geotechnical unit encountered in the PSM test pits are summarised in Table 7.

**Table 7 – Depth to the Top of Inferred Geotechnical Units Encountered in PSM Test Pits**

| Site (Lot) | PSM TP ID | Depth to Top of Inferred Geological Units (Depth m) [1] | | | | |
|---|---|---|---|---|---|---|
| | | Topsoil | Fill | Natural Soil | Bedrock | EOH [2] |
| Site 1 (Lot 11) | TP11_1 | 0.0 | 0.2 | 0.7 | 1.8 | 1.9 |
| | TP11_2 | 0.0 | 0.15 | 0.5 | N.E. | 2.2 |
| | TP11_3 | 0.0 | N.E. | 0.2 | N.E. | 2.2 |
| | TP11_4 | 0.0 | N.E. | 0.3 | 1.4 | 1.4 |
| | TP11_5 | 0.0 | N.E. | 0.4 | 0.7 | 1.0 |
| | TP11_6 | 0.0 | N.E. | 0.3 | 1.5 | 1.6 |
| | TP11_7 | 0.0 | N.E. | 0.2 | 1.3 | 1.5 |
| | TP11_8 | 0.0 | N.E. | 0.2 | 1.0 | 1.1 |
| | TP11_9 | 0.0 | N.E. | 0.2 | 0.8 | 1.1 |
| | TP11_10 | 0.0 | N.E. | 0.2 | 0.3 | 0.4 |
| | TP11_11 | 0.0 | N.E. | 0.3 | 0.7 | 0.9 |
| Site 2 (Lot 14) | TP14_1 | 0.0 | N.E. | 0.2 | 0.55 | 0.6 |
| | TP14_2 | 0.0 | N.E. | 0.3 | 1.55 | 1.6 |
| | TP14_3 | 0.0 | 0.1 | 1.3 | 2.25 | 2.3 |
| | TP14_4 | 0.0 | N.E. | 0.3 | 1.5 | 1.55 |
| | TP14_5 | 0.0 | N.E. | 0.4 | N.E. | 2.9 |
| | TP14_6 | N.E. | 0.0 | 0.8 | 2.2 | 2.5 |
| | TP14_7 | 0.0 | 0.3 | 0.3 | 2.2 | 2.3 |
| | TP14_8 | 0.0 | N.E. | 0.3 | 1.5 | 1.5 |
| | TP14_9 | 0.0 | 0.3 | 0.9 | 1.9 | 1.9 |
| | TP14_10 | N.E. | 0.0 | 0.65 | 1.8 | 2.0 |
| Site 3 (Lot 12) | TP12_1 | N.E. | 0.0 | 0.16 | 1.15 | 1.25 |
| | TP12_2 | 0.0 | N.E. | 0.3 | 0.95 | 1.0 |
| | TP12_3 | 0.0 | N.E. | 0.2 | 2.39 | 2.4 |
| | TP12_4 | 0.0 | N.E. | 0.18 | 0.95 | 1.0 |
| | TP12_5 | 0.0 | N.E. | 0.25 | 1.35 | 1.4 |
| Site 4 (Lot 2) | TP2_1 | N.E. | 0.0 | 0.4 | 1.85 | 1.9 |
| | TP2_2 | 0.0 | N.E. | 0.2 | 0.95 | 1.0 |
| | TP2_3 | 0.0 | N.E. | 0.2 | 1.35 | 1.4 |
| | TP2_4 | 0.0 | N.E. | 0.3 | 1.05 | 1.1 |
| | TP2_5 | N.E. | 0.0 | 0.5 | 1.8 | 2.0 |
| Site 5 | TP3_1 | 0.0 | N.E. | 0.25 | 0.95 | 1.0 |

| Site (Lot) | PSM TP ID | Depth to Top of Inferred Geological Units (Depth m) [1] | | | | |
|---|---|---|---|---|---|---|
| | | Topsoil | Fill | Natural Soil | Bedrock | EOH [2] |
| (Lot 3) | TP3_2 | 0.0 | N.E. | 0.2 | 1.45 | 1.5 |
| | TP3_3 | 0.0 | N.E. | 0.15 | 0.95 | 1.0 |
| | TP3_4 | 0.0 | N.E. | 0.2 | 0.95 | 1.0 |
| Site 8 (Lot 6) | TP6_1 | 0.0 | N.E. | 0.25 | 1.45 | 1.5 |
| | TP6_2 | 0.0 | 0.05 | 0.4 | 1.25 | 1.3 |
| | TP6_3 | 0.0 | N.E. | 0.3 | 0.75 | 0.8 |
| | TP6_4 | 0.0 | N.E. | 0.3 | 0.95 | 1.0 |
| | TP6_5 | 0.0 | N.E. | 0.35 | 1.25 | 1.3 |
| Site 9 (Lot 13) | TP13_1 | 0.0 | N.E. | 0.3 | 1.0 | 1.1 |
| | TP13_2 | 0.0 | N.E. | 0.3 | 1.1 | 1.1 |
| | TP13_3 | 0.0 | 0.3 | 1.1 | 2.1 | 2.1 |
| | TP13_4 | 0.0 | N.E. | 0.3 | 1.4 | 1.5 |
| | TP13_5 | 0.0 | 0.3 | 1.2 | 2.5 | 2.5 |
| | TP13_6 | N.E. | 0.0 | 1.1 | 2.8 | 2.8 |
| | TP13_7 | 0.0 | N.E. | 0.3 | 0.95 | 1.0 |
| | TP13_8 | 0.0 | 0.3 | 1.9 | 2.2 | 2.3 |
| | TP13_9 | 0.0 | 0.3 | 0.6 | 1.1 | 1.2 |
| | TP13_10 | 0.0 | 0.2 | 0.6 | 1.6 | 1.65 |

1 N.E. = Not Encountered

2 EOH = End of Hole

## 4.4 Groundwater

Groundwater inflow was observed in some locations during the geotechnical investigation. Table 8 summarises the locations at which groundwater inflow was observed. No long-term ground water monitoring was undertaken.

**Table 8 – Locations Where Groundwater Inflow Was Observed in the Test Pits During the Fieldwork**

| Site | PSM TP ID | Depth (m) | Material Description |
|---|---|---|---|
| Site 1 | Not observed. | | |
| Site 2 | TP14_6 | 1.8 | NATURAL SOIL – CLAY trace gravel |
| | TP14_7 | 1.5 | NATURAL SOIL – CLAY |
| Site 3 | Seepage observed in the JBS&G test pits excavated in the north-eastern corner of the Site. | | |
| Site 4 | Not observed. | | |
| Site 5 | Not observed. | | |
| Site 8 | Seepage observed in JBS&G test pits excavated along the dam spillway. | | |
| Site 9 | TP13_6 | 2.3 | NATURAL SOIL – CLAY |

## 5. Laboratory Testing Results

### 5.1 Geotechnical Testing

Table 9 and Table 10 present a summary of the CBR and Shrink-Swell index test results respectively. The laboratory test sheets for each set of tests are included in Appendix D and E respectively.

**Table 9 – Summary of CBR Test Results**

| Site | PSM TP ID | Depth (m) | Material Description | Soaked CBR (%) | OMC (%) | Standard Maximum Dry Density (t/m$^3$) | Swell (%) |
|---|---|---|---|---|---|---|---|
| Site 1 | TP11_3 | 0.5 – 1.0 | CLAY | 3.5* | 30.9 | 1.41 | 1.5 |
| | TP11_5 | 0.5 – 1.0 | CLAY | 5.0* | 16.4 | 1.86 | 0.0 |
| | TP11_6 | 0.5 – 1.0 | CLAY | 1.5* | 21.6 | 1.67 | 2.5 |
| | TP11_9 | 0.5 – 1.0 | CLAY | 4.0* | 17.9 | 1.75 | 0.5 |
| Site 2 | TP14_1 | 0.4 – 0.6 | CLAY | 1.5* | 17.8 | 1.74 | 2.5 |
| | TP14_5 | 0.5 – 1.0 | CLAY | 4.5* | 20.3 | 1.73 | 1.0 |
| | TP14_8 | 0.5 – 1.0 | Silty CLAY | 3.5* | 19.3 | 1.75 | 2.0 |
| | TP14_10 | 0.5 – 1.0 | Silty CLAY trace gravel, gravelly CLAY | 4.0* | 17.3 | 1.83 | 0.0 |
| Site 3 | TP12_2 | 0.45 – 1.0 | CLAY | 2.0* | 16.5 | 1.56 | 2.5 |
| | TP12_3 | 0.5 – 1.0 | CLAY | 0.5* | 13.3 | 1.64 | 3.5 |
| Site 4 | TP2_1 | 0.5 – 1.0 | CLAY trace gravel | 3.5* | 19.0 | 1.77 | 1.0 |
| | TP2_3 | 0.5 – 1.0 | CLAY | 6.0* | 23.8 | 1.58 | 1.5 |
| Site 5 | TP3_2 | 0.45 – 1.0 | CLAY | 0.5* | 21.2 | 1.50 | 4.5 |
| | TP3_4 | 0.5 – 1.0 | CLAY | 2.0** | 22.5 | 1.63 | 1.5 |
| Site 8 | TP6_2 | 0.5 – 1.0 | CLAY trace gravel | 4.0* | 19.5 | 1.73 | 2.5 |
| | TP6_5 | 0.5 – 1.0 | CLAY | 1.5** | 19.7 | 1.72 | 3.0 |
| Site 9 | TP13_1 | 0.5 – 1.0 | CLAY | 3.5* | 18.8 | 1.70 | 1.5 |
| | TP13_3 | 0.5 – 1.0 | CLAY | 7.0* | 19.1 | 1.64 | 1.5 |
| | TP13_5 | 0.5 – 1.0 | CLAY with gravel | 3.5* | 15.9 | 1.81 | 1.0 |
| | TP13_9 | 0.5 – 1.0 | CLAY | 1.0* | 14.1 | 1.87 | 3.0 |

Notes: * Indicates Soaked CBR value at 2.5 mm penetration

** Indicates Soaked CBR value at 5.0 mm penetration

**Table 10 – Summary of Shrink-Swell Index Test Results**

| Lot | PSM TP ID | Depth (m) | Material Description | Swell on Saturation (%) | Shrinkage (%) | Shrink Swell Index (%/pF) |
|---|---|---|---|---|---|---|
| Site 1 | TP11_3 | 0.5 – 0.95 | CLAY | 0.0 | 5.7 | 3.19 |
| | TP11_5 | 0.5 – 0.95 | CLAY | 0.0 | 2.1 | 1.16 |
| | TP11_6 | 0.5 – 0.95 | CLAY | 1.9 | 3.0 | 2.21 |
| Site 2 | TP14_5 | 0.5 – 0.95 | CLAY | 1.1 | 4.7 | 2.92 |
| | TP14_8 | 0.5 – 0.95 | Silty CLAY | 0.0 | 1.0 | 0.55 |
| Site 3 | TP12_2 | 0.45 – 0.90 | CLAY | 6.6 | 2.2 | 3.07 |
| | TP12_3 | 0.5 – 0.95 | CLAY | 6.9 | 2.1 | 3.10 |
| Site 4 | TP2_1 | 0.5 – 0.95 | CLAY trace gravel | 0.1 | 2.5 | 1.41 |
| | TP2_3 | 0.5 – 0.95 | CLAY | 4.4 | 2.5 | 2.60 |
| Site 5 | TP3_2 | 0.45 – 0.90 | CLAY | 1.1 | 3.2 | 2.12 |
| | TP3_4 | 0.5 – 0.95 | CLAY | 8.6 | 2.1 | 3.55 |
| Site 8 | TP6_2 | 0.5 – 0.95 | CLAY trace gravel | 1.2 | 3.8 | 2.46 |
| | TP6_5 | 0.5 – 0.95 | CLAY | 1.0 | 3.7 | 2.31 |
| Site 9 | TP13_3 | 0.6 – 1.05 | CLAY | 0.2 | 1.6 | 0.97 |
| | TP13_5 | 0.5 – 0.95 | CLAY with gravel | 0.0 | 2.0 | 1.09 |
| | TP13_9 | 0.5 – 0.95 | CLAY | 1.3 | 2.3 | 1.63 |

## 6. Bulk Earthworks

A separate bulk earthworks specification has been prepared (ref. PSM4503-004S) which sets out clearly the roles and responsibilities of the earthworks contractor and its Geotechnical Inspection and Testing Authority (GITA). The Specification complies with the intent of AS 3798-2007 "*Guidelines on earthworks for commercial and residential developments*".

Our specification generally comprises more stringent requirements than Council's requirements (e.g., lot testing, more survey, etc.). It reduces risk of poor earthworks performance. We note however depending on the actual consent conditions of the proposed subdivision and The Hills Shire council requirements, the proposed earthworks could have other requirements. Upon confirmation of the Consent Conditions, we can update PSM specification to meet both consent conditions and our design advice if requested.

## 7. Interim Geotechnical Design Advice

### 7.1 General

We note that details of the proposed earthworks (e.g., depth of fill) are not known to PSM. The design advice provided in the following sections has been prepared on the following basis:

- The subsurface conditions are as described in Section 4
- The earthworks are to be completed in accordance with the PSM bulk earthworks specification (**the Specification)** (ref. PSM4503-004S).

## 7.2 Site Classification

We understand that it is proposed to develop the sites as part of a larger residential development. Based on the laboratory testing, field observations and the inferred geotechnical units, we have classified the site in accordance with AS2870-2011 “Residential slabs and footings”.

We advise the following:

1. In cut areas within the NATURAL SOIL unit, structures that are within the scope of AS2870-2011 be designed for a site classification of Class “H1” in accordance with Table 2.1 of AS2870-2011.
2. In fill areas, further assessment of the site classification would be required and will depend on the fill materials, depth of fill and the manner in which it was placed.
    a. Where existing fill is present and there is no earthworks documentation (records), the fill cannot be considered as “controlled fill” and thus the site is classified as Class P in accordance with AS2870-2011. Further detailed investigation and assessment should be undertaken to allow for reclassification.
    b. Where new fill will be placed in accordance with PSM bulk earthworks specification (Ref. PSM4503-004S), the site can be reclassified from Class P to Class H2, provided the following are satisfied:
        i. The fill is placed strictly in accordance with PSM bulk earthworks specification.
        ii. PSM undertake review of the GITA weekly reports, interim / final certificates as described in the earthworks specification.
        iii. PSM undertake inspection during and at the completion of the bulk earthworks.

The civil and structural engineers should consider likely heave / settlement due to the effect of climatic actors in their design.

We recommend that all structures and services be detailed such that they preclude any local wetting up or drying out of the subgrade after initial equilibrium is reached following construction of the slab and that the subgrade be within specification at the time of construction of the slab. We note that normal mounding or sagging away from the perimeter of covered areas will still occur and perimeters, or open joints, will still respond to environmental changes.

## 7.3 Foundations

It is expected that the foundations used as part of the proposed development at the sites would typically include strip, pad, or other shallow footings.

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 11. Further advice should be sought if the footings are located adjacent to a batter or wall.

We note that an allowable bearing pressure (ABP) is not a soil property. It depends on many factors such as the size of the footings, the embedment depth, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FOS), as well as the soil properties. As footings get bigger or deeper the capacity increases rapidly, and as the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements in the NATURAL SOIL unit can be estimated using the elastic moduli provided in Table 11.

When assessing the settlement of the shallow footings, the designer needs to consider the additional ground settlement due to the total building load on both shallow and deeper units. The differential settlement due to the building load shall also be assessed.

Foundation conditions at the proposed shallow pad footing locations should be inspected by a suitably qualified geotechnical engineer prior to the pouring of concrete.

**Table 11 – Foundation Parameters of Inferred Geotechnical Units**

| Inferred Unit | Bulk Unit Weight (kN/m³) | Soil Effective Strength Parameters | | Ultimate Bearing Pressure under Vertical Centric Loading (kPa) | Allowable Bearing Pressure (ABP) under Vertical Centric Loading (kPa) | Elastic Parameters | |
|---|---|---|---|---|---|---|---|
| | | c' (kPa) | φ' (deg) | | | Long Term Youngs Modulus (MPa) | Poisson's Ratio |
| ENGINEERED FILL / NATURAL SOIL | 18 | 0 | 30 | 420 | 100 [1] | 10 | 0.3 |
| BEDROCK | 22 | N/A | N/A | 3,000 [2] | 700 [3] | 100 | 0.25 |

1 Pad footings (for ABP of 100 kPa) should have a minimum horizontal dimension of 0.5 m and a minimum embedment depth of 0.5 m

2 Ultimate values occur at large settlement (>5% of minimum footing)

3 ABP is an end bearing pressure to cause settlement of <1% of minimum footing)

## 7.4 Permanent and Temporary Slopes

The batter slope angles shown in Table 12 are recommended for the design of batters up to 3 m height and above the groundwater table; subject to the following recommendations:

1. The batters shall be protected from erosion.
2. Permanent batters shall be drained.
3. Temporary batters shall not be left unsupported for more than 1 month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events.
4. Where loads are imposed or structures/services are located within on batter height of the crest of the batter, further advice should be sought.

Steeper batters may be possible subject to further advice, typically including inspection during construction.

**Table 12 – Design Batter Slope Angles**

| Unit | Temporary | Permanent |
|---|---|---|
| SOIL UNITS, e.g., ENGINEEERED FILL, NATURAL SOIL | 2H : 1V | 2.5H : 1V |

## 7.5 Pavements

Subgrade CBR for pavement design depends on the material at the finished subgrade levels. The CBR tests undertaken by PSM (refer to Table 9) indicate a CBR value between 0.5% and 7.0%.

A CBR of 1.5% can be adopted for subgrade and fill formed in bulk earthworks constructed in accordance with the Specification.

Subgrade CBR for pavement design depends on the material at the finished subgrade levels.

We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised. CBR testing shall be undertaken for any new imported material within the pavement subgrade (e.g., within 1 m below pavement).

Should there be any queries, do not hesitate to contact the undersigned.

**Yours Sincerely**

**JANE SHEN**
**GEOTECHNICAL ENGINEER**

**AGUSTRIA SALIM**
**PRINCIPAL**

| | | |
|---|---|---|
| **Encl**. | Figure 1 | Locality Plan |
| | Figures 2 to 5 | PSM Test Pit Location Plan |
| | Figures 6 to 16 | Selected Site Photographs |
| | Appendix A | Historical Aerial Photographs |
| | Appendix B | Tabulated Test Pit Logs |
| | Appendix C | DCP Results |
| | Appendix D | CBR Results |
| | Appendix E | Shrink Swell Index Results |
| | Appendix F | Bulk Earthworks Specification (PSM4503-004S) |


## LEGEND

- Approximate site boundary

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

50 0 50 100 150 200m

1 : 10000 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Site Locality Plan

| PSM4503-003L | Figure 1 |
|---|---|


## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Site 1 (Lot 11) - 151 Boundary Road

| PSM4503-003L | Figure 2 |
|---|---|


## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

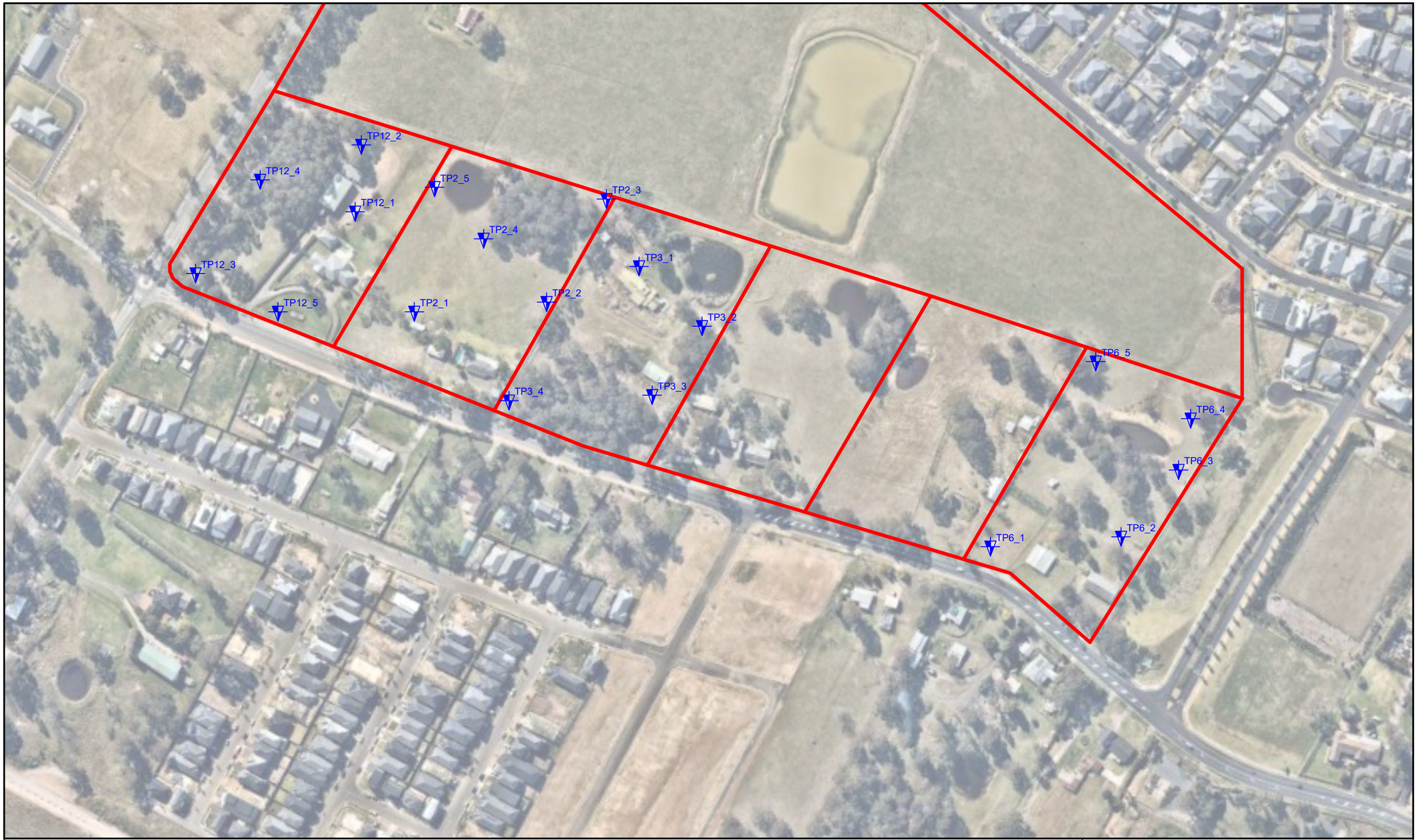
1 : 2500 FULL SIZE A3

JBS&G

The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-003L | Figure 3 |
|---|---|




## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G

The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Sites 3 (Lot 12), 4 (Lot 2), 5 (Lot 3) and 8 (Lot 6)

| PSM4503-003L | Figure 4 |
|---|---|


## LEGEND

- Approximate site boundary
- PSM test pit

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G

The Gables Residential Development
Box Hill

PSM Test Pit Location Plan
Site 9 (Lot 13) - 145 Boundary Road

| PSM4503-003L | Figure 5 |
|---|---|


Photo 1 - Terex 880 Elite Backhoe excavating TP12_1 at Site 3 (Lot 12)


Photo 2 - Yanmar ViO50 Backhoe excavating TP11_6 at Site 1 (Lot 11)

Photo 3 - Dam and shed structures in Site 1 (Lot 11)

Photo 4 - Crops in Site 1 (Lot 11)

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The Gables Residential Development

Box Hill

GEOTECHNICAL INVESTIGATION

Photo 5 - Typical site conditions (grassy cow paddock) in Site 2 (Lot 14)

Photo 6 - Dam in Site 2 (Lot 14)

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The Gables Residential Development

Box Hill

GEOTECHNICAL INVESTIGATION

Photo 7 - House and shed structures in Site 3 (Lot 12)

Photo 8 - Typical site conditions in Site 3 (Lot 12)

Photo 9 - Typical site conditions in Site 4 (Lot 2)

Photo 10 - Dam in Site 4 (Lot 2)

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The Gables Residential Development

Box Hill

GEOTECHNICAL INVESTIGATION

Photo 11 - Typical site conditions in Site 5 (Lot 3)

Photo 12 - Small fill stockpiles in Site 5 (Lot 3)

Photo 13 - Typical site conditions in Site 8 (Lot 6)

Photo 14 - Dam in Site 8 (Lot 6)

Photo 15 - Typical site conditions in Site 9 (Lot 13)


Photo 16 - Takeuchi Backhoe excavating TP13_4 at Site 9 (Lot 13)

Photo 17 - Dam in Site 9 (Lot 13)

Photo 18 - Small fill stockpiles in Site 9 (Lot 13)


Photo 19 - Typical FILL (Silty CLAY) unit

Photo 20 - Typical NATURAL SOIL (CLAY) unit


Photo 21 - Typical BEDROCK (SHALE) unit


Photo 22 - Typical BEDROCK (SANDSTONE) unit

# Appendix A
# Historical Aerial Photographs

## LEGEND

- Approximate site boundary

N

1 : 2500

12.5 0 25 50m

FULL SIZE A3

PSM

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1947
Site 1 (Lot 11) - 151 Boundary Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

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The Gables Residential Development
Box Hill

Historical Imagery - 1965
Site 1 (Lot 11) - 151 Boundary Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1986
Site 1 (Lot 11) - 151 Boundary Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 2005
Site 1 (Lot 11) - 151 Boundary Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 2 October 2016
Site 1 (Lot 11) - 151 Boundary Road

PSM4503-003L | Appendix A

LEGEND

- Approximate site boundary

N

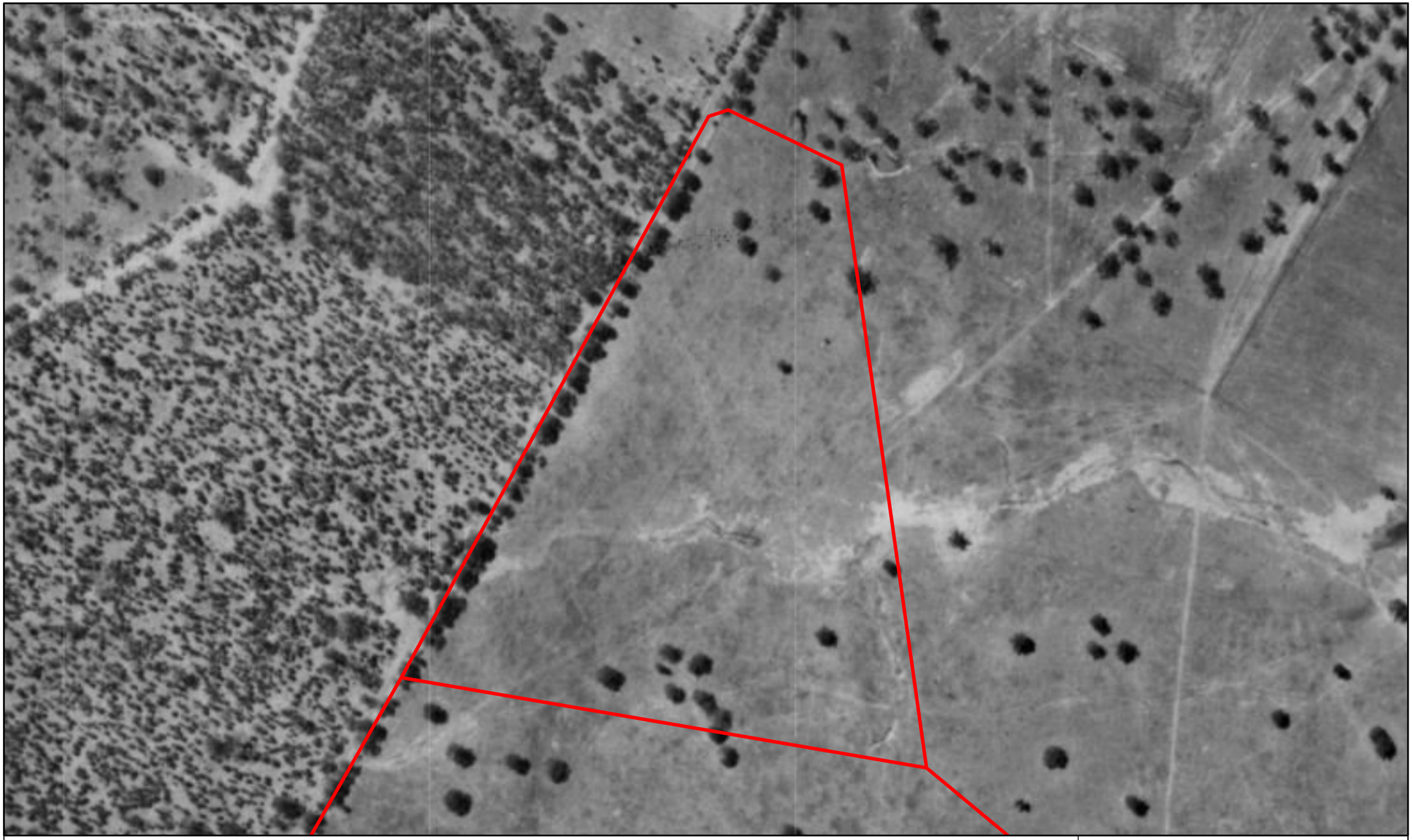
12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 7 August 2021
Site 1 (Lot 11) - 151 Boundary Road

| PSM4503-003L | Appendix A |
|---|---|



LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1947
Site 2 (Lot 14) - 1 Cataract Road

PSM4503-003L | Appendix A

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1965
Site 2 (Lot 14) - 1 Cataract Road

PSM4503-003L | Appendix A

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

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The Gables Residential Development
Box Hill

Historical Imagery - 1975
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

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The Gables Residential Development
Box Hill

Historical Imagery - 1984
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1991
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 2005
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 7 August 2021
Site 2 (Lot 14) - 1 Cataract Road

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1947
Sites 3, 4, 5, 8, 9 (Lots 12, 2, 3, 6, 13)

PSM4503-003L | Appendix A

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1965
Sites 3, 4, 5, 8, 9 (Lots 12, 2, 3, 6, 13)

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1975
Sites 3, 4, 5, 8, 9 (Lots 12, 2, 3, 6, 13)

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 1984
Sites 3, 4, 5, 8, 9 (Lots 12, 2, 3, 6, 13)

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

P S M

JBS&G
The Gables Residential Development
Box Hill

Historical Imagery - 2005
Sites 3, 4, 5, 8, 9 (Lots 12, 2, 3, 6, 13)

| PSM4503-003L | Appendix A |
|---|---|

LEGEND

- Approximate site boundary

N

12.5 0 25 50m

1 : 2500 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Nearmap - 7 August 2021
Sites 3, 4, 5, 8, 9 (Lots 12, 2, 3, 6, 13)

| PSM4503-003L | Appendix A |
|---|---|

# Appendix B
# Tabulated Test Pit Logs

# Site 1 (Lot 11) – 151 Boundary Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_1 | 0 – 0.2 | Silty CLAY; low to medium plasticity, brown; dry, firm | Grassed surface area<br>TOPSOIL |
| | 0.2 – 0.7 | Silty CLAY trace gravel; low to medium plasticity, brown; medium gravel, sub-angular, up to 15 mm, shale fragments; dry, firm to stiff | FILL |
| | 0.7 – 1.8 | CLAY; high plasticity, red and brown; moist, stiff, pp 440 kPa<br>At 1.0 m: becoming red, grey and brown, very stiff to hard, pp[1] 430 kPa<br>At 1.5 m: becoming grey with some red | NATURAL SOIL |
| | 1.8 – 1.9 | SHALE; dark grey and red, moist very low to low strength, extremely weathered | BEDROCK |
| | 1.9 | Test pit terminated at 1.9 m | Target Depth |

Note: pp = Pocket Penetrometer

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_2 | 0 – 0.15 | Silty CLAY; low plasticity, brown; moist, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.15 – 0.5 | Silty CLAY trace gravel; low plasticity, brown; fine to coarse gravel, sub-angular, up to 60 mm, shale fragments; moist, firm to stiff, rootlets | FILL |
| | 0.5 – 2.2 | CLAY; high plasticity, grey, brown and red; moist, stiff, pp 250 – 400 kPa<br>At 1.4 m: becoming very stiff to hard, pp 440 – 530 kPa<br>At 1.7 m: becoming grey and red | NATURAL SOIL |
| | 2.2 | Test pit terminated at 2.2 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_3 | 0 – 0.2 | Silty CLAY; low to medium plasticity, dark brown; moist, firm to stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 2.2 | CLAY; high plasticity, red; moist, stiff to very stiff, pp 360 – 590 kPa<br>At 1.0 m: pp 400 kPa<br>At 1.3 m: becoming red and dark grey, hard, pp 550 kPa<br>At 1.8 m: becoming grey, brown and red | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 2.2 | Test pit terminated at 2.2 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_4 | 0 – 0.3 | Clayey SILT; low plasticity, dark brown; dry, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.4 | CLAY; high plasticity, red; moist, stiff, pp 210 – 390 kPa<br>At 0.8 m: becoming red and grey, very stiff | NATURAL SOIL |
| | 1.4 | SHALE; red and dark grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.4 | Test pit terminated at 1.4 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_5 | 0 – 0.4 | Clayey SILT; low plasticity, dark brown; moist, firm to stiff, pp 330 kPa | Grassed surface area<br>TOPSOIL |
| | 0.4 – 0.7 | CLAY trace gravel; high plasticity, red, orange and brown; coarse gravel, sub-angular, up to 40 mm, shale fragments; moist, stiff, pp 160 – 230 kPa | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 0.7 – 1.0 | SHALE; grey and brown, dry, low strength, extremely weathered to highly weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_6 | 0 – 0.3 | Clayey SILT; low plasticity, dark brown; dry, firm to stiff, pp 180 – 400 kPa, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.5 | CLAY; high plasticity, red; moist, stiff<br>At 0.7 m: becoming grey, brown and red, very stiff, pp 190 – 260 kPa | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.5 – 1.6 | SHALE; red and grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.6 | Test pit terminated at 1.6 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_7 | 0 – 0.2 | Silty CLAY; low plasticity, dark brown; dry, stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 1.3 | CLAY; high plasticity, red; moist, stiff to very stiff, pp 330 – 530 kPa<br>At 0.6 m: becoming red and grey<br>At 0.9 m: pp 190 – 270 kPa | NATURAL SOIL |
| | 1.3 – 1.5 | SHALE; red and grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.5 | Test pit terminated at 1.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_8 | 0 – 0.2 | Silty CLAY trace gravel; low plasticity, brown; medium gravel, sub-angular, up to 20 mm; dry, firm to stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 1.0 | CLAY; medium to high plasticity, red; dry, very stiff, pp 300 – 400 kPa, rootlets<br>At 0.7 m: becoming red and grey, very stiff to hard, pp 480 – 600 kPa | NATURAL SOIL |
| | 1.0 – 1.1 | SHALE; red and dark grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.1 | Test pit terminated at 1.1 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_9 | 0 – 0.2 | Clayey SILT; low plasticity, brown; dry, firm to stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 0.8 | CLAY; high plasticity, red, grey and brown; moist, stiff to very stiff, pp 350 – 410 kPa, rootlets<br>At 0.6 m: becoming Gravelly CLAY | NATURAL SOIL<br>CBR sample at 0.5 m |
| | 0.8 – 1.1 | SHALE; grey, red and brown, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.1 | Test pit terminated at 1.1 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_10 | 0 – 0.2 | Silty CLAY; medium plasticity, dark brown; moist, firm to stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 0.3 | CLAY; high plasticity, grey, red and brown; moist, very stiff, pp 260 kPa | NATURAL SOIL |
| | 0.3 – 0.4 | SHALE; red, grey and brown, dry, very low to low strength, extremely weathered | BEDROCK |
| | 0.4 | Test pit terminated at 0.4 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP11_11 | 0 – 0.3 | Silty CLAY; medium to high plasticity, brown; moist, firm, pp 50 kPa, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.7 | CLAY; high plasticity, red, brown and grey; moist, stiff, 110 – 170 kPa, rootlets | NATURAL SOIL |
| | 0.7 – 0.9 | SHALE; grey and brown, dry, very low to low strength, extremely weathered | BEDROCK |
| | 0.9 | Test pit terminated at 0.9 m | Target Depth |

# Site 2 (Lot 14) – 1 Cataract Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_1 | 0 – 0.2 | Silty CLAY trace gravel; medium plasticity, dark brown; medium gravel, sub-angular, up to 10 mm; moist, soft to firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 0.55 | CLAY; medium to high plasticity, red and dark brown; moist, stiff, pp 180 kPa, rootlets<br>At 0.4 m: becoming grey and orange, pp 200 kPa | NATURAL SOIL<br>CBR sample at 0.4 m |
| | 0.55 – 0.6 | SHALE; grey and orange, dry to moist, very low to low strength, extremely weathered | BEDROCK |
| | 0.6 | Test pit terminated at 0.6 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_2 | 0 – 0.3 | Silty CLAY; medium plasticity, dark brown; moist, soft to firm, pp 100 kPa, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.3 – 1.55 | CLAY; medium to high plasticity, red and dark brown, moist, stiff, pp 250 kPa, rootlets<br>At 1.0 m: becoming CLAY trace gravel, grey and orange, very stiff, medium gravel, sub-angular to sub-rounded up to 25 mm | NATURAL SOIL |
| | 1.55 – 1.6 | SHALE; dark grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.6 | Test pit terminated at 1.6 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_3 | 0 – 0.1 | Silty CLAY; medium plasticity, dark brown; moist, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.1 – 0.8 | Silty CLAY; medium plasticity, dark brown; moist, firm, pp 180 kPa | FILL |
| | 0.8 – 1.3 | Gravelly CLAY; medium to high plasticity, dark grey; fine gravel, sub-rounded up to 3 mm; moist, soft to firm | FILL |
| | 1.3 – 2.25 | CLAY trace gravel; medium to high plasticity, orange and dark brown; medium gravel, sub-angular up to 10 mm, moist, stiff to very stiff, pp 300 kPa, rootlets<br>At 1.6 m: becoming grey and orange, dry | NATURAL SOIL |
| | 2.25 – 2.3 | SHALE; red and grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 2.3 | Test pit terminated at 2.3 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_4 | 0 – 0.3 | Silty CLAY; medium plasticity, dark brown; moist, soft to firm, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.3 – 1.5 | CLAY trace gravel; medium to high plasticity, red and dark brown; coarse gravel, sub-rounded, up to 40 mm; moist, stiff, pp 250 kPa, rootlets<br>At 0.7 m: becoming CLAY, grey and yellow | NATURAL SOIL |
| | 1.5 – 1.55 | SHALE; red and yellow, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.55 | Test pit terminated at 1.55 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_5 | 0 – 0.4 | Silty CLAY trace gravel; medium plasticity, dark brown; fine gravel, sub-angular, up to 5 mm; moist, firm, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.4 – 2.9 | CLAY; medium to high plasticity, red and grey, moist, stiff to very stiff, pp 240 kPa<br>At 2.1 m: becoming grey and yellow, pp 250 kPa | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 2.9 | Test pit terminated at 2.9 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_6 | 0 – 0.8 | Silty CLAY; medium plasticity, brown; moist, firm, rootlets<br>At 0.5 m: becoming medium to high plasticity, grey and brown | Grassed surface area (paddock)<br>FILL |
| | 0.8 – 2.2 | CLAY trace gravel; high plasticity, brown, grey and red; fine to medium gravel, sub-angular up to 20 mm; moist, firm to stiff | NATURAL SOIL<br>Water seepage observed at 1.8 m |
| | 2.2 – 2.5 | Clayey GRAVEL; red and grey, fine to medium gravel, sub-rounded to sub-angular; clay high plasticity; wet | NATURAL SOIL |
| | 2.5 | Test pit terminated at 2.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_7 | 0 – 0.3 | Silty CLAY; high plasticity, dark brown; moist, firm, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.3 – 0.7 | CLAY trace gravel; high plasticity, brown; fine gravel, sub-rounded up to 5 mm; moist, firm | FILL |
| | 0.7 – 2.2 | CLAY; high plasticity, yellow brown and grey; moist, stiff<br>At 1.2 m: becoming red, brown and grey, very stiff | NATURAL SOIL<br>Water seepage observed at 1.5 m |
| | 2.2 – 2.3 | SHALE; brown, red and grey, wet, very low to low strength, extremely weathered | BEDROCK |
| | 2.3 | Test pit terminated at 2.3 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_8 | 0 – 0.3 | Clayey SILT; low plasticity, dark brown; moist, soft to firm, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.3 – 1.5 | Silty CLAY; medium to high plasticity, brown and red; moist, stiff<br>At 1.0 m: becoming red and grey, very stiff | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.5 | SHALE; red and grey, moist, very low to low strength, extremely weathered | BEDROCK |
| | 1.5 | Test pit terminated at 1.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_9 | 0 – 0.3 | Silty CLAY; low to medium plasticity, brown; moist, firm, rootlets | Grassed surface area (paddock)<br>TOPSOIL |
| | 0.3 – 0.9 | CLAY trace gravel; low to medium plasticity, brown; fine gravel, sub-rounded up to 5 mm; moist, firm | FILL |
| | 0.9 – 1.9 | CLAY; high plasticity, red; moist, stiff<br>At 1.2 m: becoming red and grey, very stiff | NATURAL SOIL |
| | 1.9 | SHALE; red and grey, moist, very low to low strength, extremely weathered | BEDROCK |
| | 1.9 | Test pit terminated at 1.9 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP14_10 | 0 – 0.65 | Silty CLAY trace gravel; high plasticity, brown; fine gravel, sub-rounded up to 5 mm; moist, firm, rootlets | Grassed area (paddock)<br>FILL |
| | 0.65 – 1.8 | Gravelly CLAY; medium to high plasticity, red, brown and grey; fine to medium gravel, sub-rounded to sub-angular up to 20 mm; moist, stiff<br>At 1.0 m: becoming dark red, very stiff<br>At 1.5 m: becoming yellow brown | NATURAL SOIL<br>CBR sample at 0.5 m |
| | 1.8 – 2.0 | SHALE; red, brown and grey, moist, very low to low strength, extremely weathered | BEDROCK |
| | 2.0 | Test pit terminated at 2.0 m | Target Depth |

# Site 3 (Lot 12) – 93 Old Pitt Town Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP12_1 | 0 – 0.16 | Silty GRAVEL; dark brown, gravel medium to coarse, sub-angular, up to 60 mm; dry, medium dense | FILL<br>Gravel driveway |
| | 0.16 – 1.15 | CLAY trace gravel; medium plasticity, red and grey, fine gravel, sub-angular, up to 5 mm; dry, stiff to very stiff<br>At 0.95 m: becoming low to medium plasticity, grey and yellow, rock fabric visible | NATURAL SOIL |
| | 1.15 – 1.25 | SHALE; grey and yellow, dry, very low strength, extremely weathered | BEDROCK |
| | 1.25 | Test pit terminated at 1.25 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP12_2 | 0 – 0.3 | Silty CLAY; medium plasticity, dark brown; moist, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.95 | CLAY; medium plasticity, red; dry, stiff to very stiff, rootlets<br>At 0.75 m: becoming yellow and grey, tree roots | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.45 m |
| | 0.95 – 1.0 | SHALE; light brown and yellow, dry, very low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP12_3 | 0 – 0.2 | Silty CLAY; low to medium plasticity, dark brown; dry, stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 2.39 | CLAY; low to medium plasticity, red and grey; dry, stiff to very stiff, rootlets<br>At 1.2 m: becoming light grey | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 2.39 – 2.4 | SHALE; red and pale grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 2.4 | Test pit terminated at 2.4 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP12_4 | 0 – 0.18 | Silty CLAY; medium plasticity, dark brown; moist, stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.18 – 0.95 | CLAY; medium to high plasticity, red and grey; moist, stiff to very stiff, rootlets, rock fabric visible<br>At 0.82 m: becoming yellow and grey, dry, tree roots | NATURAL SOIL |
| | 0.95 – 1.0 | SHALE; grey and yellow, dry, very low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP12_5 | 0 – 0.25 | CLAY trace gravel; medium to high plasticity, dark brown; medium gravel, sub-rounded, up to 15 mm; moist, soft to firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.25 – 1.35 | CLAY; medium to high plasticity, red and dark brown; moist, firm to stiff, rootlets, rock fabric visible<br>At 0.6 m: becoming grey, very stiff | NATURAL SOIL |
| | 1.35 – 1.4 | SHALE; grey and red, dry, very low strength, extremely weathered | BEDROCK |
| | 1.4 | Test pit terminated at 1.4 m | Target Depth |

# Site 4 (Lot 2) – 95 Old Pitt Town Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP2_1 | 0 – 0.4 | Sandy CLAY; medium plasticity, dark brown; fine to very coarse sand; moist, firm, rootlets | Grassed surface area<br>FILL |
| | 0.4 – 1.3 | CLAY trace gravel; medium plasticity, red and orange; medium gravel, sub-rounded, up to 10 mm; moist, firm to stiff, rootlets | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.3 – 1.85 | Sandy CLAY; medium to high plasticity, light grey and orange; sand fine grained; moist, stiff | NATURAL SOIL |
| | 1.85 – 1.9 | SANDSTONE; fine grained, dark grey and brown, dry, very low strength, extremely weathered | BEDROCK |
| | 1.9 | Test pit terminated at 1.9 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP2_2 | 0 – 0.2 | Silty CLAY; medium plasticity, dark brown; dry, stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 0.95 | CLAY; medium plasticity, red and grey; dry, stiff to very stiff, rootlets<br>At 0.7 m: becoming grey and orange | NATURAL SOIL |
| | 0.95 – 1.0 | SHALE; grey and orange, dry, very low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP2_3 | 0 – 0.2 | Silty CLAY; low to medium plasticity, dark brown; dry, firm to stiff, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 1.35 | CLAY; medium plasticity, red and dark brown; dry, stiff, rootlets<br>At 1.2 m: becoming grey and red, very stiff, rock fabric visible | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.35 – 1.4 | SHALE; grey and red, dry, very low strength, extremely weathered | BEDROCK |
| | 1.4 | Test pit terminated at 1.4 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP2_4 | 0 – 0.3 | Silty CLAY trace gravel; medium plasticity, dark brown; fine gravel, sub-rounded, up to 5 mm; moist, soft to firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.05 | CLAY; medium to high plasticity, red and dark brown; moist, firm to stiff, rootlets<br>At 0.7 m: becoming Sandy CLAY, grey and yellow, stiff to very stiff, sand fine grained, dry | NATURAL SOIL |
| | 1.05 – 1.1 | SANDSTONE; fine grained, grey and red, dry, very low strength, extremely weathered | BEDROCK |
| | 1.1 | Test pit terminated at 1.1 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP2_5 | 0 – 0.5 | Gravelly CLAY; medium plasticity, brown; medium gravel, sub-angular, up to 20 mm; trace cobbles up to 180 mm, predominantly shale; moist, stiff, rootlets | Grassed surface area<br>FILL |
| | 0.5 – 1.8 | CLAY trace gravel; medium to high plasticity, red and dark brown; fine gravel, sub-rounded, up to 3 mm; moist, stiff<br>At 1.6 m: becoming CLAY, grey and yellow, dry, very stiff | NATURAL SOIL |
| | 1.8 – 2.0 | SHALE; grey and yellow, dry, very low strength, extremely weathered | BEDROCK |
| | 2.0 | Test pit terminated at 2.0 m | Target Depth |

# Site 5 (Lot 3) – 97 Old Pitt Town Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP3_1 | 0 – 0.25 | Silty CLAY; medium plasticity, dark brown; moist, soft to firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.25 – 0.95 | CLAY; medium to high plasticity, grey and orange; moist, stiff, pp 220 kPa, rootlets | NATURAL SOIL |
| | 0.95 – 1.0 | SANDSTONE; fine grained, grey and orange, dry, very low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP3_2 | 0 – 0.2 | Sandy Silty CLAY trace gravel; medium plasticity, dark brown; sand fine grained; medium gravel, sub-rounded to sub-angular, up to 20 mm; dry, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 1.45 | CLAY; medium to high plasticity, red and grey; dry, stiff, rootlets<br>At 1 m: becoming grey and yellow, very stiff | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.45 m |
| | 1.45 – 1.5 | SHALE; grey and pale grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.5 | Test pit terminated at 1.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP3_3 | 0 – 0.15 | Sandy Silty CLAY; medium plasticity, dark brown; sand fine grained; dry, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.15 – 0.95 | CLAY trace gravel; medium to high plasticity, red and dark brown; fine gravel, sub-angular, up to 3 mm; dry, very stiff, pp 500 kPa, rootlets<br>At 0.55 m: becoming yellow and dark brown, hard, tree roots | NATURAL SOIL |
| | 0.95 – 1.0 | SHALE; dark grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP3_4 | 0 – 0.2 | Sandy Silty CLAY; low to medium plasticity, dark brown; sand fine grained; dry, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.2 – 0.95 | CLAY; medium to high plasticity, red and grey; dry, very stiff, pp 500 kPa, rootlets<br>At 0.7 m: becoming yellow and grey | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 0.95 – 1.0 | SANDSTONE; fine grained, grey and orange, very low to low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

# Site 8 (Lot 6) – 103 Old Pitt Town Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP6_1 | 0 – 0.25 | Silty CLAY; medium to high plasticity, dark brown; moist, soft to firm, rootlets | Grassed surface area (goat paddock)<br>TOPSOIL |
| | 0.25 – 1.45 | CLAY; medium to high plasticity, light brown and red; moist, firm to stiff, rootlets<br>At 0.9 m: becoming grey and orange, moist, very stiff | NATURAL SOIL |
| | 1.45 – 1.5 | SHALE; light brown and grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.5 | Test pit terminated at 1.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP6_2 | 0 – 0.05 | Silty CLAY; medium to high plasticity, dark brown; moist, rootlets | Grassed surface area (goat paddock)<br>TOPSOIL |
| | 0.05 – 0.4 | Silty CLAY; medium to high plasticity, dark brown; moist, soft to firm, pp 50 kPa | FILL |
| | 0.4 – 1.25 | CLAY trace gravel; medium to high plasticity, red and dark brown; medium gravel, sub-rounded, up to 10 mm; moist, firm to stiff, rootlets<br>At 0.6 m: becoming CLAY, grey and red, very stiff | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.25 – 1.3 | SHALE; red and grey, dry, very low strength, extremely weathered | BEDROCK |
| | 1.3 | Test pit terminated at 1.3 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP6_3 | 0 – 0.3 | Silty CLAY; medium to high plasticity, dark brown; moist, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.75 | CLAY trace gravel; medium to high plasticity, red and dark brown; medium gravel, sub-rounded, up to 10 mm; moist, stiff, pp 250 kPa, rootlets<br>At 0.5 m: becoming grey and red, trace cobble up to 140 mm, dry, very stiff | NATURAL SOIL |
| | 0.75 – 0.8 | SHALE; grey, dry, very low strength, extremely weathered | BEDROCK |
| | 0.8 | Test pit terminated at 0.8 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP6_4 | 0 - 0.3 | Silty CLAY; medium plasticity, dark brown; moist, soft to firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.95 | CLAY; medium to high plasticity, red and dark brown; moist, stiff, rootlets<br>At 0.8 m: becoming grey and red, dry, very stiff | NATURAL SOIL |
| | 0.95 – 1.0 | SHALE; dark brown and grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP6_5 | 0 – 0.35 | Silty CLAY trace gravel; medium plasticity, dark brown; medium gravel, sub-rounded, up to 25 mm; moist, firm, rootlets | Grassed surface area<br>TOPSOIL |
| | 0.35 – 1.25 | CLAY; medium to high plasticity, red and dark brown; moist, stiff, rootlets<br>At 1.0 m: becoming grey and orange, very stiff | NATURAL SOIL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.25 – 1.3 | SHALE; orange and brown, dry, very low strength, extremely weathered | BEDROCK |
| | 1.3 | Test pit terminated at 1.3 m | Target Depth |

# Site 9 (Lot 13) – 145 Boundary Road
# Test Pit Logs

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_1 | 0 – 0.3 | SILT; light brown, rootlets; dry, very stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.0 | CLAY; high plasticity, red; dry, hard, pp > 600 kPa<br>At 0.55 m: becoming grey, yellow | NATURAL SOIL<br>CBR sample at 0.5 m |
| | 1.0 – 1.1 | SHALE; grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.1 | Test pit terminated at 1.1 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_2 | 0 – 0.3 | CLAY trace sand; high plasticity, dark brown; fine sand, rootlets; dry, stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.1 | CLAY; high plasticity, red, dark brown; dry, very stiff, pp 250 – 350 kPa<br>At 0.7 m: becoming grey, yellow, pp 250 kPa | NATURAL SOIL |
| | 1.1 | SHALE; grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.1 | Test pit terminated at 1.1 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_3 | 0 – 0.3 | Silty CLAY trace gravel; high plasticity, dark brown; sub-angular gravel up to 20 mm, rootlets; dry, firm to stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.1 | CLAY; high plasticity, red; dry, firm to stiff<br>At 0.5 m: Charcoal observed, moist, firm<br>At 1.0 m: Pipe (possibly redundant irrigation pipe) observed | FILL (backfilled dam)<br>Shrink-swell sample at 0.6 m, CBR sample at 0.5 m |
| | 1.1 – 2.1 | CLAY with gravel; high plasticity, red, grey; sub-rounded to sub-angular gravel up to 5 mm; dry, stiff, pp 250 kPa<br>At 1.5 m: becoming CLAY, grey, yellow | NATURAL SOIL |
| | 2.1 | SHALE; grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 2.1 | Test pit terminated 2.1 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_4 | 0 – 0.3 | Clayey SILT; dark brown, rootlets; dry, very stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.4 | CLAY; high plasticity, red, grey; dry, very stiff, pp 350 kPa<br>At 0.9 m: becoming grey, yellow, pp 350 kPa | NATURAL SOIL |
| | 1.4 – 1.5 | SHALE; grey, red, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.5 | Test pit terminated at 1.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_5 | 0 – 0.3 | Silty CLAY; medium to high plasticity, dark brown, rootlets; dry, stiff, pp 250 kPa | Grassed surface area<br>TOPSOIL |
| | 0.3 – 1.0 | CLAY with gravel; high plasticity, grey; sub-angular gravel up to 20 mm, trace cobbles up to 250 mm; dry, stiff to very stiff | FILL<br>Shrink-swell and CBR samples at 0.5 m |
| | 1.0 – 1.2 | CLAY; high plasticity, red, charcoal observed; moist, stiff | FILL |
| | 1.2 – 2.5 | CLAY; high plasticity, red, grey; dry, stiff to very stiff, pp 240 – 280 kPa<br>At 2.0 m: becoming grey, pp 240 – 290 kPa | NATURAL SOIL |
| | 2.5 | SHALE; grey, red, dry, very low to low strength, extremely weathered | BEDROCK |
| | 2.5 | Test pit terminated at 2.5 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_6 | 0 – 0.5 | LIME; white, pipe observed; dry, stiff, pp 300 – 310 kPa, rootlets | Small stockpile<br>FILL |
| | 0.5 – 0.8 | Silty CLAY; medium plasticity, dark brown, rootlets; dry, stiff | FILL (backfilled dam) |
| | 0.8 – 1.1 | CLAY; high plasticity, grey; dry, stiff | FILL |
| | 1.1 – 2.8 | CLAY; high plasticity, orange, red; dry, stiff to very stiff, pp 150 – 280 kPa<br>At 1.5 m: becoming red, grey<br>At 2.0 m: becoming grey, orange, very stiff, pp 300 – 330 kPa<br>At 2.3 m: Becoming moist to wet | NATURAL SOIL<br>Water seepage observed at 2.3 m |
| | 2.8 | SHALE: grey, moist, very low to low strength, extremely weathered | BEDROCK |
| | 2.8 | Test pit terminated at 2.8 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_7 | 0 – 0.3 | Silty CLAY; medium plasticity, dark brown, rootlets; dry, very stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.95 | CLAY; high plasticity, red; dry, hard, pp > 600 kPa<br>At 0.6 m: Pipe (likely redundant irrigation pipe) in cross-cutting trench backfilled with ash/charcoal fill<br>At 0.8 m: becoming grey and red | NATURAL SOIL |
| | 0.95 – 1.0 | SHALE; grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.0 | Test pit terminated at 1.0 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_8 | 0 – 0.3 | Silty CLAY; medium plasticity, dark brown, rootlets; dry, very stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.4 | Gravelly CLAY; medium to high plasticity, grey; sub-angular gravel up to 60 mm, trace cobbles up to 250 mm | FILL (backfilled dam) |
| | 0.4 – 1.9 | CLAY trace cobbles; high plasticity, red, orange, shale fragments up to 100 mm observed; dry, very stiff<br>At 0.6 m: becoming grey, yellow, pp 260 kPa | FILL |
| | 1.9 – 2.2 | CLAY; high plasticity, red, brown, grey; dry, very stiff, pp 240 – 280 kPa | NATURAL SOIL |
| | 2.2 – 2.3 | SHALE; grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 2.3 | Test pit terminated at 2.3 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_9 | 0 – 0.3 | Silty CLAY; medium plasticity, dark brown, rootlets; dry, stiff | Grassed surface area<br>TOPSOIL |
| | 0.3 – 0.6 | CLAY trace cobbles; high plasticity, red, grey; shale fragments up to 150 mm observed; dry, very stiff, pp 320 kPa | FILL<br>Shrink-swell and CBR samples at 0.5 m |
| | 0.6 – 1.1 | CLAY; high plasticity, grey; dry, very stiff, pp 260 – 280 kPa | NATURAL SOIL |
| | 1.1 – 1.2 | SHALE; grey, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.2 | Test pit terminated at 1.2 m | Target Depth |

| Test Pit ID | Approximate Depth (m) | Material Encountered | Notes |
|---|---|---|---|
| TP13_10 | 0 – 0.2 | Silty CLAY trace gravel; medium to high plasticity, dark brown; sub-rounded to sub-angular gravel up to 3 mm, rootlets; dry, stiff | Grassed surface area<br>Backfilled dam area<br>TOPSOIL |
| | 0.2 – 0.6 | Silty CLAY; medium to high plasticity, light brown; dry, stiff | FILL |
| | 0.6 – 1.6 | CLAY; high plasticity, red, grey; dry, very stiff, pp 310 – 350 kPa<br>At 1.1 m: becoming grey, pp 360 – 440 kPa | NATURAL SOIL |
| | 1.6 – 1.65 | SHALE: grey, red, dry, very low to low strength, extremely weathered | BEDROCK |
| | 1.65 | Test pit terminated at 1.65 m | Target Depth |

# Appendix C
# DCP Results

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 2 |
| **Project** | The Gables Residential Development - Lot 11 | **Date** | 4-Aug-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *BT* | Tip Type | *CONICAL* |

| Test Depth LOCATION | *DCP* TP11_1 | *DCP* TP11_2 | *DCP* TP11_3 | *DCP* TP11_4 | *DCP* TP11_5 | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 3 | 5 | 6 | 6 | 3 | |
| 0.20 | 3 | 5 | 7 | 8 | 4 | |
| 0.30 | 4 | 5 | 3 | 7 | 4 | |
| 0.40 | 4 | 7 | 5 | 6 | 3 | |
| 0.50 | 5 | 5 | 4 | 7 | 7 | |
| 0.60 | 3 | 5 | 6 | 5 | 8 | |
| 0.70 | 6 | 5 | 6 | 4 | 12 | |
| 0.80 | 6 | 3 | Terminated | 3 | Terminated | |
| 0.90 | 5 | 4 | Target Depth | 3 | Target Depth | |
| 1.00 | 5 | 7 | | 4 | | |
| 1.10 | 5 | 8 | | 4 | | |
| 1.20 | 5 | 7 | | 6 | | |
| 1.30 | 5 | 7 | | 5 - Refusal | | |
| 1.40 | 5 | 6 | | Hard bouncing | | |
| 1.50 | 5 | 7 | | | | |
| 1.60 | 9 | 5 | | | | |
| 1.70 | Terminated | Terminated | | | | |
| 1.80 | Target Depth | Target Depth | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** 2 **of** 2 | |
| **Project** | The Gables Residential Development - Lot 11 | **Date** | 5-Aug-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *BT* | Tip Type | *CONICAL* |

| Test Depth | *DCP* | *DCP* | *DCP* | *DCP* | *DCP* | *DCP* |
|---|---|---|---|---|---|---|
| LOCATION | TP11_6 | TP11_7 | TP11_8 | TP11_9 | TP11_10 | TP11_11 |
| 0.10 | 4 | 7 | 13 | 7 | 9 | 2 |
| 0.20 | 4 | 6 | 11 | 6 | 8 | 2 |
| 0.30 | 3 | 4 | 11 | 5 | 7 | 2 |
| 0.40 | 6 | 5 | 11 | 9 | 6 | 1 |
| 0.50 | 4 | 4 | 11 | 7 | 8 | 3 |
| 0.60 | 4 | 4 | 11 | 7 | 17 | 5 |
| 0.70 | 4 | 2 | 12 | 7 | 19 | 4 |
| 0.80 | Terminated | Terminated | Terminated | Terminated | Terminated | Terminated |
| 0.90 | Target Depth | Target Depth | Target Depth | Target Depth | Target Depth | Target Depth |
| 1.00 | | | | | | |
| 1.10 | | | | | | |
| 1.20 | | | | | | |
| 1.30 | | | | | | |
| 1.40 | | | | | | |
| 1.50 | | | | | | |
| 1.60 | | | | | | |
| 1.70 | | | | | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
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| 2.60 | | | | | | |
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| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 2 |
| **Project** | The Gables Residential Development - Lot 14 | **Date** | 16-Jul-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth LOCATION | *DCP* TP14_2 | *DCP* TP14_3 | *DCP* TP14_4 | *DCP* TP14_5 | *DCP* | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 1 | 2 | 1 | 1 | | |
| 0.20 | 2 | 3 | 3 | 2 | | |
| 0.30 | 1 | 3 | 2 | 2 | | |
| 0.40 | 2 | 5 | 2 | 3 | | |
| 0.50 | 3 | 3 | 3 | 2 | | |
| 0.60 | 2 | 1 | 4 | 3 | | |
| 0.70 | Terminated | 0 | Terminated | Terminated | | |
| 0.80 | Target Depth | 2 | Target Depth | Target Depth | | |
| 0.90 | | 1 | | | | |
| 1.00 | | 2 | | | | |
| 1.10 | | 4 | | | | |
| 1.20 | | 3 | | | | |
| 1.30 | | 5 | | | | |
| 1.40 | | 6 | | | | |
| 1.50 | | 6 | | | | |
| 1.60 | | Terminated | | | | |
| 1.70 | | Target Depth | | | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 2 **of** 2 |
| **Project** | The Gables Residential Development - Lot 14 | **Date** | 2-Aug-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *BT* | Tip Type | *CONICAL* |

| Test Depth LOCATION | *DCP* TP14_6 | *DCP* TP14_7 | *DCP* TP14_8 | *DCP* TP14_9 | *DCP* TP14_10 | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 5 | 3 | 2 | 4 | 4 | |
| 0.20 | 2 | 2 | 2 | 2 | 2 | |
| 0.30 | 4 | 1 | 2 | 2 | 5 | |
| 0.40 | 2 | 1 | 2 | 2 | 8 | |
| 0.50 | 2 | 2 | 3 | 3 | 2 | |
| 0.60 | 1 | 2 | 3 | 1 | 3 | |
| 0.70 | 2 | 3 | 4 | 3 | 3 | |
| 0.80 | 2 | 4 | Terminated | 3 | 3 | |
| 0.90 | 3 | 6 | Target Depth | 5 | 5 | |
| 1.00 | 4 | 9 | | 6 | 8 | |
| 1.10 | 7 | 11 | | 6 | 8 | |
| 1.20 | 9 | 13 | | 8 | 12 | |
| 1.30 | 11 | 16 | | 14 | 14 | |
| 1.40 | 13 | 16 | | 18 | 20 - Refusal | |
| 1.50 | 15 | 18 | | 23 | Hard bouncing | |
| 1.60 | Terminated | Terminated | | Terminated | | |
| 1.70 | Target Depth | Target Depth | | Target Depth | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
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| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 1 |
| **Project** | The Gables Residential Development - Lot 12 | **Date** | 12-Jul-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth / LOCATION | *DCP* TP12_2 | *DCP* TP12_3 | *DCP* TP12_4 | *DCP* TP12_5 | *DCP* | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 8 | 10 | 4 | 0 | | |
| 0.20 | 8 | 16 | 8 | 1 | | |
| 0.30 | 6 | 10 | 6 | 3 | | |
| 0.40 | 6 | 9 | 6 | 2 | | |
| 0.50 | 9 | 6 | 6 | 3 | | |
| 0.60 | 9 | 9 | 9 | 4 | | |
| 0.70 | Terminated | Terminated | Terminated | Terminated | | |
| 0.80 | Target Depth | Target Depth | Target Depth | Target Depth | | |
| 0.90 | | | | | | |
| 1.00 | | | | | | |
| 1.10 | | | | | | |
| 1.20 | | | | | | |
| 1.30 | | | | | | |
| 1.40 | | | | | | |
| 1.50 | | | | | | |
| 1.60 | | | | | | |
| 1.70 | | | | | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 1 |
| **Project** | The Gables Residential Development - Lot 2 | **Date** | 13-Jul-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth / LOCATION | *DCP* TP2_1 | *DCP* TP2_2 | *DCP* TP2_3 | *DCP* TP2_4 | *DCP* TP2_5 | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 1 | 5 | 6 | 1 | 4 | |
| 0.20 | 2 | 8 | 5 | 2 | 5 | |
| 0.30 | 3 | 8 | 5 | 2 | 4 | |
| 0.40 | 3 | 10 | 5 | 3 | 4 | |
| 0.50 | 3 | 16 | 5 | 3 | 2 | |
| 0.60 | 3 | 12 | 6 | 3 | 2 | |
| 0.70 | Terminated | Terminated | Terminated | Terminated | Terminated | |
| 0.80 | Target Depth | Target Depth | Target Depth | Target Depth | Target Depth | |
| 0.90 | | | | | | |
| 1.00 | | | | | | |
| 1.10 | | | | | | |
| 1.20 | | | | | | |
| 1.30 | | | | | | |
| 1.40 | | | | | | |
| 1.50 | | | | | | |
| 1.60 | | | | | | |
| 1.70 | | | | | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
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| 2.60 | | | | | | |
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| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
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| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 1 |
| **Project** | The Gables Residential Development - Lot 3 | **Date** | 14-Jul-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth LOCATION | *DCP* TP3_1 | *DCP* TP3_2 | *DCP* TP3_3 | *DCP* TP3_4 | *DCP* | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 1 | 3 | 7 | 4 | | |
| 0.20 | 2 | 6 | 6 | 2 | | |
| 0.30 | 1 | 5 | 7 | 4 | | |
| 0.40 | 3 | 4 | 8 | 5 | | |
| 0.50 | 2 | 6 | 8 | 7 | | |
| 0.60 | 4 | 6 | 13 | 8 | | |
| 0.70 | Terminated | Terminated | Terminated | Terminated | | |
| 0.80 | Target Depth | Target Depth | Target Depth | Target Depth | | |
| 0.90 | | | | | | |
| 1.00 | | | | | | |
| 1.10 | | | | | | |
| 1.20 | | | | | | |
| 1.30 | | | | | | |
| 1.40 | | | | | | |
| 1.50 | | | | | | |
| 1.60 | | | | | | |
| 1.70 | | | | | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 1 |
| **Project** | The Gables Residential Development - Lot 6 | **Date** | 15-Jul-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth LOCATION | *DCP* TP6_1 | *DCP* TP6_2 | *DCP* TP6_3 | *DCP* TP6_4 | *DCP* TP6_5 | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 1 | 1 | 2 | 1 | 2 | |
| 0.20 | 1 | 1 | 3 | 2 | 3 | |
| 0.30 | 1 | 1 | 4 | 4 | 5 | |
| 0.40 | 3 | 2 | 4 | 5 | 6 | |
| 0.50 | 3 | 3 | 6 | 4 | 11 | |
| 0.60 | 4 | 3 | 6 | 4 | 10 | |
| 0.70 | Terminated | Terminated | Terminated | Terminated | Terminated | |
| 0.80 | Target Depth | Target Depth | Target Depth | Target Depth | Target Depth | |
| 0.90 | | | | | | |
| 1.00 | | | | | | |
| 1.10 | | | | | | |
| 1.20 | | | | | | |
| 1.30 | | | | | | |
| 1.40 | | | | | | |
| 1.50 | | | | | | |
| 1.60 | | | | | | |
| 1.70 | | | | | | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 1 |
| **Project** | The Gables Residential Development - Lot 13 | **Date** | 20-Oct-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth LOCATION | *DCP* TP13_1 | *DCP* TP13_2 | *DCP* TP13_3 | *DCP* TP13_4 | *DCP* TP13_5 | *DCP* |
|---|---|---|---|---|---|---|
| 0.10 | 9 | 5 | 4 | 13 | 9 | |
| 0.20 | 12 | 5 | 4 | 12 | 6 | |
| 0.30 | 14 | 5 | 8 | 13 | 9 | |
| 0.40 | 15 | 6 | 5 | 10 | 12 | |
| 0.50 | 26 | 5 | 5 | 13 | 9 | |
| 0.60 | 30 - Refusal | 3 | 3 | 14 | 17 | |
| 0.70 | Hard Bouncing | Terminated | 3 | Terminated | 10 | |
| 0.80 | | Target Depth | 3 | Target Depth | 6 | |
| 0.90 | | | 2 | | 6 | |
| 1.00 | | | 2 | | 8 | |
| 1.10 | | | 2 | | 4 | |
| 1.20 | | | 3 | | 5 | |
| 1.30 | | | 3 | | 4 | |
| 1.40 | | | 3 | | 8 | |
| 1.50 | | | 3 | | 7 | |
| 1.60 | | | Terminated | | Terminated | |
| 1.70 | | | Target Depth | | Target Depth | |
| 1.80 | | | | | | |
| 1.90 | | | | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# *DYNAMIC CONE PENETROMETER TEST RESULTS*

| | | | |
|---|---|---|---|
| **Job No.** | PSM4503 | **Sheet** | 1 **of** 1 |
| **Project** | The Gables Residential Development - Lot 13 | **Date** | 21-Oct-21 |

| | | | |
|---|---|---|---|
| Test Method | *AS 1289.6.3.2. - 1997 Methods of Testing Soils for Engineering Purposes - 9 kg Dynamic Cone Penetrometer Test* | Drop Height | *510 mm* |
| | | Hammer Mass | *9 kg* |
| Tested by | *JS* | Tip Type | *CONICAL* |

| Test Depth | *DCP* | *DCP* | *DCP* | *DCP* | *DCP* | *DCP* |
|---|---|---|---|---|---|---|
| LOCATION | TP13_6 | TP13_7 | TP13_8 | TP13_9 | TP13_10 | |
| 0.10 | 4 | 10 | 12 | 8 | 6 | |
| 0.20 | 4 | 10 | 13 | 8 | 4 | |
| 0.30 | 3 | 10 | 30 | 6 | 6 | |
| 0.40 | 0 | 10 | 30 | 5 | 7 | |
| 0.50 | 1 | 9 | 12 | 12 | 8 | |
| 0.60 | 2 | 9 | 10 | 16 | 7 | |
| 0.70 | 2 | Terminated | 11 | Terminated | Terminated | |
| 0.80 | 5 | Target Depth | 12 | Target Depth | Target Depth | |
| 0.90 | 7 | | 12 | | | |
| 1.00 | 5 | | 15 | | | |
| 1.10 | 4 | | 17 | | | |
| 1.20 | 5 | | 17 | | | |
| 1.30 | 13 | | 15 | | | |
| 1.40 | 8 | | 14 | | | |
| 1.50 | 8 | | 12 | | | |
| 1.60 | Terminated | | 12 | | | |
| 1.70 | Target Depth | | 30 | | | |
| 1.80 | | | 30 - Refusal | | | |
| 1.90 | | | Hard Bouncing | | | |
| 2.00 | | | | | | |
| 2.10 | | | | | | |
| 2.20 | | | | | | |
| 2.30 | | | | | | |
| 2.40 | | | | | | |
| 2.50 | | | | | | |
| 2.60 | | | | | | |
| 2.70 | | | | | | |
| 2.80 | | | | | | |
| 2.90 | | | | | | |
| 3.00 | | | | | | |
| 3.10 | | | | | | |
| 3.20 | | | | | | |
| 3.30 | | | | | | |
| 3.40 | | | | | | |
| 3.50 | | | | | | |
| 3.60 | | | | | | |
| 3.70 | | | | | | |
| 3.80 | | | | | | |
| 3.90 | | | | | | |
| 4.00 | | | | | | |

Comments:

# Appendix D
# CBR Results

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**Facsimile:** 02 9888 5001
**Email:** dtreweek@jkgroup.net.au

SOIL TEST SERVICES
ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 13
**Report Date:** 17/08/2021
**Page 1 of 1**

| | TP11_6 | TP11_9 | TP11_3 | TP11_5 |
|---|---|---|---|---|
| TESTPIT NUMBER | TP 1 | TP 35 | TP 41 | TP 59 |
| DEPTH (m) | 0.50 - 1.00 | 0.50 - 1.00 | 0.50 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | 4.5 | 4.5 | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | 1.67 STD | 1.75 STD | 1.41 STD | 1.86 STD |
| Optimum Moisture Content (%) | 21.6 | 17.9 | 30.9 | 16.4 |
| Moulded Dry Density (t/m$^3$) | 1.63 | 1.71 | 1.38 | 1.82 |
| Sample Density Ratio (%) | 98 | 98 | 98 | 98 |
| Sample Moisture Ratio (%) | 102 | 100 | 100 | 100 |
| Moisture Contents | | | | |
| Insitu (%) | 20.6 | 13.9 | 30.4 | 11.8 |
| Moulded (%) | 22.1 | 18.0 | 30.9 | 16.4 |
| After soaking and | | | | |
| After Test, Top 30mm(%) | 27.8 | 22.5 | 34.9 | 18.9 |
| Remaining Depth (%) | 23.5 | 20.5 | 32.5 | 17.4 |
| Material Retained on 19mm Sieve (%) | 0 | 11* | 0 | 6* |
| Swell (%) | 2.5 | 0.5 | 1.5 | 0.0 |
| **C.B.R. value:** @2.5mm penetration | 1.5 | 4.0 | 3.5 | 5 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 05/08/2021.
- * Denotes not used in test sample.

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Approved Signatory / Date (D. Treweek) 17/8/21

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SOIL TEST SERVICES

ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 9
**Report Date:** 28/07/2021
**Page 1 of 1**

| | | | |
|---|---|---|---|
| TESTPIT NUMBER | | TP 14_1 | TP 14_5 |
| DEPTH (m) | | 0.40 - 0.60 | 0.50 - 1.00 |
| Surcharge (kg) | | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | | 1.74 STD | 1.73 STD |
| Optimum Moisture Content (%) | | 17.8 | 20.3 |
| Moulded Dry Density (t/m$^3$) | | 1.70 | 1.69 |
| Sample Density Ratio (%) | | 98 | 98 |
| Sample Moisture Ratio (%) | | 98 | 100 |
| Moisture Contents | | | |
| Insitu (%) | | 18.9 | 22.0 |
| Moulded (%) | | 17.5 | 20.3 |
| After soaking and | | | |
| After Test, Top 30mm(%) | | 28.2 | 23.2 |
| | Remaining Depth (%) | 21.3 | 22.2 |
| Material Retained on 19mm Sieve (%) | | 17* | 0 |
| Swell (%) | | 2.5 | 1.0 |
| **C.B.R. value:** | @2.5mm penetration | 1.5 | 4.5 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 19/07/2021.
- * Denotes not used in test sample.
- Both samples were dried back prior to testing as the sample was too saturated.

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28/07/2021
Authorised Signature / Date
(D. Treweek)

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SOIL TEST SERVICES

ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 11
**Report Date:** 11/08/2021


| | TP14_8 | TP14_10 |
|---|---|---|
| TESTPIT NUMBER | TP 51 | TP 58 |
| DEPTH (m) | 0.50 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | 1.75 STD | 1.83 STD |
| Optimum Moisture Content (%) | 19.3 | 17.3 |
| Moulded Dry Density (t/m$^3$) | 1.69 | 1.80 |
| Sample Density Ratio (%) | 97 | 98 |
| Sample Moisture Ratio (%) | 94 | 102 |
| Moisture Contents | | |
| Insitu (%) | 20.9 | 19.7 |
| Moulded (%) | 18.2 | 17.7 |
| After soaking and | | |
| After Test, Top 30mm(%) | 24.8 | 21.8 |
| Remaining Depth (%) | 21.6 | 18.4 |
| Material Retained on 19mm Sieve (%) | 0 | 0 |
| Swell (%) | 2.0 | 0.0 |
| **C.B.R. value:** @2.5mm penetration | 3.5 | 4.0 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 03/08/2021.

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(D. Treweek)

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ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 1
**Report Date:** 20/07/2021
**Page 1 of 1**

| | | TP12_2 | TP12_3 |
|---|---|---|---|
| TESTPIT NUMBER | | TP 3 | TP 18 |
| DEPTH (m) | | 0.45 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | | 1.56 STD | 1.64 STD |
| Optimum Moisture Content (%) | | 16.5 | 13.3 |
| Moulded Dry Density (t/m$^3$) | | 1.52 | 1.60 |
| Sample Density Ratio (%) | | 98 | 98 |
| Sample Moisture Ratio (%) | | 104 | 102 |
| Moisture Contents | | | |
| Insitu (%) | | 17.3 | 12.9 |
| Moulded (%) | | 17.1 | 13.5 |
| After soaking and | | | |
| After Test, Top 30mm(%) | | 32.2 | 27.5 |
| Remaining Depth (%) | | 26.2 | 23.4 |
| Material Retained on 19mm Sieve (%) | | 0 | 25* |
| Swell (%) | | 2.5 | 3.5 |
| **C.B.R. value:** | @2.5mm penetration | 2.0 | 0.5 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 13/07/2021.
- * Denotes not used in test sample.

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(D. Treweek)

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SOIL TEST SERVICES

ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 3
**Report Date:** 20/07/2021
**Page 1 of 1**

| | | TP2_1 | TP2_3 |
|---|---|---|---|
| TESTPIT NUMBER | | TP 95_1 | TP 95_3 |
| DEPTH (m) | | 0.50 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | | 1.77 STD | 1.58 STD |
| Optimum Moisture Content (%) | | 19.0 | 23.8 |
| Moulded Dry Density (t/m$^3$) | | 1.73 | 1.55 |
| Sample Density Ratio (%) | | 98 | 98 |
| Sample Moisture Ratio (%) | | 100 | 98 |
| Moisture Contents | | | |
| Insitu (%) | | 19.6 | 19.8 |
| Moulded (%) | | 18.9 | 23.2 |
| After soaking and | | | |
| After Test, Top 30mm(%) | | 27.2 | 31.6 |
| Remaining Depth (%) | | 21.5 | 26.8 |
| Material Retained on 19mm Sieve (%) | | 5* | 0 |
| Swell (%) | | 1.0 | 1.5 |
| **C.B.R. value:** | @2.5mm penetration | 3.5 | 6 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 13/07/2021.
- * Denotes not used in test sample.

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(D. Treweek)

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# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 5
**Report Date:** 21/07/2021
**Page 1 of 1**

| | | TP3_2 | TP3_4 |
|---|---|---|---|
| TESTPIT NUMBER | | TP 97_2 | TP 97_4 |
| DEPTH (m) | | 0.45 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | | 1.50 STD | 1.63 STD |
| Optimum Moisture Content (%) | | 21.2 | 22.5 |
| Moulded Dry Density (t/m$^3$) | | 1.47 | 1.59 |
| Sample Density Ratio (%) | | 98 | 98 |
| Sample Moisture Ratio (%) | | 101 | 102 |
| Moisture Contents | | | |
| Insitu (%) | | 21.2 | 17.9 |
| Moulded (%) | | 21.4 | 22.9 |
| After soaking and | | | |
| After Test, Top 30mm(%) | | 37.1 | 33.6 |
| Remaining Depth (%) | | 27.9 | 24.6 |
| Material Retained on 19mm Sieve (%) | | 2* | 1* |
| Swell (%) | | 4.5 | 1.5 |
| **C.B.R. value:** | @2.5mm penetration | 0.5 | |
| | @5.0mm penetration | | 2.0 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 14/07/2021.
- * Denotes not used in test sample.

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(D. Treweek)

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SOIL TEST SERVICES
ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Ref No:** L4645E
**Report:** 7
**Report Date:** 27/07/2021
**Page 1 of 1**

| | TP6_2 | TP6_5 |
|---|---|---|
| TESTPIT NUMBER | TP 103_2 | TP 103_5 |
| DEPTH (m) | 0.50 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | 1.73 STD | 1.72 STD |
| Optimum Moisture Content (%) | 19.5 | 19.7 |
| Moulded Dry Density (t/m$^3$) | 1.69 | 1.69 |
| Sample Density Ratio (%) | 98 | 98 |
| Sample Moisture Ratio (%) | 101 | 98 |
| Moisture Contents | | |
| Insitu (%) | 22.9 | 20.3 |
| Moulded (%) | 19.6 | 19.3 |
| After soaking and | | |
| After Test, Top 30mm(%) | 23.3 | 28.9 |
| Remaining Depth (%) | 20.5 | 22.2 |
| Material Retained on 19mm Sieve (%) | 4* | 6* |
| Swell (%) | 2.5 | 3.0 |
| **C.B.R. value:** @2.5mm penetration | 4.0 | |
| @5.0mm penetration | | 1.5 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 16/07/2021.
- * Denotes not used in test sample.

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SOIL TEST SERVICES
ABN 43 002 145 173

# FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**Report No.:** L4645E - 15
**Report Date:** 2/11/2021
**Page 1 of 1**

| TESTPIT NUMBER | | TP 13_1 | TP 13_3 | TP 13_5 | TP 13_9 |
|---|---|---|---|---|---|
| DEPTH (m) | | 0.50 - 1.00 | 0.50 - 1.00 | 0.50 - 1.00 | 0.50 - 1.00 |
| Surcharge (kg) | | 4.5 | 4.5 | 4.5 | 4.5 |
| Maximum Dry Density (t/m$^3$) | | 1.70 STD | 1.64 STD | 1.81 STD | 1.87 STD |
| Optimum Moisture Content (%) | | 18.8 | 19.1 | 15.9 | 14.1 |
| Moulded Dry Density (t/m$^3$) | | 1.66 | 1.60 | 1.77 | 1.84 |
| Sample Density Ratio (%) | | 98 | 98 | 98 | 98 |
| Sample Moisture Ratio (%) | | 98 | 95 | 100 | 98 |
| Moisture Contents | | | | | |
| Insitu (%) | | 13.9 | 20.0 | 17.8 | 14.0 |
| Moulded (%) | | 18.3 | 18.2 | 15.9 | 13.8 |
| After soaking and | | | | | |
| After Test, Top 30mm(%) | | 24.5 | 26.1 | 20.9 | 23.0 |
| Remaining Depth (%) | | 20.7 | 21.3 | 18.4 | 15.8 |
| Material Retained on 19mm Sieve (%) | | 1* | 2* | 17* | 8* |
| Swell (%) | | 1.5 | 1.5 | 1.0 | 3.0 |
| **C.B.R. value:** | @2.5mm penetration | 3.5 | 7 | 3.5 | 1.0 |

**NOTES:** Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Test Pit logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 22/10/2021.
- * Denotes not used in test sample.

NATA Accredited Laboratory Number:1327

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02/11/2021
Authorised Signature / Date
(D. Treweek)

# Appendix E
# Shrink-Swell Index Test Results

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SOIL TEST SERVICES

ABN 43 002 145 173

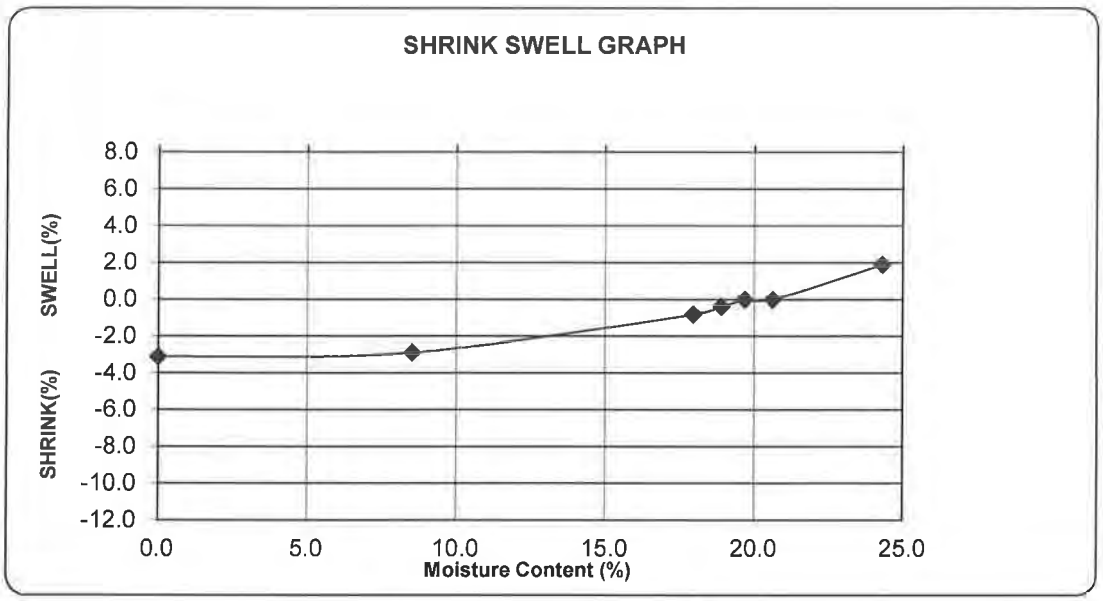
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 14
**Report Date:** 25/08/2021


TP11_6

| Testpit No.: 01 | | Depth: N/A | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 20.6% | 24.3% | 240 | kPa | 130 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | | SWELL ON SATURATION | SHRINKAGE |
| 25 | -0.1% | | | 1.9% | 3.0% |




**SHRINK SWELL INDEX**
**2.21 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 05/08/2021.

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Authorised Signature / Date
(D. Treweek)

25/8/21

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SOIL TEST SERVICES

ABN 43 002 145 173

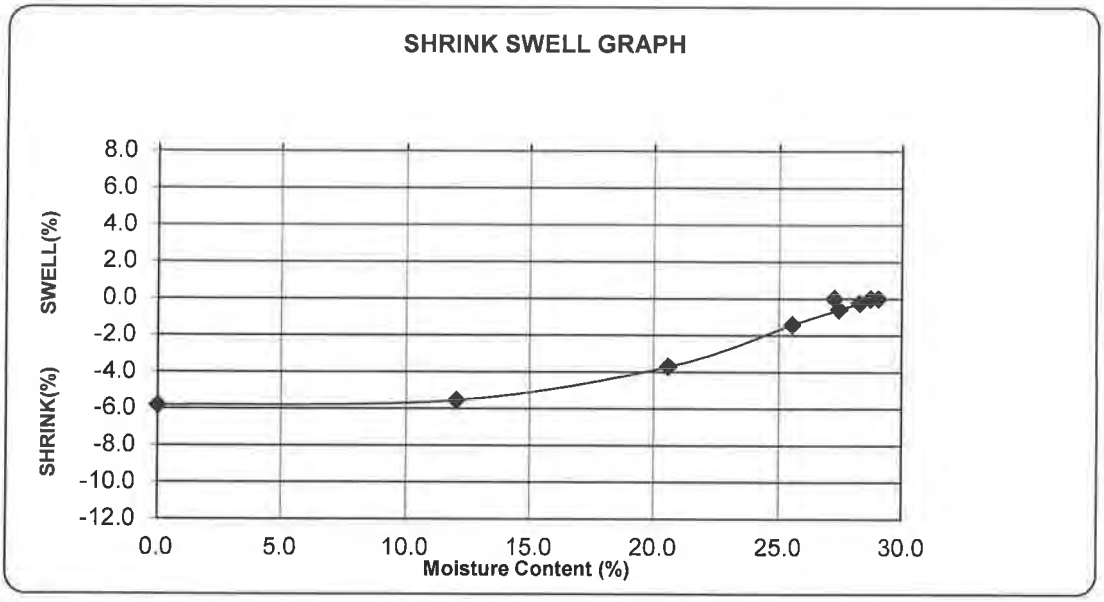
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 14
**Report Date:** 25/08/2021


TP11_3

| Testpit No.: 41 | | Depth: N/A | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 27.2% | 29.0% | 380 | kPa | 280.320 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | | SHRINKAGE |
| 25 | 1.1% | | 0.0% | | 5.7% |




**SHRINK SWELL INDEX**
**3.19 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 05/08/2021.

NATA Accredited Laboratory Number:1327



Authorised Signature / Date
(D. Treweek)
25/8/21

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**Telephone:** 02 9888 5000
**Facsimile:** 02 9888 5001

SOIL TEST SERVICES

ABN 43 002 145 173

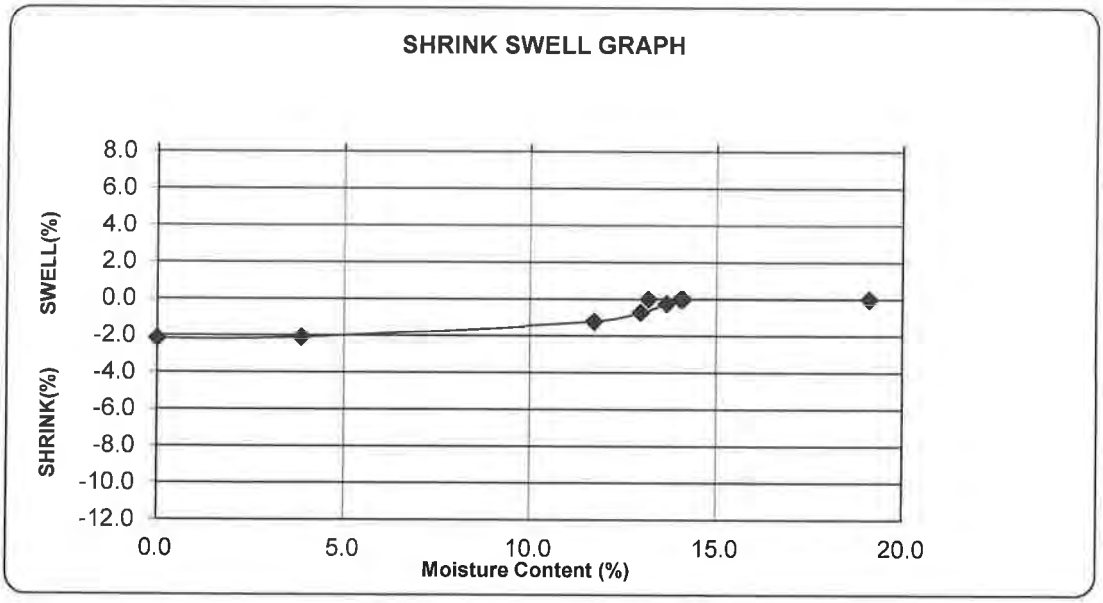
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 14
**Report Date:** 25/08/2021


TP11_5

| Testpit No.: 59 | | Depth: N/A | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 13.2% | 19.1% | 450 | kPa | 290 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | SHRINKAGE | |
| 25 | -0.2% | | 0.0% | 2.1% | |




**SHRINK SWELL INDEX**
**1.16 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 05/08/2021.

NATA Accredited Laboratory Number:1327



Authorised Signature / Date (D. Treweek) 25/8/21

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SOIL TEST SERVICES

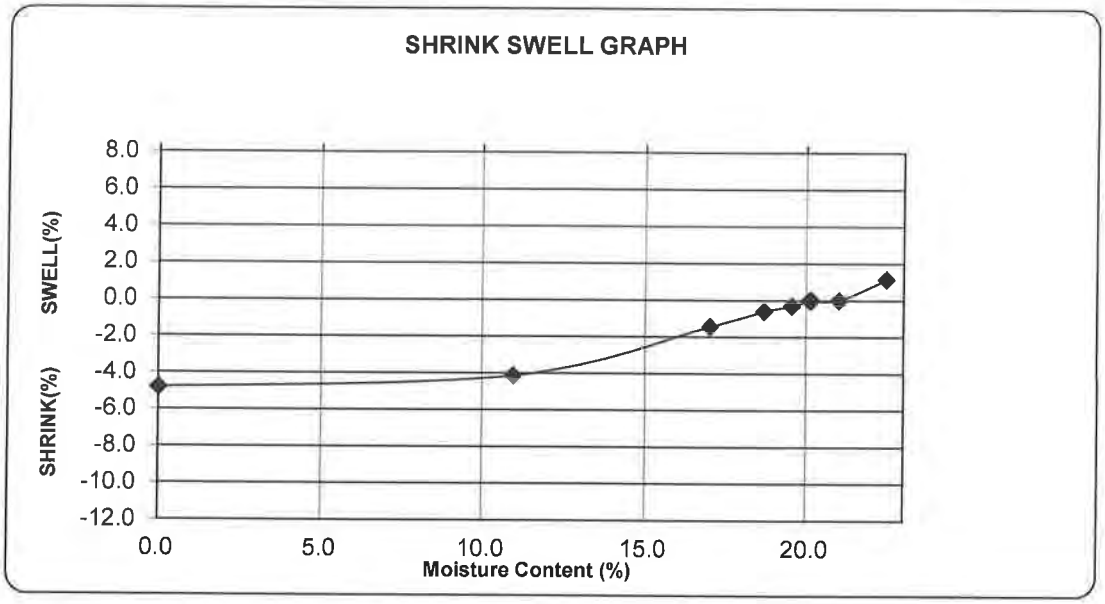
ABN 43 002 145 173

## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.:** PSM4503

**STS Job No:** L4645E
**Report:** 10
**Report Date:** 27/07/2021
**Page** 1 of 1

| Testpit No.: 14_5 | | Depth: 0.50 - 0.95m | |
|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | AFTER TEST |
| 21.0% | 22.5% | 230 kPa | 210 kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | SWELL ON SATURATION | SHRINKAGE |
| 25 | -0.6% | 1.1% | 4.7% |




**SHRINK SWELL INDEX**
**2.92 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 19/07/2021.

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SOIL TEST SERVICES

ABN 43 002 145 173

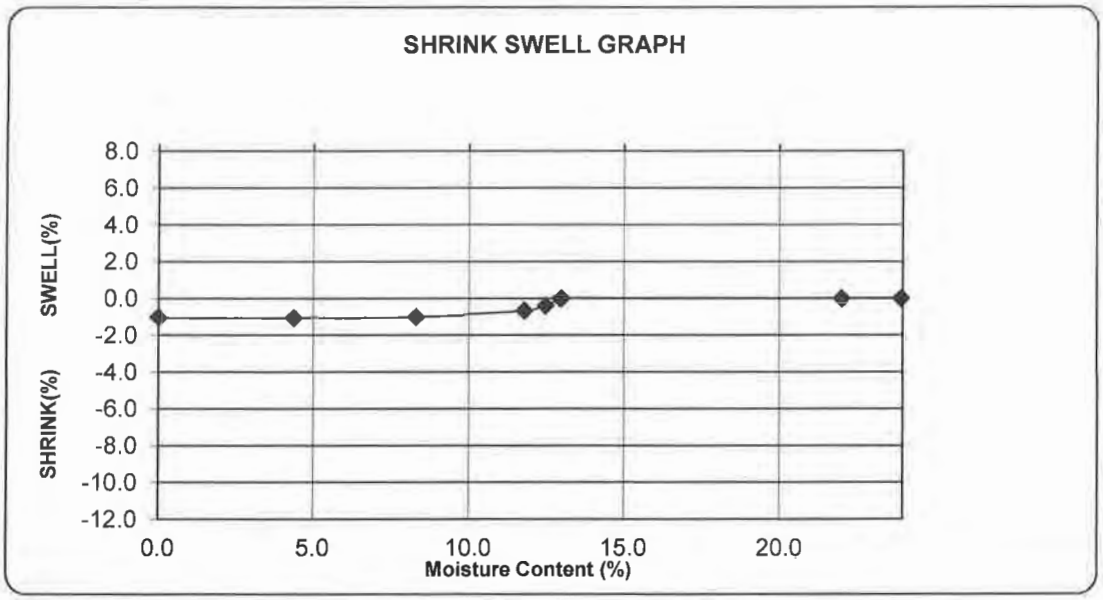
# SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 12
**Report Date:** 11/08/2021
**Page** 1 of 1

TP14_8 0.5 - 0.95 m

| Testpit No.: 51 | | Depth: 0.50 - 1.00m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 22.0% | 23.9% | 160,200 | kPa | 200 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | | SWELL ON SATURATION | SHRINKAGE |
| 25 | -1.0% | | | 0.0% | 1.0% |




**SHRINK SWELL INDEX**
**0.55 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 03/08/2021.

NATA Accredited Laboratory Number:1327



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SOIL TEST SERVICES

ABN 43 002 145 173

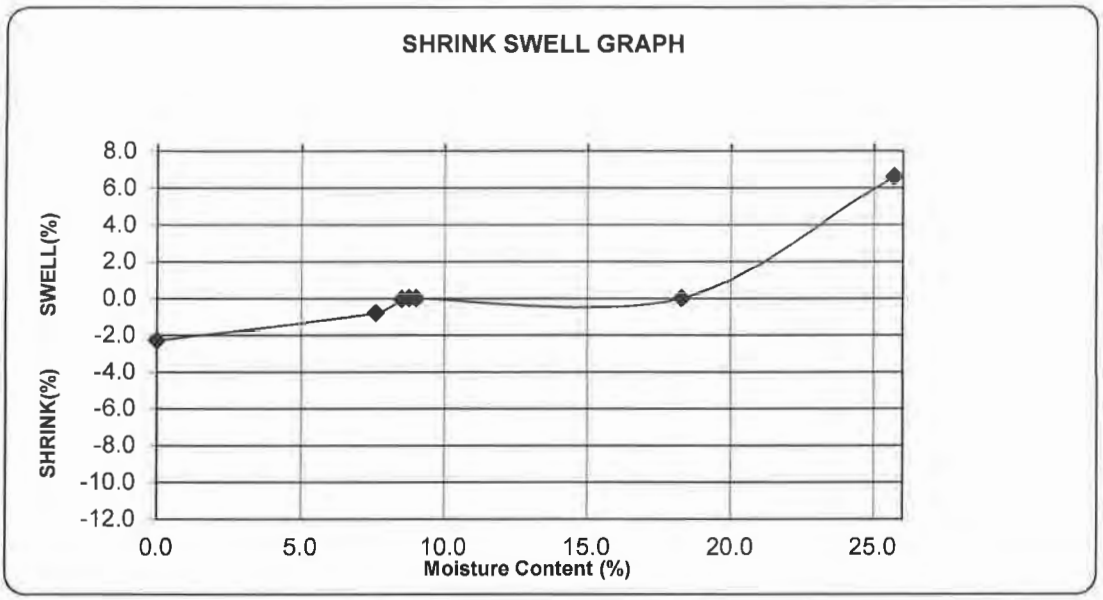
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 2
**Report Date:** 21/07/2021


TP12_2

| Testpit No.: 3 | | Depth: 0.45 - 0.90m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 18.3% | 25.7% | >350 | kPa | 310 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | SHRINKAGE | |
| 25 | -0.7% | | 6.6% | 2.2% | |




**SHRINK SWELL INDEX**
**3.07 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 13/07/2021

NATA Accredited Laboratory Number:1327



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**SOIL TEST SERVICES**

ABN 43 002 145 173

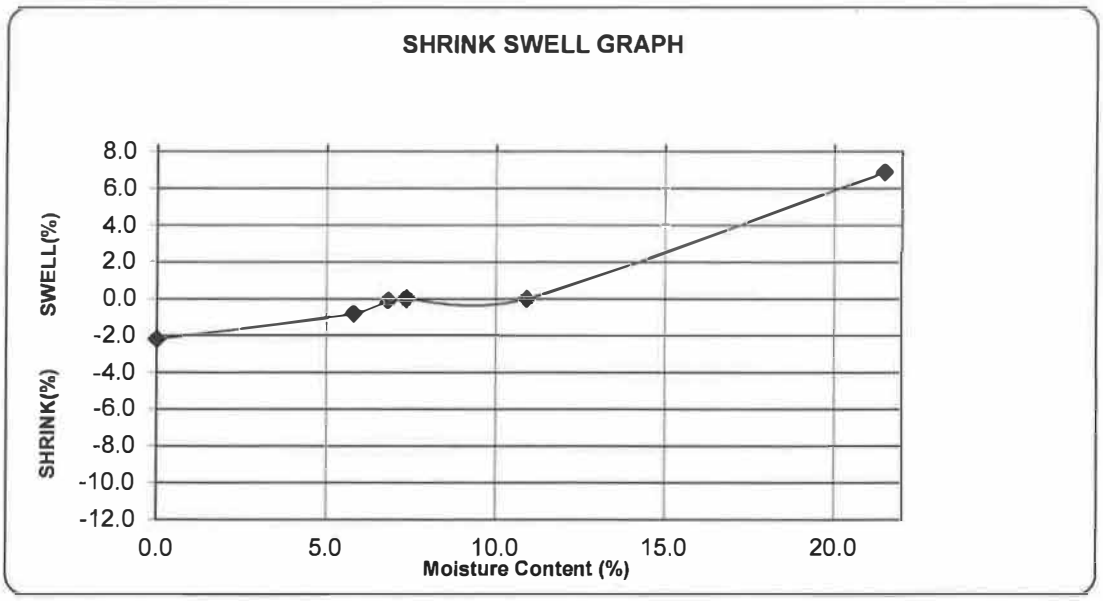
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.:** PSM4503

**STS Job No:** L4645E
**Report:** 2
**Report Date:** 21/07/2021


TP12_3

| Testpit No.: 18 | | Depth: 0.50 - 0.95m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 10.9% | 21.5% | >500 | kPa | 230 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | SHRINKAGE | |
| 25 | -0.3% | | 6.9% | 2.1% | |




**SHRINK SWELL INDEX**
**3.10 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 13/07/2021.

NATA Accredited Laboratory Number:1327



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**SOIL TEST SERVICES**

ABN 43 002 145 173

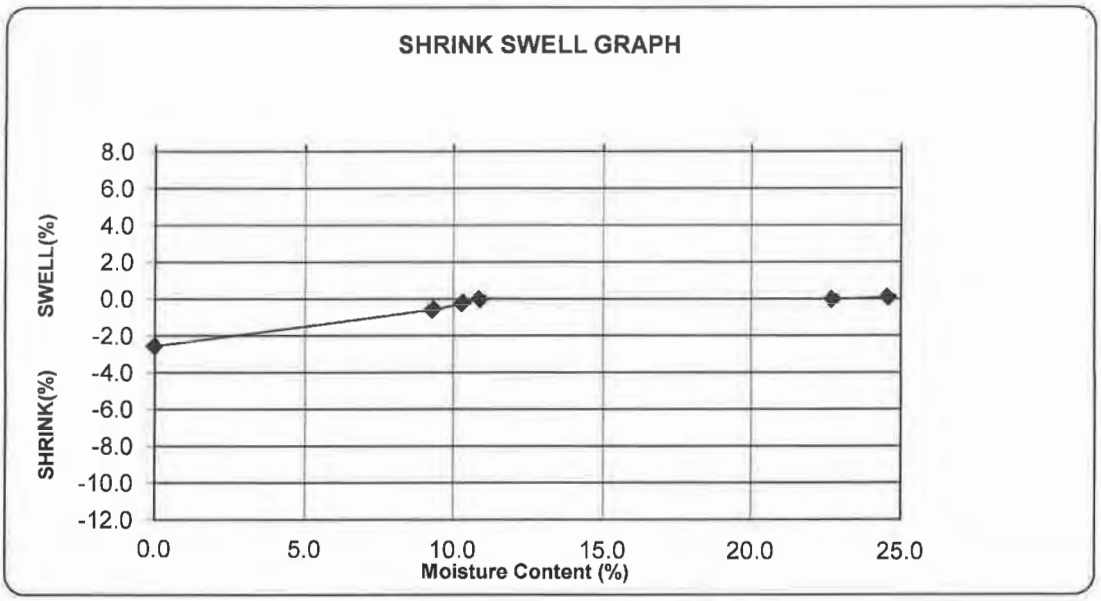
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 4
**Report Date:** 21/07/2021
**Page** 1 of 2

TP2_1

| Testpit No.: 95_1 | | Depth: 0.50 -0.95m | |
|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | AFTER TEST |
| 22.7% | 24.6% | 230,280 kPa | 190,200 kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | SWELL ON SATURATION | SHRINKAGE |
| 25 | -3.9% | 0.1% | 2.5% |




**SHRINK SWELL INDEX**
**1.41 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.

- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 13/07/2021.

NATA Accredited Laboratory Number:1327



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**SOIL TEST SERVICES**
ABN 43 002 145 173

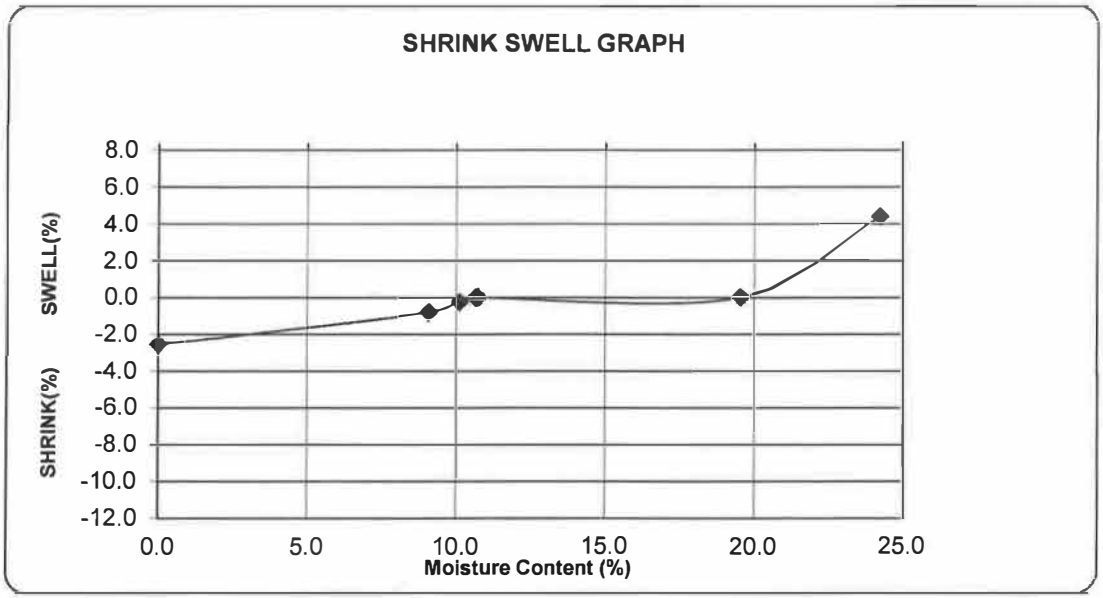
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 4
**Report Date:** 21/07/2021


TP2_3

| Testpit No.: 95_3 | | Depth: 0.50 - 0.95m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE | TEST | AFTER | TEST |
| 19.5% | 24.2% | >500 | kPa | 190,200 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | | SWELL ON SATURATION | SHRINKAGE |
| 25 | -1.0% | | | 4.4% | 2.5% |




**SHRINK SWELL INDEX**
**2.60 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 13/07/2021.

NATA Accredited Laboratory Number:1327



Authorised Signature / Date (D. Treweek) 21/7/21

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**SOIL TEST SERVICES**

ABN 43 002 145 173

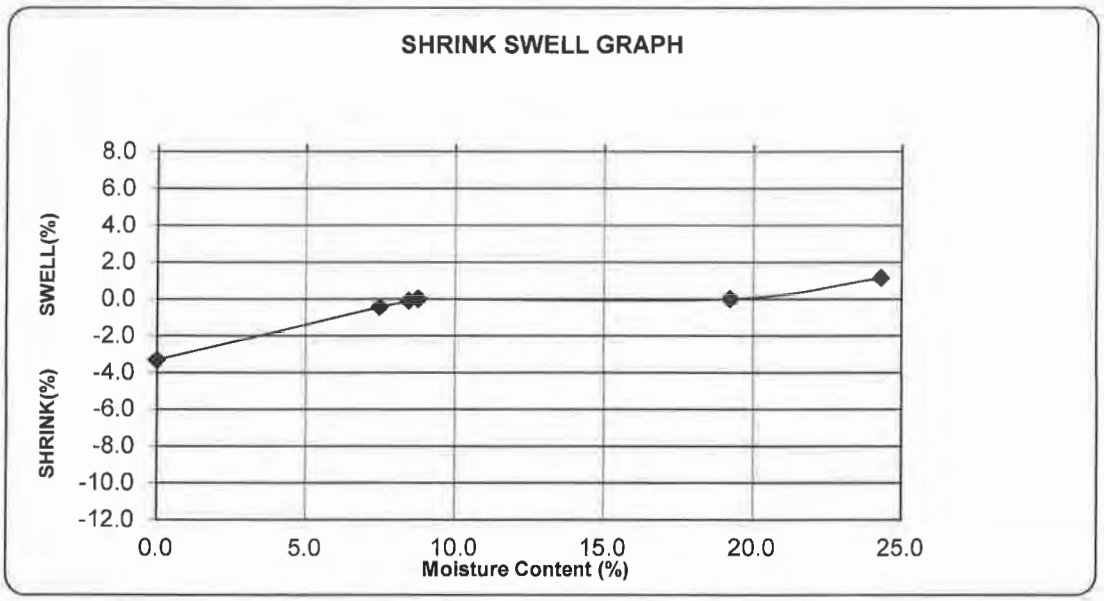
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 6
**Report Date:** 21/07/2021


TP3_2

| Testpit No.: 97_2 | | Depth: 0.45 - 0.90m | |
|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | AFTER TEST |
| 19.2% | 24.3% | >500 kPa | 300 kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | SWELL ON SATURATION | SHRINKAGE |
| 25 | 0.0% | 1.1% | 3.2% |




**SHRINK SWELL INDEX**
**2.12 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 14/07/2021.

NATA Accredited Laboratory Number:1327



Authorised Signature / Date
(D. Treweek)

21/7/21

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**SOIL TEST SERVICES**

ABN 43 002 145 173

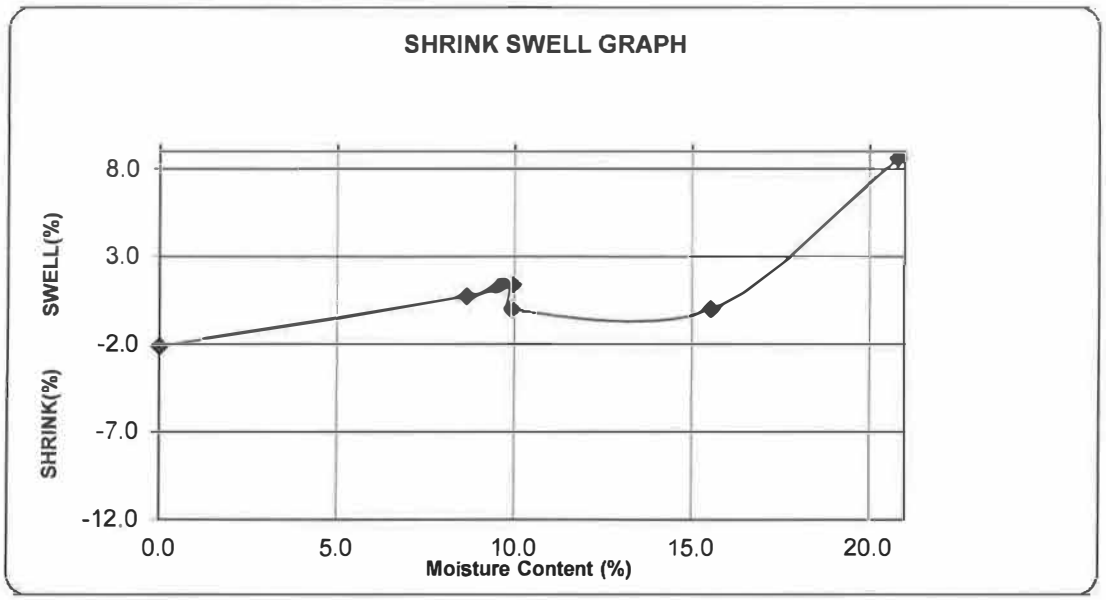
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 6
**Report Date:** 21/07/2021


TP3_4

| Testpit No.: 97_4 | | Depth: 0.50 - 0.95m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 15.5% | 20.8% | >600 | kPa | 190 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | SHRINKAGE | |
| 25 | -0.8% | | 8.6% | 2.1% | |




**SHRINK SWELL INDEX**
**3.55 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 14/07/2021.

NATA Accredited Laboratory Number:1327



Authorised Signature / Date (D. Treweek) 21/7/21

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SOIL TEST SERVICES

ABN 43 002 145 173

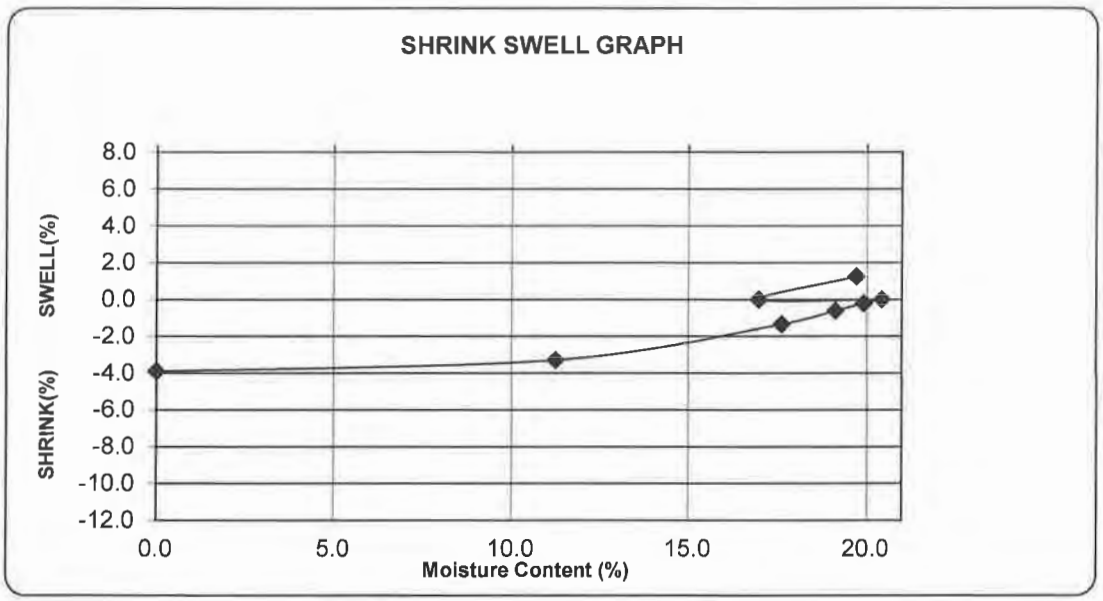
# SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 8
**Report Date:** 27/07/2021


TP6_2 0.5 - 0.95 m

| Testpit No.: 103_2 | | Depth: 0.45 - 0.90m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 17.0% | 19.7% | 150.210 | kPa | 160 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | | SHRINKAGE |
| 25 | -0.8% | | 1.2% | | 3.8% |




**SHRINK SWELL INDEX**
**2.46 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 16/07/2021.

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SOIL TEST SERVICES

ABN 43 002 145 173

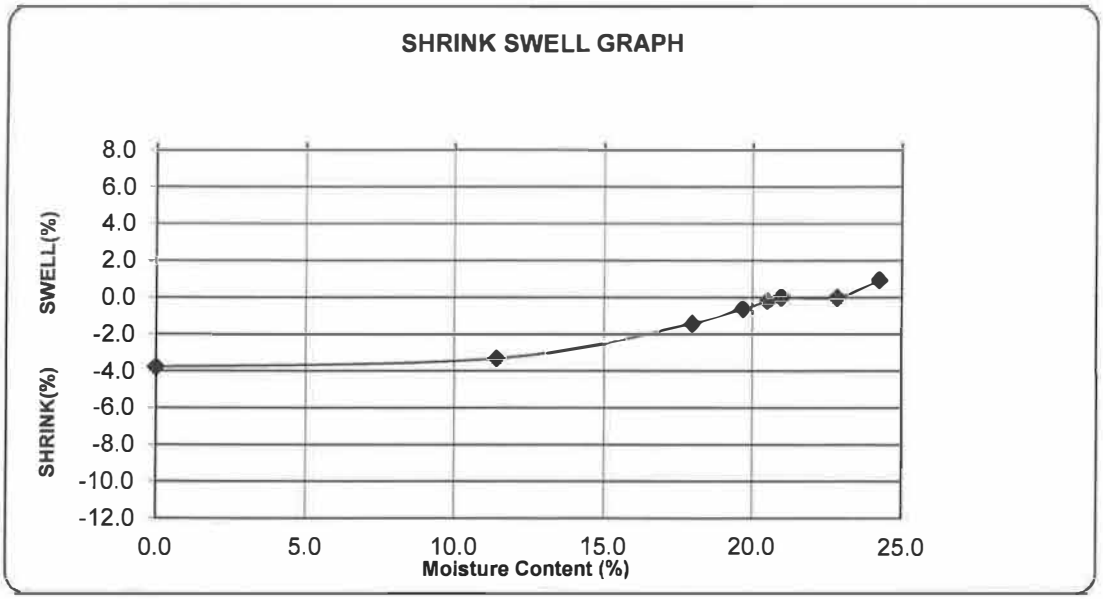
## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.: PSM4503**

**STS Job No:** L4645E
**Report:** 8
**Report Date:** 27/07/2021


TP6_5

| Testpit No.: 103_5 | | Depth: 0.50 - 0.95m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 22.8% | 24.2% | 370.400 | kPa | 370 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | SWELL ON SATURATION | SHRINKAGE | |
| 25 | -0.8% | | 1.0% | 3.7% | |




**SHRINK SWELL INDEX**
**2.31 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 16/07/2021.



Authorised Signature / Date (D. Treweek) 27/7/21

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SOIL TEST SERVICES

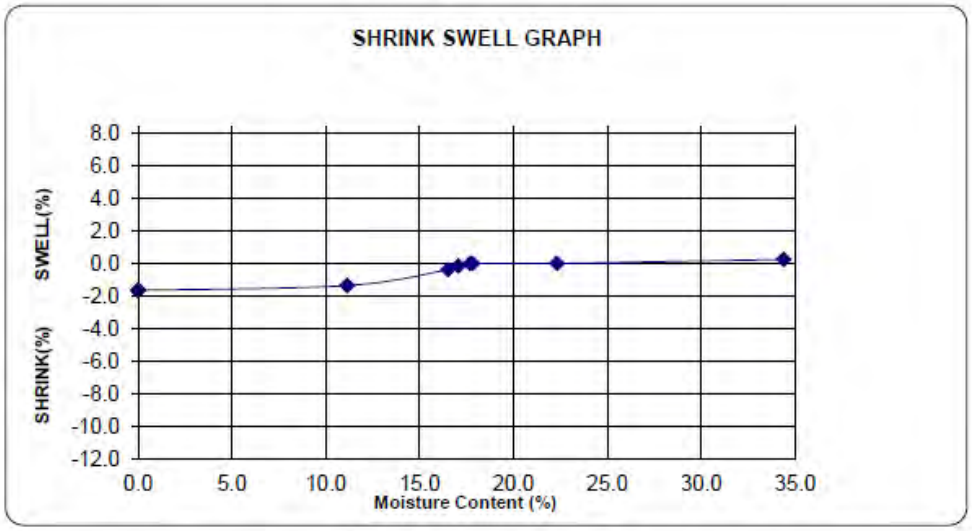
ABN 43 002 145 173

## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.:** PSM4503

**Report No.:** L4645E - 16
**Report Date:** 5/11/2021


| Testpit No.: 13_3 | | Depth: 0.6m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 22.3% | 34.4% | 270 | kPa | 150,200 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | | SWELL ON SATURATION | SHRINKAGE |
| 25 | -0.4% | | | 0.2% | 1.6% |




**SHRINK SWELL INDEX**
**0.97 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 22/10/2021.

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05/11/2021
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(D. Treweek)

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SOIL TEST SERVICES

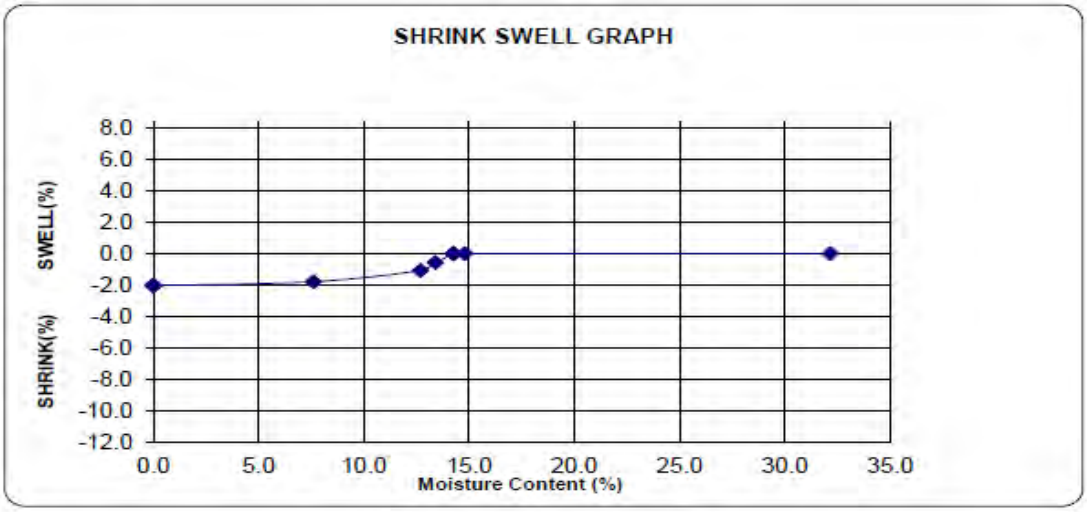
ABN 43 002 145 173

## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

**Client:** Pells Sullivan Meynink
**PSM Job No.:** PSM4503

**Report No.:** L4645E - 16
**Report Date:** 5/11/2021


| Testpit No.: 13_5 | | Depth: 0.5m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 14.8% | 32.2% | 260 | kPa | 200 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | | SWELL ON SATURATION | SHRINKAGE |
| 25 | -0.5% | | | 0.0% | 2.0% |




**SHRINK SWELL INDEX**
**1.09 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 22/10/2021.

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05/11/2021
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(D. Treweek)

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SOIL TEST SERVICES

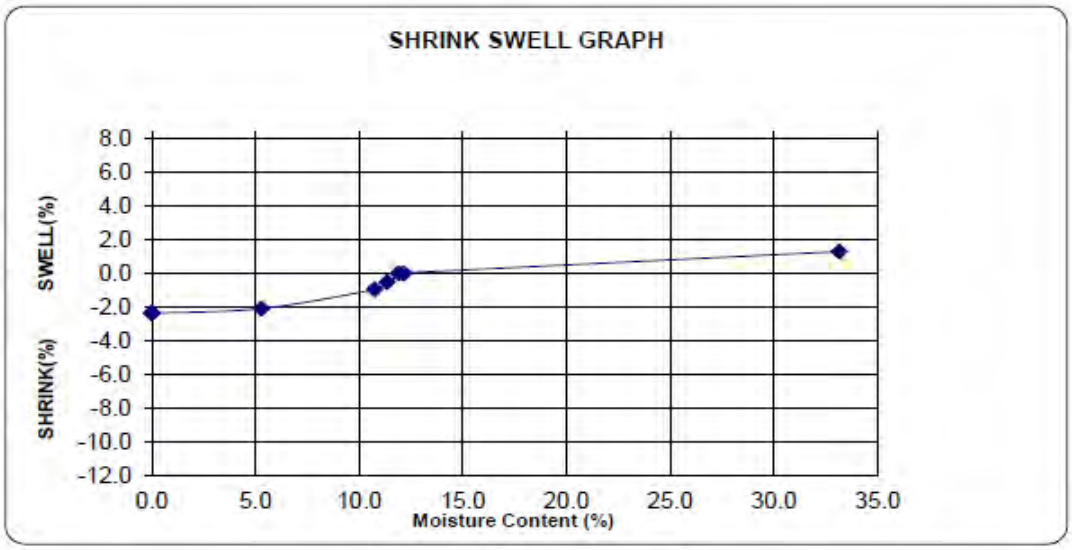
ABN 43 002 145 173

## SHRINK - SWELL TEST REPORT
## TEST METHOD: AS1289 7.1.1

Client: Pells Sullivan Meynink
PSM Job No.: PSM4503

Report No.: L4645E - 16
Report Date: 5/11/2021


| Testpit No.: 13_9 | | Depth: 0.5m | | | |
|---|---|---|---|---|---|
| MOISTURE CONTENT (SWELL) | | ESTIMATED UNCONFINED COMPRESSIVE STRENGTH | | | |
| BEFORE TEST | AFTER TEST | BEFORE TEST | | AFTER TEST | |
| 11.9% | 33.2% | 550,600 | kPa | 350,420 | kPa |
| LOAD | SETTLEMENT UNDER LOAD BEFORE SATURATION | | | SWELL ON SATURATION | SHRINKAGE |
| 25 | -0.3% | | | 1.3% | 2.3% |




**SHRINK SWELL INDEX**
**1.63 %/pF**

**Notes:** Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 22/10/2021.

NATA

NATA Accredited Laboratory Number:1327



05/11/2021
Authorised Signature / Date
(D. Treweek)

# Appendix F
# Bulk Earthworks Specification (PSM4503-004S)

# The Gables Residential Development

## Bulk Earthworks Specification Filling, Cutting and Testing

PSM4503-004S 09 November 2021

PSM Consult Pty Limited ABN 47 134 739 496

www.psm.com.au

# Table of Contents



# List of Appendices

# 1. Scope

This specification details the requirements for the bulk earthworks to be undertaken at The Gables residential development, Box Hill. The area where this specification is applicable is shown in Figure 1. This includes areas where material is filled to bulk earthworks level (BEL) within the site.

Fill placed in accordance with this specification is denoted as Engineered Fill.

This specification does not address any environmental, contamination or erosion issues with respect to the fill material.

There is a HOLD POINT on placing fill in Section 2.4 of this specification.

# 2. Filling Works

## 2.1 Subgrade Preparation

The condition of the subgrade should be assessed immediately prior to the commencement of filling.

All Engineered Fill is to be placed on one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Engineered compacted fill placed in accordance with this or other approved specifications for which the Geotechnical Inspection and Testing Authority (GITA) has a Level 1 certificate certifying compliance with that approved specification AND of at least stiff consistency.
4. Existing fill and other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM. PSM may also direct a bridging layer of Engineered Fill be placed and compacted to a Dry or Hilf Density Ratio (Standard Compaction) of between 95% and 102%. Any such layer shall be a Lot under Clause 5.3.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be moisture conditioned and compacted to be in accordance with Clauses 2.5 and 2.6 of this specification.

Engineered Fill shall be placed only on subgrade approved by the GITA as being in accordance with this specification.

## 2.2 Base Geometry and Permanent Batters

The slope of any buried batter shall be less than 2H:1V unless otherwise directed by PSM.

The contractor shall remove or flatten any geometrical obstructions (e.g., protrusions or holes) such that subsequent Engineered Fill can be placed to achieve the requirements of this specification.

Engineered Fill shall be placed only on areas where the base geometry has been approved by the GITA.

Permanent batters in fill shall be built by overfilling then cut back to the final slopes as shown in the bulk earthworks drawings, e.g., 2H:1V, or other method as approved by PSM.

## 2.3 Material

### 2.3.1 Imported Fill

Imported Engineered Fill is to conform to one of the following definitions:

1. “Virgin excavated natural material” (**VENM**) as defined by the Protection of the Environment Operations Act 1997 No 156, Schedule 1, on Page 209:

   *“Virgin excavated natural material (e.g., clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:*

a. *has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphide ores or soils, or.*

b. *consists of excavated natural materials that meet such criteria as may be approved by the EPA".*

2. "Excavated natural material" (**ENM**) as defined under Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014:

*"Excavated natural material is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:*

a. *been excavated from the ground, and.*

b. *contains at least 98% (by weight) natural material, and.*

c. *does not meet the definition of Virgin Excavated Natural Material in the Act.*

*Excavated Natural Material does not include material that has been located in a hotspot; that has been processed; or that contains asbestos, Acid Sulphate Soils (ASS), Potential Acid Sulphate soils (PASS) or sulfidic ores."*

### 2.3.2 Site Won Material

Site won material shall comprise material won from excavations on site including natural and existing fill. Material needs to satisfy Clause 2.3.3

### 2.3.3 All Fill

The Engineered Fill shall be approved by the GITA as suitable for use in a structural fill.

Engineered Fill shall not comprise unsuitable material as defined by Clause 4.3 of AS3798-2007 "Guidelines on earthworks for commercial and residential developments" as:

a. *"organic soils, such as many topsoils, severely root-affected subsoils and peat.*

b. *materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture.*

c. *materials containing substances which can be dissolved or leached out in the presence of moisture (e.g.: gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g.: some shales and sandstones), unless these matters are specifically addressed in the design.*

d. *silts, or materials that have the deleterious engineering properties of silt.*

e. *other materials with properties that are unsuitable for the forming of structural fill, and.*

f. *fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient proportions to affect the required performance of the fill."*

The GITA shall assess that the proportion of deleterious material in each Lot is not greater than 1% by weight. Deleterious material is defined by Table 3015.3 of the RTA QA Specification 3051 (Edition 5 June 1998) as:

*"Type III: Rubber, Plastic, Bitumen, Paper, Cloth, Paint, Wood and Other Vegetable Matter".*

If the GITA is not able to visually assess the above criterion, the GITA shall arrange appropriate testing.

All Engineered Fill particles shall be able to be incorporated within a single layer. Further, less than 30% of particles shall be retained on the 37.5 mm sieve.

Engineered Fill shall be able to be tested in accordance with the Standard Compaction method (AS1289.5.4.1) or Hilf test method (AS1289.5.7.1). These methods require less than 20% retained on the 37.5 mm sieve. Where between 20% and 30% of particles are retained on the 37.5 mm sieve the above test methods shall still be adopted and test reports annotated appropriately.

These requirements should be met by the material after placement and compaction.

Only material approved by the GITA shall be placed as Engineered Fill.

## 2.4 Fill Zonation and Placement

| HOLD POINT | |
|---|---|
| Process Held | Placement of Fill |
| Submission detail | The Contractor / GITA submit to PSM a Weekly Certificate as defined in Clause 6.2.1 of this specification for the earthworks completed to the previous Saturday no later than 5 pm of the subsequent Wednesday. |
| Release of Hold Point | PSM to confirm receipt of Weekly Certificate and recommend release of Hold Point if initial assessment of the Weekly Certificate indicates it complies with requirements of this specification. The contract superintendent should then release the Hold Point if it considers appropriate. |

Engineered Fill shall be placed in accordance with the following requirements:

1. In near horizontal, laterally extensive layers of uniform material and thickness, deposited systematically across the work area as determined by the GITA.
2. The compacted thickness of each layer shall be equal to or less than 250 mm.

Engineered Fill shall only be placed on subgrade in accordance with this specification and approved by the GITA.

## 2.5 Compaction

Engineered Fill shall be placed and compacted to a Dry or Hilf Density Ratios (Standard Compaction) of:

- between 98% and 103% below 0.5 m of BEL
- between 100% and 103% within the upper 0.5 m of BEL.

The insitu density shall be measured over the full depth of each layer placed.

## 2.6 Moisture Control

The placement moisture variation or Hilf moisture variation shall be controlled to be between 2% dry of optimum and 2% wet of optimum.

Placement moisture content of the Engineered Fill shall be measured.

# 3. Cutting

## 3.1 Subgrade Condition

The subgrade is to comprise one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Existing fill and other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be excavated and filled to the BEL in accordance with this specification.

# 4. Survey

## 4.1 Filling Areas

The survey requirements are as follows:

1. Any approved subgrade shall be surveyed prior to first filling such that subgrade levels are established to within ± 0.1 m. The area subject to approval shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
2. The Lot boundaries shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
3. The location of the field density tests shall be assessed and shown on the Lot boundary plan drawing to an accuracy of at least +/-5 m in plan.
4. The elevation of the field density tests shall be surveyed to an accuracy of +/-0.05 m.

The plan drawing shall show at the boundaries of the site and other identifiable site features, so as to allow the location of the lots and the test to be recoverable.

## 4.2 Cutting Areas

Any approved subgrade for cut areas shall be surveyed such that subgrade levels are established to within ± 0.1 m.

# 5. Inspection and Testing

## 5.1 Role of the GITA

The Geotechnical Inspection and Testing Authority (GITA) shall be contracted to document and certify that the works undertaken by the contractor has been completed in accordance with the relevant design and specifications.

## 5.2 Level 1 Control

The GITA shall adopt Level 1 responsibility as described in Section 8.2 of AS 3798-2007 "Guidelines on earthworks for commercial and residential developments":

> *"The primary objective of Level 1 Inspection and Testing is for the geotechnical inspection and testing authority (GITA) to be able to express an opinion on the compliance of the work. The GITA is responsible for ensuring that the inspection and testing are sufficient for this purpose.*
>
> *The geotechnical inspection and testing authority need to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include:*
>
> - *Completion of removal of topsoil*
> - *Placing of imported or cut material*
> - *Compaction and adding/removal of moisture*
> - *Trenching and backfilling*
> - *Test rolling*
> - *Testing.*
>
> *The superintendent should agree a suitable inspection and testing plan prior to commencement of the works.*
>
> *On completion of the earthworks, the GITA will usually be required to provide a report setting out the inspections, sampling and testing it has carried out, and the locations and results thereof. Unless very unusual conditions apply, the GITA should also be able to express an opinion that the works (as far as it has been able to determine) comply with the requirements of the specification and drawings."*

For this particular contract, Level 1 responsibility includes:

1. Lot testing as per Clause 5.3 of this specification.
2. A frequency of compaction testing not less than that specified in Clause 5.4 of this specification.
3. The GITA documenting and reporting its activity in the terms required by Clause 6 of this specification.
4. The GITA undertaking adequate inspections and testing to comply with the above requirements and to be able to certify the fill in the terms required by Clause6 of this specification.

## 5.3 Lot Testing

This specification requires lot testing to be undertaken.

A Lot is defined as a single layer of Engineered Fill consisting of uniform material which has undergone similar treatment.

Lot testing comprises the following:

1. A Lot shall be identified by the Contractor or the GITA with a Lot Number and presented for testing.
2. A Lot shall be deemed to be in accordance with the specification if all the tests undertaken within the Lot are in accordance with the specification, i.e., "a none to fail basis".
3. If any one test undertaken within a Lot fails, the whole of the Lot shall be reworked and retested.

Any portion of the placed Engineered Fill must be part of a single lot and all Lots will require approval by the GITA.

## 5.4 Testing Frequency (Compaction Testing)

The frequency of compaction testing for each lot shall not be less than the greater of:

1. For lot less than 50 $m^3$.
    a. 1 test per lot.
2. For lot between 50 $m^3$ and 100 $m^3$.
    a. 2 tests per lot.
3. For lot greater than 100 $m^3$.
    a. 1 test per 500 $m^3$ of material placed.
    b. 3 tests per lot.

A laboratory moisture content test shall be undertaken for each field density test.

## 5.5 Proof Rolling and Plate Load Testing

Proof rolling, together with minor boxing out and refilling, of the upper surface of the bulk earthworks will be undertaken as directed by PSM. The plant to be adopted depends upon the design loads adopted by the structural engineers for each section of the site. Any remediation of soft spots identified during proof rolling shall be undertaken in accordance with this Specification (Cl 2.5 and 2.6).

Plate load testing shall be undertaken at the direction of PSM at the following stages:

1. At final bulk earthworks level (BEL). Expected test frequency is approximately a day of testing for each building pad.

The contractor is to make a suitable reaction (e.g., 20 tonne excavator) available for the tests.

## 5.6 Inspection and Testing

The GITA shall at least undertake the following tasks:

Cut areas

1. Identify the subgrade as one of the three (3) subgrade types listed in Clause 3.1 of this specification and assess that the subgrade condition of cut areas is in accordance with the subgrade condition requirements

of Clause 3.1 of this specification. If the cut subgrade has been approved by PSM, the GITA will be required to reference the approval in its weekly report.

2. Should Engineered Fill be required to fill overcut areas, assess that filling has been placed in accordance with this specification.

Fill areas

3. For fill areas, identify the subgrade as one of the four (4) subgrade types listed in Clause 2.1 of this specification and assess that the subgrade condition of any area prior to placement of fill material is in accordance with the subgrade preparation requirements of Clause 2.1 of this specification. For the following subgrade types, GITA needs to include / refer to PSM approval in its weekly report:
   a. Existing fill and other materials as approved by PSM.
4. Assess that the base geometry of any area prior to placement of fill material is in accordance with the base geometry requirements of Clause 2.2 of this specification.
5. For each Lot, identify the material as either Site Won or Imported fill as defined in Clause 2.3 of this specification and assess that the material placed is in accordance with the fill material requirements of Clause 2.3 of this Specification.
6. Assess the proportion of deleterious material is in accordance with the requirements of Clause 2.3.3 of this Specification.
7. Assess that the Engineered Fill has been placed in accordance with the requirements for fill zonation and placement of Clause 2.4 of this specification.
8. Assess that each Lot as presented for approval by the contractor is in accordance with the requirements for Lot definition of Clause 5.3 of this specification.
9. Ensure that the survey requirements in Clause 5 of this specification have been completed.
10. Estimate the approximate volume of Engineered Fill placed in each Lot presented for approval.
11. Conduct Lot testing in accordance with the construction control testing requirements of Clauses 5.3 and 5.4 of this specification.
12. Assess that the compaction of each Lot is in accordance with the requirements of Clause 2.5 of this specification. The GITA shall select a depth of insitu density tests that allows the density of the full layer to be assessed.
13. Assess that the moisture variation of each Lot is in accordance with the requirements for moisture control in Clause 2.6 of this specification.
14. Conduct material property testing in accordance with the material testing requirements in this specification.

# 6. Reporting and Certification

## 6.1 Reporting

The GITA shall produce at least the following reports:

1. *VENM / ENM Validation Reports*. Such a report shall transmit the VENM or ENM validation certificates for the fill imported to site.
2. *Subgrade Approval Reports* (a sample is attached). Such a report shall:
   – Document assessments undertaken for tasks 1 and task 3 of Clause 5.6 including reporting the subgrade type
   – Document the subgrade survey that has been undertaken
   – Approve or reject the subgrade condition and base geometry for filling, based on tasks 3 and 4 of Clause 5.6
   – Approve or reject the subgrade condition for cut areas based on task 1.
3. *Lot Approval Reports* (a sample is attached). Such a report shall:
   – Document assessments, testing and survey undertaken for tasks 3 to 14 of Clause 5.6
   – Report material identification undertaken for task 5 of Clause 5.6

- Report the assessed proportion of deleterious material for task 6 of Clause 5.6
- Report the results of testing undertaken for task 11 of Clause 5.6
- Approve or reject lots based on tasks 12 and 13 of Clause 5.6.

4. Material Testing Reports. Such a report shall:
   - Report the results of material property testing undertaken for task 14 of Clause 5.6.
5. *Daily Reports* (a sample is attached). Such a report shall be completed daily and shall:
   - Document time spent on site by the GITA personnel
   - List subgrade assessments and approvals undertaken each day with reference to relevant Subgrade Approval Report(s)
   - List Lots presented, accepted and approved or rejected each day, with reference to relevant Lot Approval Report(s)
   - List survey undertaken each day as for task 9 of Clause 5.6 and not already documented in the Subgrade or Lot Approval Reports
   - Document other relevant activities undertaken on site that day (site instructions, breakdowns, compaction equipment used, etc.).

## 6.2 Certification

### 6.2.1 Weekly Certificate

The GITA shall produce a Weekly Certificate for any week in which earthworks are undertaken in accordance with this specification. The Weekly Certificate will cover all works from the previous Weekly Certificate until the end of work on a Saturday.

The Weekly Certificate shall transmit the following:

- Copy or reference to the complete specification document(s)
- Subgrade Approval Reports
- Lot Approval Reports
- Material property testing reports
- Daily Reports
- Survey of subgrade geometry prior to filling or in cut areas
- Plan survey drawing showing lot boundaries and location of density tests
- Survey documenting filling undertaken to date and showing location of testing
- Provide an Excel spreadsheet presenting the results of the week's acceptance testing completed by the GITA.

And certify that:

*"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM4503-004S Rev XX dated XXX)."*

### 6.2.2 Interim or Final Filling Certificate

At the completion of the bulk earthworks, or as requested by the Client, the GITA shall provide an Interim or Final Filling Certificate which shall:

1. Transmit a reference list of the Weekly Certificates.
2. Provide an Excel spreadsheet presenting the results of all the acceptance testing completed by the GITA.
3. Certify that *"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM4503-004S Rev XX dated XXX)."*

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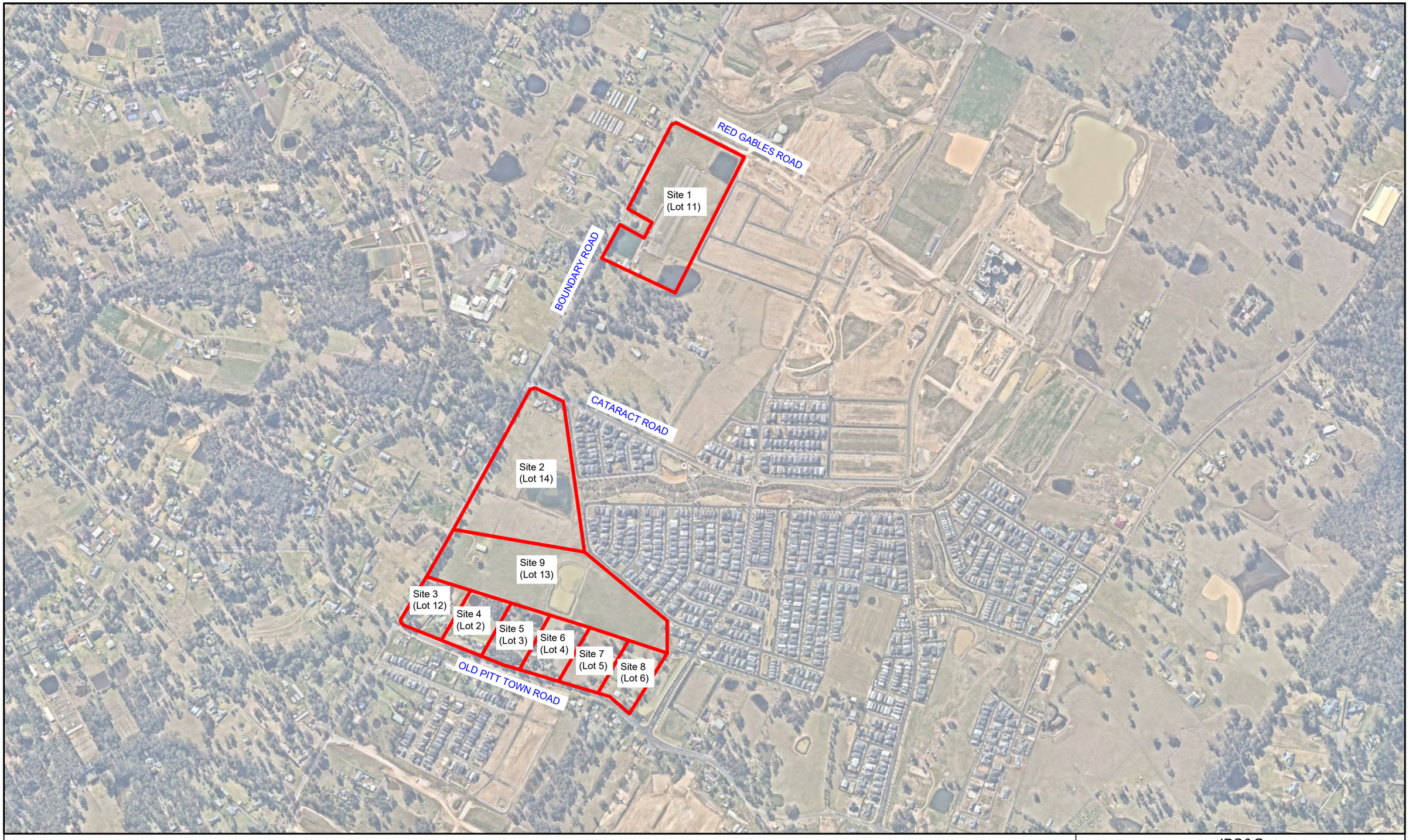
# Appendix A
# Figure 1




## LEGEND

- Approximate site boundary

NEARMAP AERIAL IMAGE DATED 7 AUG 2021

N

50 0 50 100 150 200m

1 : 10000 FULL SIZE A3

JBS&G
The Gables Residential Development
Box Hill

Site Locality Plan

| PSM4503-004S | Figure 1 |
|---|---|

# Appendix B
# Subgrade Approval Report

## GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

**NATA accreditation number**

# SUBGRADE APPROVAL REPORT

| | |
|---|---|
| Client: | Contractor: |
| Job number: | Report number: |
| Project: | Technician: |

Subgrade areas assessed:

| Area ID | Date | Approximate extent | Subgrade description | Geometry summary | Specification reference | Compliance (Pass/Fail) | Survey reference | Approved (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

COMMENTS:

Signed: Date:

# Appendix C
# Lot Approval Report

# GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

**NATA accreditation number**

## LOT APPROVAL REPORT

| | |
|---|---|
| Client: | Report number: |
| Job number: | Report date: |
| Project: | Technician: |
| Contractor: | Test methods: |

| | |
|---|---|
| **LOT ID:** | **Sheet of** |
| Retest (Yes/No) | Original test report number: |
| Specification reference | |
| Location: | |
| Lot boundary survey reference/location: | |
| Materials description: | *(MATERIAL TYPE, colour, minor components, maximum particle size)* |
| Material identification: | *(Identify the material as defined in Clause 2.3.1, Clause 2.3.2 or Clause 2.3.3 of the Specification )* |
| Deleterious material assessment: | *(Report proportion of deleterious material)* |
| Layer thickness: | |
| Accepted as Lot: (Yes/No) | Date: |
| Approximate volume (m3) | Number of tests required: |

| **Test ID No.** | | | | |
|---|---|---|---|---|
| Test soil description | | | | |
| Date tested: | | | | |
| Grid reference | | | | |
| Surveyed test locations (RL,E,N) | | | | |
| Test depth (mm) | | | | |
| Max size (mm) | | | | |
| % Oversize material (wet) | | | | |
| Field wet density ($t/m^3$) | | | | |
| Field moisture content (%) | | | | |
| PWCD ($t/m^3$) | | | | |
| Compactive effort | | | | |
| Moisture variation (%) | | | | |
| HILF density ratio (%) | | | | |
| TEST (Pass/Fail) | | | | |

| | | | |
|---|---|---|---|
| **LOT APPROVAL** | (Pass/Fail) | Signed: | Date: |

# Appendix D
# Daily Report

# GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

**NATA accreditation number**

## DAILY REPORT

| | |
|---|---|
| Client: | Report number: |
| Job number: | Report date: |
| Project: | |
| Location: | Level of testing: Level 1 |
| Contractor | Technician: |
| Time on site: | |
| Time off site: | |

### 1. Subgrade Approval

| Areas ID | Subgrade Approval Report No: | Comments |
|---|---|---|
| | | |

### 2. Lot Approval

| Lot ID | Lot Approval Report No: | Comments |
|---|---|---|
| | | |

### 3. Survey

| Type of survey | Survey undertaken by: | Reference |
|---|---|---|
| | | |

### 4. Instructions received on site

### 5. Instructions given on site

**COMMENTS:**

| | |
|---|---|
| Signed: | Date: |

# Appendix E
# Certification Letter (Sample Only)

Our Ref:

Date:

Addressed to: Earthwork Contractor

Attention: Earthwork Contractor Representative

Dear

**RE: SAMPLE INTERIM (OR FINAL) FILLING CERTIFICATE**
**INDUSTRIAL DEVELOPMENT, BULK EARTHWORKS**
**CERTIFICATION OF EARTHWORKS**
**BETWEEN [DATE OF COMMENCEMENT] AND [DATE OF COMPLETION]**

In the period between [date start] and [date finish] the contractor has undertaken earthworks in areas XXX and XXX.

During the above period:

- The GITA has prepared the following Subgrade Approval Reports:

1. Subgrade Approval Report No 1
2. ……

- The GITA has prepared the following Lot Approval Reports:

1. Lot Approval Report No 1
2. ……

- The GITA has prepared the following Daily Reports:

1. Daily Report No 1……
2. ……

- The following subgrade survey was undertaken:

1. Subgrade Survey reference……
2. ……

- The following weekly survey was undertaken:

1. Weekly survey of week ending …….reference……..
2. ……

Copies of all the above documents are attached.

The GITA certifies that all the earthworks undertaken in the above stated period are documented in the above reports and have been undertaken in accordance with the Specifications (ref. PSM4503-004S, dated XXX) a copy of which is attached, with the exception of:

1. List outstanding issues (not approved subgrade, lots, unsuitable material, failed tests etc.)
2. ……..

Signed

GITA