



COTERRA
ENVIRONMENT

Environmental Summary Report

Lot 500 Gavour Road, Wattle Grove

Rev 0

September 2025

CALIBRE | COMMITMENT | COLLABORATION

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1 Introduction

1.1 Background

Providence Lifestyle is progressing the design and development of Lot 500 Gavour Road, Wattle Grove (the site; Figure 1) for an integrated aged care facility. The site is approximately 15.2 hectares (ha) in size, and has a north-west to east-south orientation, bound by Gavour Road and Welshpool Road within the City of Kalamunda. The site is zoned 'Rural' under the Metropolitan Region Scheme (MRS) and 'Special Use' under the City of Kalamunda Local Planning Scheme No. 3 (CoK, 2025). The site is subject to a Local Development Plan (LDP), which was adopted by the City of Kalamunda in 2019 (Appendix 1).

Development approval for the integrated aged care facility will be sought through a Development Approval pursuant to the *Planning and Development Act 2005* (PD Act).

1.1.1 Previous design and approval

On 26 September 2017 Amendment 57 to the City of Kalamunda's Local Planning Scheme 3 (LPS 3) was gazetted after assessment by the Western Australian Planning Commission (WAPC) to zone the site 'Special Use (Integrated Aged Care Facility)', in line with potential future development as an Integrated Aged Care Facility, from 'Special Rural'. The proposed future development of the site aimed to allow 'ageing in place' with 'a full range of accommodation designed for the aged including independent living units (Aged or dependent Person's Dwellings) and a nursing home component (Aged Residential Care Facility) as well as common use community facilities'.

The Environmental Protection Authority (EPA) reviewed Amendment 57 and determined that the Scheme Amendment was 'Not to be Assessed' under Part IV of the *Environmental Protection Act 1986* (EP Act). The EPA provided the following advice:

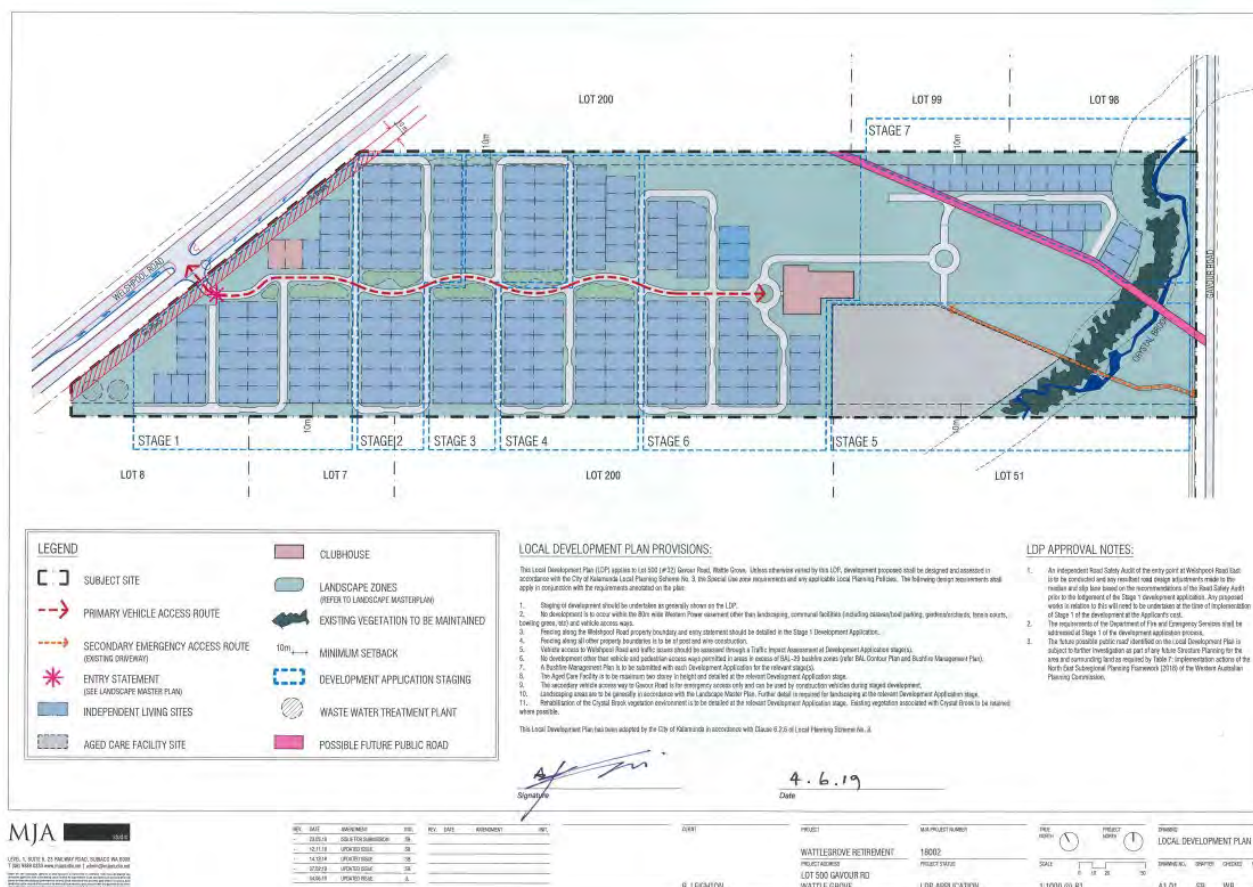
- Insufficient information has been provided to comprehensively determine the nature of the hydrological connection between the treated effluent disposal/irrigation area and the Swan/Canning river system and therefore, the environmental impacts of the proposed Waste Water Treatment Plant (WWTP) cannot be determined at this stage.
- The (then) Department of Environmental Regulation (DER) advised that the proposed WWTP would be a prescribed premise under the *Environmental Protection Regulations 1987* and require a works approval under the provisions of Section 52 of the EP Act. The DER can only undertake a detailed environmental assessment of the proposed WWTP following the submission of an application for a works approval.
- Management of urban water should be addressed in accordance with Planning Bulletin 92: Urban Water Management (WAPC, 2008) and Better Urban Water Management (WAPC 2008).
- The EPA strongly recommends that a decision on the scheme amendment be postponed until:
 - A works approval application for the WWTP for this site is assessed by the DER; and
 - an urban water management document is approved by the (then) Department of Water in accordance with Planning Bulletin 9 Urban Water Management (WAPC, 2008) and Better Urban Water Management (WAPC 2008).

Key environmental conditions specified in LPS3 (relevant to Lot 500) as an outcome of Amendment 57 include:

- Development on the site shall be connected to the reticulated sewerage system or alternative wastewater treatment system to the satisfaction of the Health Department of Western Australia and the local government on the advice of the Department of Water and Swan River Trust. In the event

- If development is approved without connection to the reticulated sewerage system, then:
 - i. prior to the approval of any development on Lot 500, an Urban Water Management Plan shall be prepared and approved by the Council on advice of the Department of Water and the Swan River Trust; and
 - ii. the approved alternative waste water disposal system shall be designed and implemented so that it is able to connect to the reticulated sewerage system if and when it is extended to within 200 metres of a boundary of Lot 500, then within 2 years of such occurrence, the owner or owners of Lot 500 shall connect all of the development on the lot to the reticulated sewerage system at the owner's cost.

- Rehabilitation of the Crystal Brook vegetation environment is to be detailed at the relevant Development Application stage. Existing vegetation associated with Crystal Brook to be retained where possible.



- An integrated aged care facility is a development that shall not be strata titled.

This condition imposed restrictions on development of the proposed facility, as it was necessary to obtain Certificate of Title's for the financing of future dwellings. As a result of this constraining condition, Amendment 107 was initiated to remove the strata titling restriction. Amendment 107 did not pose any changes to the environmental conditions to the site under LPS3 and the EPA determined the Amendment as 'Scheme Amendment Not to be Assessed Under Part IV of EP Act. No Advice Given. (Not Appealable).'

1.2 Proposed Development

The proposed development includes:

- 190 homes
- Various facilities (clubhouse, pickleball courts, wellness retreat etc.).

The above dwellings will be developed across eight stages, with an additional aged persons area located adjacent to Welshpool Road East to be developed in future.

All dwellings will be connected to the Water Corporations reticulated sewerage system, which is considered to be significantly improved environmental outcome in comparison to the LDP which shows effluent management on-site.

1.3 Purpose of Report

This Environmental Summary Report (ESR) has been prepared by Coterra Environment to accompany Providence Lifestyle's Development Application (DA) package and outlines:

- the environmental values of the site
- the design, management and mitigation strategies proposed to be implemented as development proceeds.

1.4 Key Legislation, Policies and Guidance Documents

1.4.1 Environmental Factor Guideline: Inland Waters (EPA, 2018)

This guideline provides an outline of how Inland Waters is considered by the Environmental Protection Authority (EPA) in the environmental impact assessment (EIA) process, including assessment of potential environmental impacts, implications of cumulative impacts, the mitigation hierarchy (direct and indirect impacts), management approaches and predicted residual impacts (EPA, 2018).

1.4.2 Better Urban Water Management (WAPC, 2008)

This document provides guidance on the implementation of State Planning Policy 2.9 Water Resources (WAPC, 2006), which is a requirement of the State Water Strategy for Western Australia (WAPC, 2003).

The intentions of the Better Urban Water Management document are (WAPC, 2008):

- To facilitate better management and use of our urban water resources by ensuring an appropriate level of consideration is given to the total water cycle at each stage of the planning system
- To assist regional, district and local land use planning, as well as subdivision and development phases of the planning process
- To provide a framework for how water resources should be considered at each planning stage by identifying the various actions and investigations required to support the planning decision being made
- To identify agencies responsible for provision of water resource information

The document should be applied to both new greenfield and urban renewal projects where residential, commercial, industrial and rural residential uses and development are proposed, including rural townsite areas.

1.4.3 Environmental Guidance for Planning and Development – Guidance Statement 33 (EPA, 2008)

The purpose of EPA Guidance Statement 33 – Environmental Guidance for Planning and development is (EPA, 2008):

1. To provide an overview of environmental protection processes and information, to assist land use planning and development in Western Australia
2. To describe referral and environmental impact assessment processes under Part IV of the Environmental Protection Act 1986 and, in particular, the procedures applied to schemes
3. To provide the EPA's advice on a range of environmental factors in order to assist participants in land use planning and development to protect, conserve and enhance the environment.

1.4.4 Draft State Planning Policy 2.9 Planning for Water (WAPC, 2021)

The intent of the draft Policy is to ensure that planning and development considers water resource management and includes appropriate water management measures to achieve optimal water resource outcomes. The objectives of the Policy are (WAPC, 2021):

1. Protect and improve the environmental, social, cultural and economic values of the State's water resources
2. Protect public health and the long-term supply of good quality and affordable drinking water
3. Manage the risk of riverine flooding to people, property and infrastructure
4. Ensure the secure and sustainable supply, use and re-use of water resources
5. Ensure future development is resilient to the water-related impacts of climate change
6. Minimise future costs and protect public health by ensuring that appropriate wastewater infrastructure is provided.

1.4.5 Guidance for planning and development: Protection of naturally vegetated areas in urban and peri-urban areas (EPA, 2021)

The purpose of this document is to set out the views and expectations of the EPA for the protection of naturally vegetated areas in the design of urban and peri-urban development proposals, and applies to strategic planning, new schemes and scheme amendments, structure plans and subdivision and development proposals in urban and peri-urban areas of Western Australia. Although urban and peri-urban areas are the focus of the guidance, the guidance may also be applied to proposals impacting any naturally vegetated areas in Western Australia.

The guidance is to be used to avoid, minimise or rehabilitate impacts on naturally vegetated areas, encouraging planners, developers, proponents and referrers to integrate design advice in this guidance during project planning (EPA, 2021).

1.4.6 Referral guideline for 3 WA threatened black cockatoo species Carnaby's cockatoo (*Zanda latirostris*), Baudin's cockatoo (*Zanda baudinii*) and the Forest Red Tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (DAWE 2022).

The referral guidelines provide guidance on what actions are likely and unlikely to require referral to the Minister for the Environment because they could have a significant impact on black cockatoos, as well as providing details on the types of things that need to be considered when determining whether or not a

proposal needs to be referred. The guideline outlines information on habitat quality, survey expectations and standards for mitigating impacts, which could influence a decision on whether to refer an action (DAWE, 2022).

1.4.7 Kalamunda Clean and Green Local Environment Strategy 2019 – 2029

The purpose of the City of Kalamunda Local Environment Strategy (LES) is to assist in protecting the landscape character of Kalamunda and guide improvements in the City's own operations and its work with stakeholders and community groups.

The LES provides the framework to manage environmental pressures and improve sustainable practices over the next decade and beyond. It will assist in protecting the landscape character of Kalamunda and guide improvements in the City's own operations and its work with stakeholders and community groups. The LES is organised into four key themes:

- The value of green space and natural areas
- Conserving natural resources
- Reducing waste
- Managing the impacts.

1.4.8 City of Kalamunda Urban Forest Strategy

The purpose of the City of Kalamunda Urban Forest Strategy (UFS) is to guide the strategic and holistic management of the City's urban forest, with consideration to trees on both public and private land, as well as the role and amount of canopy cover in different land uses.

The strategy identified goals and objectives to protect and grow the urban forest, and outlines specific, measurable actions needed to achieve these. The UFS defines the urban forest as:

- All trees greater than 3 m in height that occur within the City of Kalamunda, except for trees within the Perth Airport locality and trees on land reserved as state forest, national parks and regional parks.

1.4.9 City of Kalamunda Local Biodiversity Strategy

The City of Kalamunda Local Biodiversity Strategy (LBS) was developed to guide the retention, conservation and management of Local Natural Areas (LNAs) for the perpetual wellbeing of the City's residents, enterprise and ecosystem. The LBS aims to identify conservation priorities and methods to improve biodiversity, retain natural ecological processes and protect and enhance LNAs to provide a resilient place for people, enterprise and ecosystems to flourish into the future.

The scope of the LBS focuses on retaining, conserving and managing LNAs on land managed by the City, and identifies the following five goals:

- Retain and protect: Retain and protect LNAs and other biodiversity values on City-managed land and private land
- Investigate: Investigate and actively pursue new resourcing (human, funding and data) and research opportunities to enable further investment and improvement in on-ground actions on public and private land to manage and protect local biodiversity.
- Manage and enhance: Manage, enhance and rehabilitate LNAs and other biodiversity values on City-managed land to improve the quality and quantity of biodiversity values
- Link: Maintain and improve local and regional ecological linkages that allow flora and fauna species movement and the flow of genetics throughout the landscape
- Engage: Actively engage with Aboriginal representatives to understand and integrate cultural knowledge into local biodiversity management, engage with the community to strengthen the

appreciation of biodiversity values, and encourage them to retain, protect and enhance biodiversity values on private land.

2 Existing Environment

2.1 Climate

The Perth region experiences a Mediterranean climate with warm, dry summers and cooler, wet winters. The closest Bureau of Meteorology (BoM) weather station to the site is the Gosnells City Station (No. 009106), located approximately 5 km southwest of the site (BoM, 2025).

2.1.1 Rainfall and Temperature

Gosnells experiences an annual mean rainfall of 776.0 mm, with highest mean rainfall experienced in June (160.5 mm) and lowest mean rainfall experienced across warmer months. Mean maximum temperatures are highest in January and February (average of 33.0°C; highest recorded temperatures in February of 46.0°C) and mean minimum temperatures are recorded in July (average of 8.9°C; lowest recorded temperature 0.5°C) (BoM, 2025; Plate 2-1).



Plate 2-1: Mean Rainfall and Mean Maximum Temperature – Gosnells Station

Source: BoM, 2025

2.1.2 Wind

Strongest winds experienced by the Gosnells locality are summer morning easterlies and afternoon south-westerlies. In winter, strongest winds in the morning arise from a north- north-easterly direction, and afternoon winds from the west (BoM, 2025; Plate 2-2 to Plate 2-5).

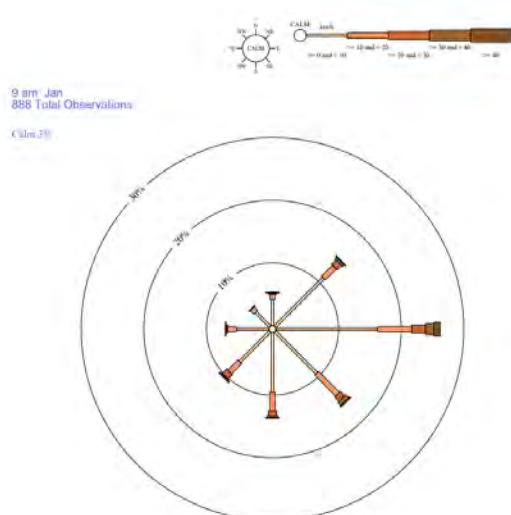


Plate 2-2: January 9am Wind Rose

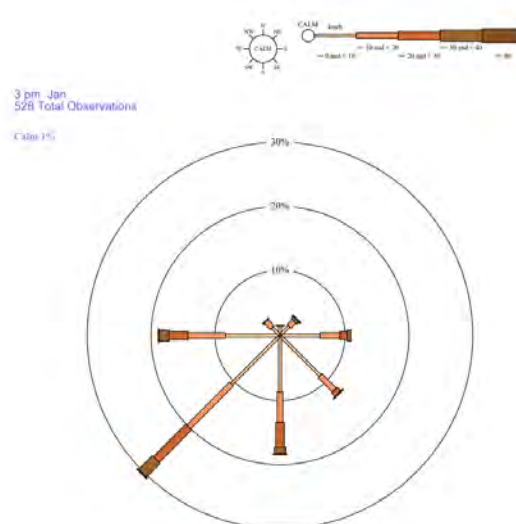


Plate 2-3: January 3pm Wind Rose

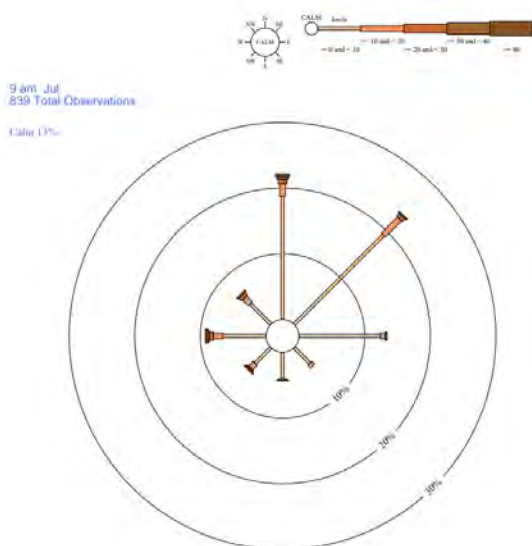


Plate 2-4: July 9am Wind Rose

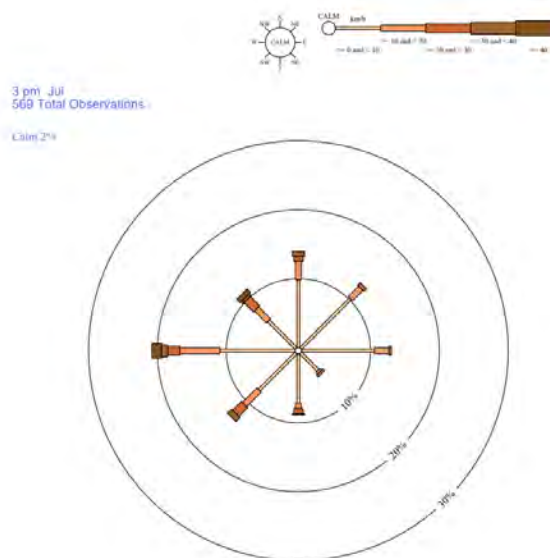


Plate 2-5: July 3pm Wind Rose

Source: BoM, 2025

2.2 Topography and Landform

Topography at the site generally slopes downward in a north-westerly direction toward Welshpool Road East, and varies in height ranging from approximately 49 metres Australian height datum (mAHD) to 37 mAHD in the northern end of the site (MNG Access, 2025; Figure 2).

Within the southern portion of the site is Crystal Brook, which forms an incised gully that is approximately 1 to 2 m below ground level in the area where it traverses the site (Strategen, 2014).

2.3 Geology and Soils

2.3.1 Regional Mapping

Regional scale environmental geology mapping indicates that soils at the site comprise the following (Jordan, 1986; Figure 2):

- Northern and north-eastern parts of the site: Gravelly Silt (Mgs2) - strong brown, tough, common pebbles of fine to coarse grained, subrounded granite, some dolerite and rare sandstone, variable sand content
- North-western part of the site: Sand (S10) - Bassendean Sand overlying sandy clay to clayey sand of the Guildford Formation.
- Southern part of the site: Sand (S12) - structureless, yellow, fine-grained, subangular and medium to coarse grained subrounded to rounded quartz, feldspar and heavy minerals common, minor silt and clay

The S10 and S12 units have a Class II 'low to moderate' risk of Acid Sulfate Soils (ASS) within 3 m of the site surface. The Mgs2 unit is not identified to pose an ASS risk. The closest mapped Class I 'moderate to high' risk ASS area is located approximately 600 m west from the northwest corner of the site (Landgate, 2025; Figure 2).

The Department of Primary Industries and Regional Development (DPIRD) maps the following soil subsystems within the site (DPIRD, 2025):

- Forrestfield D Range F2 phase (unit 213Fo_Ff2): Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E. marginata*, *E. calophylla* and some *B. grandis*.
- Forrestfield F4 Phase (unit 213Fo_F4): Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.
- Forrestdale (D Range) F1 Phase (unit 213Fo_Ff1): Foot and low slopes < 10% with deep rapidly drained siliceous yellow brown sands, and pale or bleached sands with yellow-brown subsoil. Shrubland of unidentified species.

Land degradation risk categories for each mapped unit are outlined below (Table 2-1). As noted below, the highest land degradation risk is wind erosion of the 213Fo_Ff1 unit, and flood hazard of the 213Fo_F4 unit (DPIRD, 2025).

Table 2-1: Land degradation Risk Categories

Land Degradation Risk Category	213Fo_Ff2	213Fo_F4	213_Fo_Ff1
Water Erosion	0% of map unit has a very high to extreme hazard	60% of map unit has a very high to extreme hazard	0% of map unit has a very high to extreme hazard
Wind Erosion	10% of map unit has a high to extreme hazard	15% of map unit has a high to extreme hazard	100% of map unit has a high to extreme hazard
Flood Hazard	0% of the map unit has a moderate to high hazard	70% of the map unit has a moderate to high hazard	0% of map unit has a moderate to high hazard
Salinity Hazard	0% of map unit has a moderate hazard	0% of map unit has a moderate hazard	0% of map unit has a moderate hazard
Waterlogging and Inundation	0% of map unit has a moderate to very high risk	0% of map unit has a moderate to very high risk	0% of map unit has a moderate to very high risk

Source: DPIRD, 2024

2.3.2 Geotechnical Investigation

Galt geotechnics undertook an assessment of the site in 2021 which identified ground conditions in the north to be consisted with geological mapping; however, the remainder of the site comprised gravelly and clayey soils, in contrast to the mapping. The south and southeast of the site contained increased fines content with depth, and decreasing gravel content with depth (Galt Geotechnics, 2021; Appendix 3).

2.4 Hydrology

2.4.1 Surface Water

The Crystal Brook meanders through the southern portion of the site, draining ultimately offsite into the Yule Brook, which discharges into the Canning River (Landgate 2025; Figure 3). Crystal Brook forms a gully, and is approximately 1 to 2 m below ground level in the area in which it traverses the site, flowing in an easterly direction towards Yule Brook for approximately eight months of the year (Strategen 2014). The 1% annual exceedance probability (AEP) floodplain area has not been mapped by DWER; however, given Crystal Brook is 1 to 2 m lower than the surrounding parts of the site, the floodplain of Crystal Brook is not anticipated to extend significantly into the site (Strategen 2014).

Notably, where the vertical banks of the Crystal Brook form, the soils appear clayey in nature (predominantly in eastern portion of creekline), becoming flatter as soils are less clayey and have more structure (western portion of creekline) (Strategen, 2014). Examples of where banks showcase this geology and topography are shown below (Plate 2-6 and Plate 2-7).

There are no mapped wetlands within the site, with the closest Conservation Category Wetland (CCW) being located approximately 850 m west of the site at its closest point (Landgate, 2025; Figure 3).

The site is within two catchments (separated by the Crystal Brook); however, the development is considered to be outside of the area influenced by Crystal Brook. There is little runoff evident from the site, and it is considered likely that all runoff is infiltrated prior to leaving the site (DEC, 2025).

**Plate 2-6: Eastern embankment of Crystal Brook****Plate 2-7: Western embankment of Crystal Brook**

Source: Coterra Environment, 23 January 2025

2.4.2 Groundwater

The site is underlain by the Perth Superficial Swan aquifer, which overlays the Leederville and Yarragadee North aquifers (DWER 2025a). Based on a search of the DWER Water Register database, there is some groundwater available for allocation in the superficial aquifer within this subarea.

Galt Geotechnics (2021) noted that shallow perched groundwater may occur during winter.

The DWER 2019 regional groundwater mapping contours do not extend over this area (DWER 2025b); however, Strategen (2014) reported the Perth Groundwater Atlas (2nd edition, DoE 2004) mapped the minimum groundwater levels on site as ranging between 16 to 18 mAHD, which indicates a depth to groundwater of between 33 m in the southeast and 20 m in the northwest and flowing in a westerly direction (Strategen, 2014; Figure 3).

The site is not located within a Public Drinking Water Source Area (PDWSA) (DWER 2025b).

Crystal Brook and Yule Brook are noted to sit above the regional groundwater table. This indicates that the watercourses are 'losing streams', relying on water from higher elevated areas, being the Daring Scarp, and which remain in situ due to the clayey sediments at their base limiting infiltration to the regional groundwater aquifer (Strategen, 2014).

Predevelopment groundwater monitoring was undertaken by Strategen as a part of the LWMS preparation and indicated that all measured levels of nutrients were within allowable Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines, except for total Ammonia as the Nitrogen values were recorded as slightly above guideline levels. This is attributed to historical use of the land (DEC, 2025).

2.5 Flora and Vegetation

2.5.1 Vegetation Complex

Regional scale mapping (Heddl et. al. 1980) indicates that remnant vegetation onsite forms part of the Forrestfield Vegetation Complex (Landgate, 2025). This complex is described as:

- Vegetation ranges from open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah) to open forest of *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) - *Allocasuarina fraseriana* (Sheoak) - Banksia species. Fringing woodland of *Eucalyptus rudis* (Flooded Gum) in the gullies that dissect this landform.

The remaining extent of the Forrestfield Complex within the Swan Coastal Plain is 12.3%, and 11.4% within the City of Kalamunda (GoWA, 2019).

2.5.2 Previous Surveys

In 2018, Western Botanical undertook a reconnaissance level flora and vegetation survey of the site. The survey recorded eight vegetation units, with each unit described below (Table 2-2).

No Threatened or Priority species were identified, and none are expected to occur, given most of the site is highly modified and completely degraded and/or degraded. Slashing has historically regularly been undertaken at the site to mitigate fire impacts, and remnant vegetation is restricted to a narrow strip nearby the western boundary (Western Botanical, 2018).

Vegetation Unit 1 (*Banksia menziesii* open woodland) was identified as potentially being representative of the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community, however, does not meet the minimum patch size threshold to be considered for inclusion (must be at least 0.5

Vegetation units within site

Vegetation units	Example Site Photograph
Unit 1: <i>Banksia menziesii</i> open woodland - Open woodland of <i>Banksia menziesii</i> (approximately 10 trees) with understory of resprouting <i>Xanthorrhoea</i>. Condition: Good, Area: 0.32 ha	
Unit 2: <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> open woodland - Open woodland of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Allocasuarina fraseriana</i> with occasional trees of <i>Banksia attenuata</i>. Condition: Good, Area: 0.57 ha	
Unit 3: <i>Corymbia calophylla</i> spare woodland - Sparse open woodland of <i>Corymbia calophylla</i> with sparse understory of resprouting <i>Xanthorrhoea</i>. Condition: Good, Area: 0.27 ha	
Unit 4: <i>Corymbia calophylla</i> open woodland - Open woodland of <i>Corymbia calophylla</i> with dense mixed	-

Vegetation units	Example Site Photograph
understorey containing occasional small trees of <i>Banksia ilicifolia</i>. Condition: Good, Area: 0.10 ha	
Unit 5: <i>Corymbia calophylla</i> (<i>Eucalyptus rudis</i>) open woodland over degraded/cleared - Open woodland of <i>Corymbia calophylla</i> (<i>Eucalyptus rudis</i> variably present) over a historically cleared understorey. Condition: Degraded, Area: 2.91 ha	
Unit 6: <i>Corymbia citriodora</i> (planted) and <i>Eucalyptus rudis</i> woodland over degraded/cleared - Open woodland of <i>Corymbia citriodora</i> (planted) and <i>Eucalyptus rudis</i> (remnant) woodland over a historically cleared understorey. Condition: Degraded, Area: 0.84 ha	
Unit 7: <i>Corymbia calophylla</i> woodland over dense garden planting - <i>Corymbia calophylla</i> woodland over a dense tall understorey and ground layer of exotic plantings. A creek runs through a portion of the unit but is not associated with a separate vegetation unit. The Declared Pest <i>Zantedeschia aethiopica</i> (Arum Lilly) is present within this unit. Condition: Completely Degraded, Area: 1.51 ha	
Unit 8: Mixed native and exotic plantings - A variable unit representing historically completely cleared areas with mixed plantings of exotic species and non-local native species. Condition: Completely Degraded, Area: 0.43 ha	

Source: Western Botanical, 2018

However, given the extent of time that has passed since the 2018 survey, and the lack of native vegetation understorey within the site due to ongoing fire mitigation measures, PGV Environmental undertook an assessment in May 2024 which mapped the dominant tree types (native and non-native) within the site (Figure 4), along with the following corresponding tree codes, (PGV, 2025):

Non-native Trees

- **Ccit:** *Corymbia citriodora* (Lemon-scented Gum)
- **Cm:** *Corymbia maculata* (Spotted Gum)
- **Cyp:** *Cupressus macrocarpa* (Golden Cypress)
- **Ecsm:** *Eucalyptus camaldulensis* (River Red Gum)
- **Eg:** *Eucalyptus grandis* (Rose gum)
- **El:** *Eucalyptus lehmannii* (Bushy Yate)
- **P:** *Pinus radiata* (Radiata pine)
- **Ex:** Exotic shrubs

Native Trees

- **AF:** *Allocasuarina fraseriana* (Sheoak)
- **Ba:** *Banksia attenuata* (Slender Banksia)
- **Bm:** *Banksia menziesii* (Menzies banksia)
- **Cc:** *Corymbia calophylla* (Marri)
- **Em:** *Eucalyptus marginata* (Jarrah)
- **Er:** *Eucalyptus rudis* (Flooded Gum)

2.5.3 Conservation Significant Flora

One individual of *Conospermum undulatum* (Wavy-leaved Smokebush) was recorded along the northern boundary of the site (Appendix 4). This species is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act).

2.6 Fauna and Habitat

Several fauna and habitat assessments have been undertaken across the site. Each survey has utilised previously collected results to provide an updated and targeted assessment, to inform the proposed development design.

2.6.1 Previous Surveys

A level 1 vertebrate fauna and habitat assessment and targeted Carnaby's Black Cockatoo assessment was undertaken by Western Wildlife in 2018. The following presents the key findings reported by Western Wildlife (2018).

Fauna habitats observed in the site were:

- Cleared areas with exotic trees
- Creek
- Remnant/regrowth Marri forest (mostly in association with the creek)
- Parkland cleared native forest

The identified habitats were lacking in native understorey and generally degraded, but the canopy of Jarrah, Marri and She-oak trees are likely to support some native fauna species. The creek is likely to provide a local ecological linkage across the southern part of the site. Overall, 31 Jarrah, Marri or Flooded Gum trees were identified that demonstrated a diameter at breast height (DBH) equal to or greater than 50 cm (i.e., met the minimum size criteria to be considered potentially suitable for black cockatoo breeding).

Two frog, two reptile, one mammal and 27 bird species were observed opportunistically during the site visit.

The only four conservation significant fauna likely to use the study area on a regular basis are:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Endangered (EPBC Act and BC Act)

- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) – Endangered (EPBC Act and BC Act)
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable (EPBC Act and BC Act)
- Quenda (*Isoodon fusciventer*) – DBCA Priority 4

The study area represents a small area of foraging habitat for black-cockatoos and although potential breeding habitat is present, only one tree appeared to have a large hollow that may be suitably sized for cockatoos.

The Quenda (*Isoodon fusciventer*) is relatively common in the Perth Hills and is likely to occur throughout the local area, wherever there is dense vegetation at ground level. The Quenda was observed in a patch of weeds along the creek. Foraging signs of this native mammal were also noted in weedy areas on the eastern boundary of the property.

The creek provides breeding habitat for native frogs and a small number of common waterbird species. The fringing vegetation, which were dominated by exotic plants, is likely to support some terrestrial birds and a few generalist reptile species.

2.6.2 2024 Black Cockatoo Foraging Habitat Assessment

In May 2024 PGV Environmental undertook a foraging habitat assessment for Carnaby's Black Cockatoo (*Zanda latirostris*), Baudin's Black Cockatoo (*Zanda baudinii*) and Forest Red Tailed Black Cockatoo (*Calyptorhynchus banksii naso*) within the site (Appendix 4). The assessment reviewed dominant tree types within the site and provided a broad-scale map summarising this vegetation (Figure 4). Foraging habitat for Carnaby's Black Cockatoo (*Zanda latirostris*), Baudin's Black Cockatoo (*Zanda baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) that correlates to the broad tree types within the site is provided in Table 2-3 below (Figure 5 and Figure 6) (Appendix 4).

PGV Environmental (2025) recorded a total of 2.84 ha of foraging habitat for Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoos within the site, with a total of 2.74 ha of Carnaby's Black cockatoo also recorded within the site. The difference in foraging areas is attributed to the presence of Sheoak trees which are foraged on by Baudins' and Forest Red-tailed Black Cockatoos only (Appendix 4).

Table 2-3: Dominant tree types and black cockatoo foraging

Tree Mapping Unit	Forage Species for Black Cockatoo	
	Carnaby's Black Cockatoo	Baudin's and Forest Red-tailed Black Cockatoo
Af	No	Yes
AfBm	Yes	Yes
AfCc	Yes	Yes
AfEm	Yes	Yes
Cc	Yes	Yes
CcEr	Yes	Yes
Ccit	No	No
Cm	No	No
Cyp	No	No
Ecam	No	No
Eg	No	No
EgCm	No	No
El	No	No
Em	Yes	Yes
EmBa	Yes	Yes
EmCc	Yes	Yes
Ex	No	No
P	No	No

Source: PGV, 2025

2.7 Conservation Areas

The site does not contain any Bush Forever (BF) areas, with the closest BF area being located across Welshpool Road East (BF Site 50 – Welshpool Road Bushland, Wattle Grove) (Landgate, 2025; Figure 7). The site is located approximately 1.5 km east of the BF Site 387 – Greater Brixton Street Wetlands, Kenwick.

A Regional Ecological Linkage is mapped along the northern border of the site, being Link ID 41, which extends from Lesmurdie Recreation Reserve in the east, to the CCW UFI 15020 in the west. Ecological linkages were historically mapped across the Perth region to highlight areas of connecting remnant vegetation which may act as stepping stones between habitats (Del Marco, et. al., 2004).

Majority of the site is mapped as being within an Environmentally Sensitive Area (ESA); however, upon closer inspection of the ESA mapping within the site it appears the ESA mapping within the northern portion of the site represents a buffer to a Threatened Ecological Community (TEC) located on the opposite side of Welshpool Road East and within BF site 50, as indicated within the Bush forever Directory (DEP, 2000).

2.8 Bushfire

The entire site is mapped as being within a Bush Fire Prone Area (Landgate, 2024a). These areas are defined as being subject to, or likely subject to bushfire attack and are identified by the presence of and proximity to bushfire prone vegetation and includes both the area containing the bushfire prone vegetation and a 100 m buffer zone immediately surrounding it.

As a part of the DA, updated Bushfire Attack Level contours and an associated Bushfire Management Plan have been prepared and should be considered in conjunction with this EAR.

2.9 Contaminated Sites and Land Use History

The site is not mapped by the DWER's Contaminated Sites Database as having any known contamination. There are no known contaminated sites within a 1 km radius of the site (DWER, 2025).

Vegetation within the site was cleared prior to 1953, and historical land uses prior to this time included farming and dairy. The house built in this time was demolished to facilitate installation of the power easement, which was installed between 1974 and 1977. In the 1960's and 1970's, the site was subject to sand extraction and cattle grazing, leaving the land in the paddock at the site completely degraded. Currently, the site holds a singular private residence and sporting (polo) facilities (Appendix 5).

2.10 Heritage

2.10.1 European Heritage

Although not within the site, the site is adjacent to the boundary of the 'Avenue of Lemon Scented Gums', identified in the City of Kalamunda's Municipal heritage Inventory. The stand of Lemon Scented Gums was listed in the City's Municipal Heritage in 2019 for its sense of place provided to the community, as well as its visual amenity (CoK, 2019). The stand extends over approximately 450 m along Welshpool road East, where originally 18 trees were planted in the median strip of the road, and 17 trees were planted along the southern boundary (adjacent to the site). This heritage site is not within the development area.

There are no listed places within the site under the State's InHerit database (Heritage Council, 2025).

2.10.2 Aboriginal Heritage

The site does not contain any mapped Aboriginal Heritage places. The closest known Aboriginal Heritage place is located approximately 125 m north of the site (being Yule Brook; Place ID 36929) (MNG Access, 2025).

All persons on site will be made aware of their obligations under the *Aboriginal Heritage Act 1972*, should any unexpected finds be encountered during siteworks.

3 Potential Environmental Impacts and Proposed Management

3.1 Hydrology

3.1.1 Potential Impacts

The following have been identified as potential environmental impacts to the site's hydrology which may occur as a result of future development of the site:

- Loss of waterway features and landform
- Modification of existing surface water hydrology within the site, resulting in potential impacts to the waterway, flora and vegetation and terrestrial fauna habitat values
- Modification of existing groundwater hydrology within the site, resulting in potential impacts to groundwater dependent ecosystems within the site.

3.1.2 Stormwater Drainage Design and Management

Based on site topography and geology, there is little evidence that runoff from the site will occur. Stormwater from the development (up to and including the 1% AEP event) will be retained and disposed of via soakage. Lot connections will be provided to each allotment within the site, which will facilitate direction of stormwater into a below ground detention system, also designed to hold roof runoff. Detention basins will hold all stormwater run-off from the site prior to infiltration (DEC, 2025).

Land adjacent to the site has the potential to contribute greater runoff to the site than what is currently experienced. As such, stormwater management will also include construction of a cut off drain along this interface (DEC, 2025).

3.1.3 Groundwater Management

Given the separation of the sites surface levels and existing groundwater levels beneath the site (approximately 18 m), no specific management is required for the purposes of groundwater management (DEC, 2025). However, as the site contains areas of clayey sand, some perching of groundwater may occur on the substrate. To manage this, it is proposed to install subsoils throughout this area to control the potential perching (DEC, 2025).

3.2 Acid Sulphate Soils

As the site is mapped as being of moderate to low risk of ASS within 3 m of natural soil surface, but of high to moderate risk beyond 3 m of natural soil surface, construction work is not proposed to exceed this depth and will therefore not encounter ASS (DEC, 2025).

3.2.1 Waterway and Foreshore Management

Alongside this ESR, a biophysical assessment to ensure an appropriate foreshore area and development setback has been undertaken by Coterra Environment. As an outcome of the biophysical assessment was the preparation of an associated Foreshore Management Plan (FMP) to be implemented where relevant (once approved). The aims of the FMP are to protect the waterway and enhance both aesthetic and environmental values of the foreshore area and brook.

3.3 Vegetation and Flora

3.3.1 Potential Impacts

Although vegetation is scattered throughout the site, it is highly modified and exhibits limited ecological attributes, the development footprint has been positioned to minimise the clearing of native trees and maximise the retention of potential nesting trees (refer to Site Masterplan presented in Appendix 2).

The Masterplan, maps the extent of native vegetation proposed to be cleared to facilitate development as approximately 1 ha

No impacts to any conservation significant vegetation are expected to occur as the *Conospermum undulatum* individual is to be retained in a landscaped area.

3.3.2 Management Measures

The proposed siting of the development within the site has been carefully selected to reduce clearing impacts to areas of native vegetation, as well as enhancing and protecting the vegetation at site. Where possible, the development has been sited within the already cleared paddock area of the site in order to minimise impacts to native vegetation. Vegetation which is to be retained will be clearly demarcated prior to construction works commencing to ensure no impacts to this vegetation occur.

Alongside hydrological management objectives, the FMP also serves to identify mitigation and management measures which reduce impacts on vegetation identified for retention through targeted weed control, access management and erosion control.

3.4 Fauna and Habitat

3.4.1 Potential Impacts

The proposed development requires removal of less than 1 ha of foraging habitat for Black Cockatoos (noting there is overlap between the Carnaby's and Baudin's/Forest Red-tailed Cockatoo habitat (PGV Environmental, 2025), refer Table 2-3) (Figure 5 and Figure 6) (Appendix 4).

It is not expected that impacts to any black cockatoo breeding or roosting habitat will occur, nor any significant impacts to habitat utilised by other conservation significant species.

3.4.2 Management Measures

The proposed development footprint has been sited to reduce impacts to fauna by retaining native vegetation/trees, which includes:

- Fringing native vegetation associated Crystal Brook
- Carnaby's Black Cockatoo foraging habitat
- Baudin's and Forest Red Tailed Black Cockatoo foraging habitat
- All Black Cockatoo potential nesting trees.

Specific fauna management measures proposed are:

- During clearing and construction of the development area, native vegetation and individual trees to be retained within the development (i.e. foreshore reserve, POS, trees in road reserves, etc.) will be clearly demarcated and fenced off temporarily, to restrict entry of vehicles, machinery or people into these areas, which could potentially result in damage to, or removal of vegetation proposed for retention
- Clearing of trees, if possible, will be undertaken outside of the breeding season for bushland birds (i.e., not between July and November) to avoid injury or death to nesting birds or their young

- Clearing will be undertaken toward areas of remnant vegetation, where possible
- A zoologist/Fauna Relocator will be present on site during clearing works to manage any displaced fauna

Should injured, abandoned or distressed fauna be found onsite, the following protocol will be undertaken:

1. Animal found.
2. If Fauna Relocator is onsite, advise them immediately of the presence of the animal.
3. If Fauna Relocator is not onsite (i.e. if injured animal is found after the clearing program has finished), identify animal, if possible (determine if potentially venomous).
4. Contact Project Superintendent, Fauna Relocator or Environmental Consultant for instructions. If these representatives cannot be reached, contact the DBCA Wildcare helpline (**9474 9055**).
5. If unable to stay with the animal, clearly mark its position so it is visible to all personnel that approach the site.
6. First preference is to leave the animal alone until experienced assistance arrives. If this is not possible, the following handling and temporary holding instructions may be enacted (only if absolutely necessary and only as a last resort):
 - Nesting birds (and all avifauna) should be left undisturbed until an appropriate course of action has been followed. Young birds found within a nest should only be removed if considered by a specialist to be abandoned or injured
 - For any small mammals found at any time on site, the best method of storage and transportation would be within calico bags. Mammals may become stressed and agitated in traps or hard containers, sometimes resulting in injury. Mammals transported in hessian sacks remain calmer due to the dark environment and if kept in the shade and on a soft, secure surface can be transported with relatively limited stress and injury
 - Reptiles can, in most cases, be transported within calico bags of varying size to suit the animal. Plastic carry boxes can also be used with some air holes, leaf litter and sand within them. The animals should always be placed within an area of shade so that they do not overheat.
7. If in any doubt about whether the animal is venomous, do not under any circumstances attempt to handle. Instead, monitor the location of the animal and await arrival of an experienced wildlife officer or reptile handler.
8. Fauna Relocator and/or Environmental Consultant to contact DBCA or wildlife carers as appropriate.

3.5 Construction Management

3.5.1 Dust

The potential for dust to cause disturbance includes:

- Nuisance dust generated during construction or clearing entering neighbouring properties and impacts residents
- Deposition of dust on retained vegetation
- Impacts to waterways.

If required, at the request of the City of Kalamunda, a Dust Management Plan may be prepared and implemented (once endorsed). However, the below management measures are proposed during demolition, earthworks and construction of the proposed development:

- Plan earthmoving works so that they are completed just prior to the time they are needed

- Observe weather conditions and do not commence or continue earthworks if conditions are unsuitable e.g. under conditions of strong winds
- Pre-water areas to be disturbed, if required
- Regular use of the water cart over disturbed areas and vehicular access tracks, if required
- Watering sprays on stockpiles and materials to be loaded and during loading, if required
- Hydromulch or similar binding material to be used in completed earthwork areas where little or no further vehicle or pedestrian traffic is likely.

3.5.2 Noise

Noise may be generated during demolition, earthworks and construction of the proposed development.

Considerations of noise impacts to both neighbours and fauna include:

- Vegetation proposed to be retained around the site offers screening for noise impacts to neighbours
- Maximum speed on site restricted to 20 km/hr
- Construction works will only occur between the hours of 7.00am and 7.00pm Monday to Saturday, with no works occurring on Sundays or public holidays
- Equipment on site will be well maintained and in good operating condition
- All vehicles will be switched off when not in use.

If required, at the request of the City of Kalamunda, a Construction Noise Management Plan may be prepared and implemented (once endorsed).

3.5.3 Disease and Weeds

3.5.3.1 Dieback

The site does not contain any indicative signs that dieback is present. However, in the interest of risk reduction, the following will apply during construction:

- Minimise site entry points to only those necessary
- Ensure all vehicles, tools and contractor footwear are clean upon entry to the site
- All site workers will be made aware of the potential spread of dieback and the requirement to keep machinery, footwear and tools clean
- Any mulch produced will be re-used on site, or, if any mulch is brought into site it will be from a dieback free source.

3.5.3.2 Polyphagous Short-hole Borer

Recently the Perth metropolitan region has experienced an invasion of the polyphagous shot-hole borer (PSHB; *Euwallacea fornicatus*), a beetle native to Southeast Asia which attacks plants by tunnelling into trunks, stems and branches causing structural damage, as well as facilitating the growth of *Fusarium* fungus, which restricts absorption of water and nutrients within the tree. The DPIRD has established a quarantine area, of which the site currently sits within the 'Zone B' area where fewer to no infested plants have been recorded, and maintains a buffer between infested areas and the rest of Western Australia (DPIRD, 2024).

In order to maintain this zone, the following will apply to the site:

- Revegetation plants will only be sourced from within 'Zone B', so as to not risk introduction of the PSHB

- Untreated or unseasoned wood will not be moved outside of the quarantine area (Zone A and Zone B) unless chipped to pieces that are 2.5 cm or less in diameter
- Plant materials, including living plants, that are greater than 2 cm in diameter must not be moved outside of the quarantine area
- Wood, plant materials or living plants can be moved into Zone A
- Any machinery used to handle green waste must be cleaned prior to leaving the quarantine area.

3.5.3.3 Weeds

The site currently contains areas of unmanaged weeds, as well as garden areas of non-native species. The proposed development has the potential to spread weeds via vehicle movements, construction waste movement and foot traffic.

To prevent this, the following management measures are proposed:

- Minimise site entry points to only those necessary
- Ensure all vehicles, tools and contractor footwear are clean upon entry to the site
- Apply appropriate weed control techniques (e.g., no whipper snipping while grass weeds are in seed)

Weed control areas are documented in the proposed FMP. All other weed control will be undertaken as per the landscaping plans.

3.5.4 Access Management

The potential for unauthorised site access may occur.

The site will be securely fenced and locked at the conclusion of each working day to ensure no damage occurs to the site's environment as a result of unauthorised access during construction.

3.5.5 Rubbish Control

Rubbish generated as a result of construction will be removed and disposed of appropriately. As construction nears the creekline, construction fencing to prevent wind-blown materials will be erected to reduce risk of rubbish entering the Crystal Brook.



4 Conclusion

The proposed siting of a resort style living facility for over 55's at Lot 500 Gavour Road, Wattle Grove has been carefully considered to reduce impacts on the environment. The development incorporates retaining areas of higher quality fauna habitat, creekline vegetation/habitat and utilises existing cleared areas to the greatest extent possible.

Management actions proposed as a part of the development, as detailed in this EAR as well as the associated FMP, outline key mitigation strategies to address the key environmental impacts identified (Figure 8).

It is concluded, that based on the nature and extent of the development in conjunction with proposed environmental management actions, that the development does will not result in an unacceptable environmental impact.

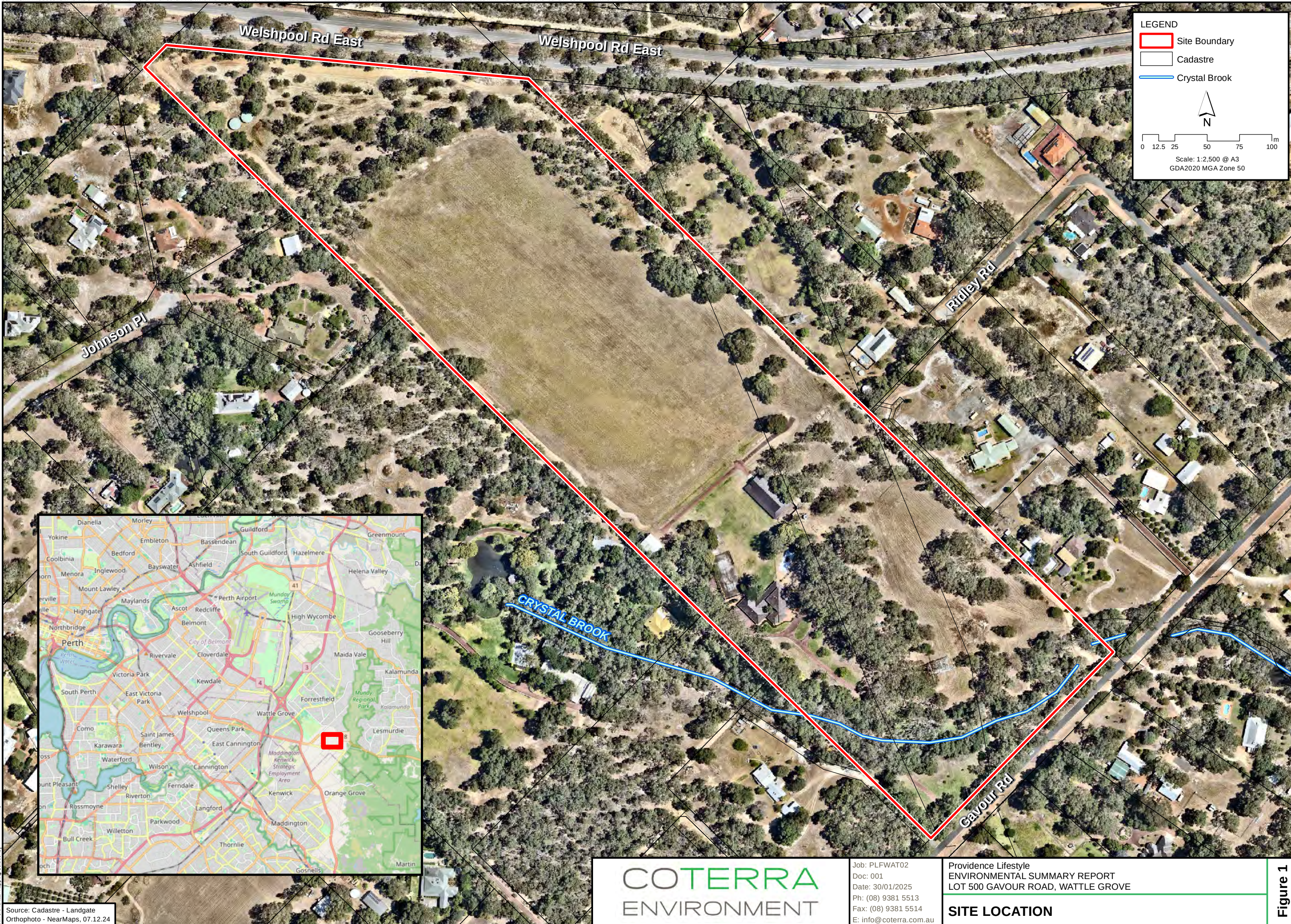
5 References

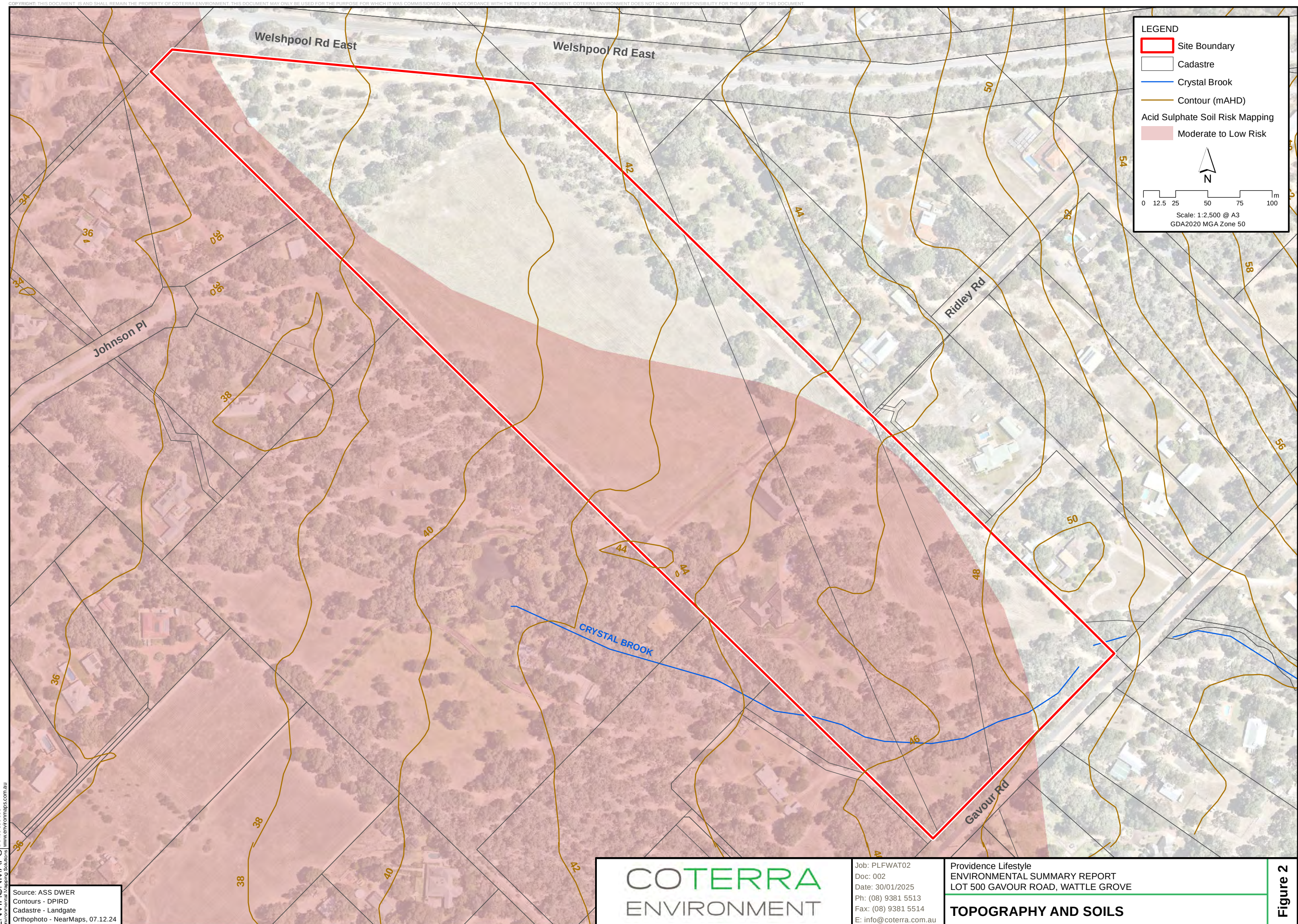
- Bureau of Meteorology (2025). *Climate Data Online*. Australian Government, Canberra, Australian Capital Territory. Available at: [Climate Data Online - Map search \(bom.gov.au\)](https://www.bom.gov.au/ClimateDataOnline/MapSearch/).
- City of Kalamunda (2019). *Local Planning Policy 22 – heritage Area – Welshpool Road East – Avenue of Lemon Scented Gums*. Available via: <https://www.kalamunda.wa.gov.au/our-city/project-details/municipal-inventory-of-heritage-places>
- City of Kalamunda (2025). Intramaps. Available via: <https://maps.kalamunda.wa.gov.au/intramaps22b/>
- Del Marco, A., Taylor, R., Clarke, K., Savage, K., Cullity, J. and Miles, C. (2004). *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*. Perth Biodiversity Project, Western Australian Local Government Association, Perth, Western Australia.
- Department of Agriculture, Water and the Environment (2022). *Referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*. Commonwealth of Australia, Canberra, Australian Capital Territory. Available at: [Referral guideline for 3 WA threatened black cockatoo species \(dcceew.gov.au\)](https://www.dcceew.gov.au/heritage/referral-guideline-for-3-wa-threatened-black-cockatoo-species).
- Department of Environmental Protection (DEP) (2000). *Bush Forever: Volume 2 Directory of Bush Forever Sites*. Government of Western Australia, Perth, Western Australia. Available at: www.wa.gov.au/system/files/2023-06/directory-of-bush-forever-sites-volume2.pdf.
- Department of Primary Industries and Regional Development (2025). *Natural Resource Information (WA)*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Natural Resource Information \(WA\)](https://www.dpir.wa.gov.au/natural-resource-information).
- Department of Primary Industries and Regional development (DPIRD) (2024). *Polyphagous shot-hole borer*.
- Department of Water and Environmental Regulation (2019). *A Guide to the Exemption and Regulations for Clearing Native Vegetation under Part V of the Environmental Protection Act 1986*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [A guide to the exemptions and regulations for clearing native vegetation \(der.wa.gov.au\)](https://www.der.wa.gov.au/publications/a-guide-to-the-exemptions-and-regulations-for-clearing-native-vegetation).
- Department of Water and Environmental Regulation (DWER) (2025a). *Water Register*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Water Register](https://www.der.wa.gov.au/water-register).
- Department of Water and Environmental Regulation (DWER) (2025b). *Perth Groundwater Map*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Perth Groundwater Map](https://www.der.wa.gov.au/perth-groundwater-map).
- Department of Water and Environmental Regulation (DWER) (2025c). *Contaminated Sites Database*. Government of Western Australia, Perth, Western Australia. Available at: <https://www.der.wa.gov.au/your-environment/contaminated-sites>.
- Environmental Protection Authority (2008). *Guidance Statement No.33 – Environmental Guidance for Planning and Development*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [GS33-270508.pdf \(epa.wa.gov.au\)](https://www.epa.wa.gov.au/publications/guidance-statement-no-33).
- Environmental Protection Authority (2021). *Guidance for planning and development: Protection of naturally vegetated areas in urban and peri-urban areas*. EPA, Western Australia.
- Environmental Protection Authority (EPA) (2018). *Environmental Factor Guideline – Inland Waters*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Guideline-Inland-Waters-29062018.pdf \(epa.wa.gov.au\)](https://www.epa.wa.gov.au/publications/guideline-inland-waters).
- Galt Geotechnics (2021). *Geotechnical Study Wattle grove Retirement Village: Lot 500 Gavour Road, Wattle Grove*. Report prepared for Pritchard Francis.
- Government of Western Australia (2003). *A State Water Strategy – for Western Australia*. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/940679.pdf>



- Government of Western Australia (2019). *2018 South West Vegetation Complex Statistics. Current as of March 2019*. WA Department of Biodiversity, Conservation and Attractions, Perth, Western Australia. [Online]. Available at: [DBCA South West Vegetation Complex Statistics - 2018 South West Vegetation Complex Statistics Report - data.wa.gov.au](https://data.wa.gov.au/dataset/dbca-south-west-vegetation-complex-statistics-2018-south-west-vegetation-complex-statistics-report).
- Hedde E. M., Loneragan O. W. and Havel J. J. (1980). *Vegetation of the Darling System*. Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Perth, Western Australia.
- Heritage Council (2025). *inHerit – Our Heritage Places*. Government of Western Australia, Perth, Western Australia. Available at: <http://inherit.stateheritage.wa.gov.au/Public/>.
- Jordan J.E. (1986). *Armada Part Sheets 2033 I and 2133 IV, Perth Metropolitan Region. 1:50,000. Environmental Geology Series*. Geological Survey of Western Australia, Perth, Western Australia.
- Landgate (2025). *Shared Land Information Platform (SLIP) – Locate V5*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Locate V5 \(slip.wa.gov.au\)](https://slip.wa.gov.au/).
- MNG Access (2025). *MNG Maps*. Available at: <https://www.mngaccess.com.au/>.
- PGV (2025). *32 Gavour Road, Wattle Grove – EPBC Referral Advice*. Prepared for Ecofit Homes Pty Ltd.
- Strategen (2014). *Lot 500 Welshpool Road East/Gavour Road Wattle Grove: Local Water Management Strategy*. Report prepared for Retirement Care Pty Ltd.
- Western Australian Planning Commission (2008). *Better Urban Water Management*. Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Better Urban Water Management \(www.wa.gov.au\)](http://www.wa.gov.au/government/publications/better-urban-water-management)
- Western Australian Planning Commission (2021). *Draft State Planning Policy 2.9 Planning for Water*, Government of Western Australia, Perth, Western Australia. [Online]. Available at: [Draft SPP 2.9 Planning for water policy \(www.wa.gov.au\)](https://www.wa.gov.au/government/publications/draft-state-planning-policy-2.9-planning-for-water).
- Western Australian Planning Commission (WAPC) (2006). *State Planning Policy 2.9 – Water Resources*. Government of Western Australia, Perth, Western Australia. Available at: [State Planning Policy 2.9 Water Resources \(www.wa.gov.au\)](https://www.wa.gov.au/government/publications/state-planning-policy-2.9-water-resources).
- Western Botanical (2018). *Reconnaissance Survey of Flora and Vegetation Lot 500 Gavour Road Wattle Grove*. Report prepared for Aquatic Solutions.
- Western Wildlife (2018). *Lot 500 (32) Gavour Road, Wattle Grove*. Report prepared for Aquatic Solutions.

Figures







LEGEND

- Site Boundary
- Cadastre
- Watercourse - minor, non-perennial
- Drain - minor
- Lake - perennial
- Earth Dam

N

0 25 50 100 150 200m

Scale: 1:5,000 @ A3
GDA2020 MGA Zone 50

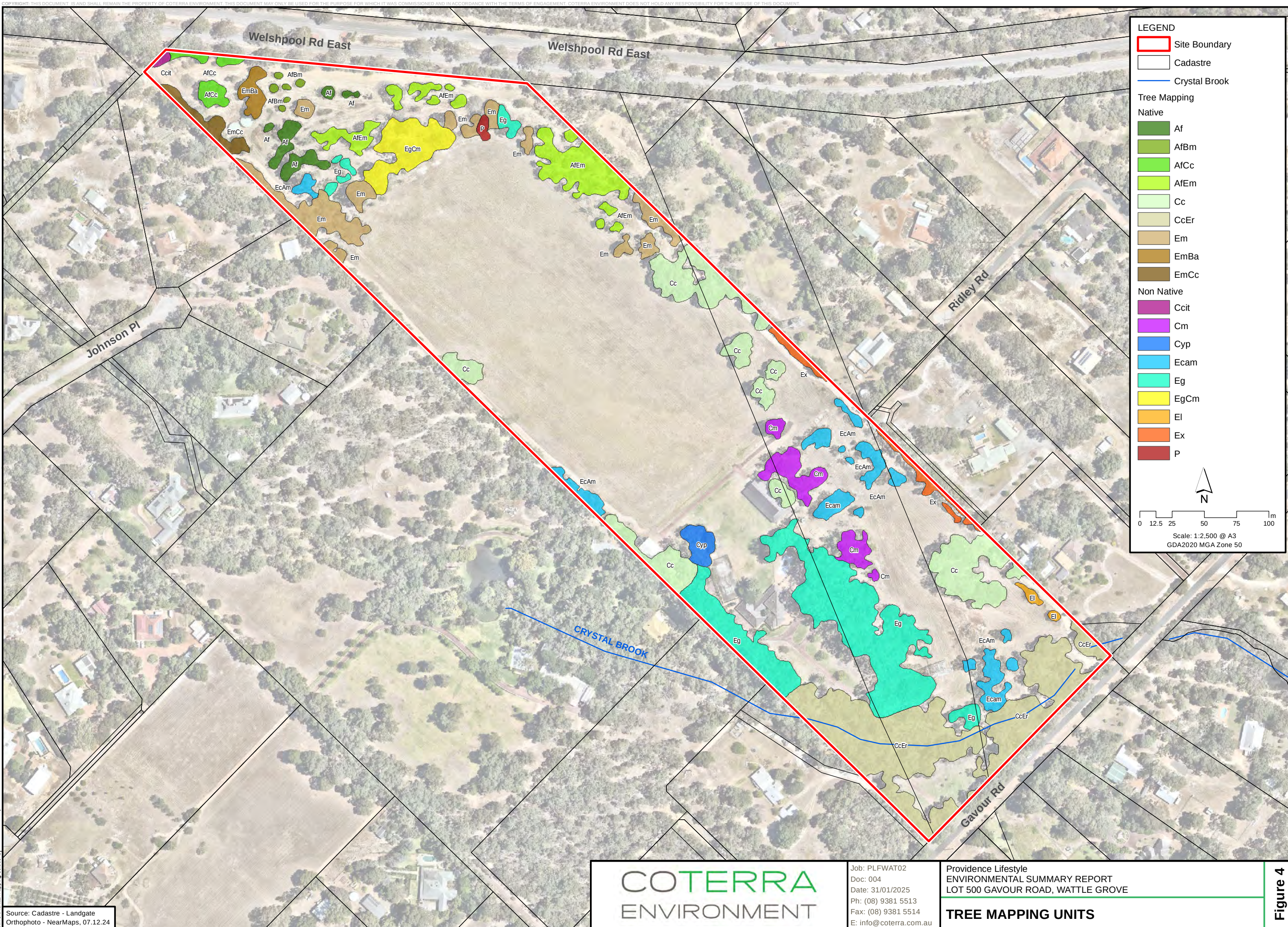
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Cadastre - Landgate
Orthophoto - NearMaps, 07.12.24

Job: PLFWAT03
Doc: 002
Date: 30/01/2025
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Providence Lifestyle
ENVIRONMENTAL SUMMARY REPORT
LOT 500 GAVOUR ROAD, WATTLE GROVE

HYDROLOGY AND WATERWAYS

Figure 3



LEGEND

Site Boundary

Cadastre

Crystal Brook

Tree Mapping

Native

- Af
- AfBm
- AfCc
- AfEm
- Cc
- CcEr
- Em
- EmBa
- EmCc

Non Native

- Ccit
- Cm
- Cyp
- EcAm
- Eg
- EgCm
- El
- Ex
- P

0 12.5 25 50 75 100

Scale: 1:2,500 @ A3
GDA2020 MGA Zone 50

ENVIRONMAPS | t: 0406 590 006
Environmental Mapping Solutions | www.environmaps.com.au

Source: Cadastre - Landgate
Orthophoto - NearMaps, 07.12.24

COTERRA
ENVIRONMENT

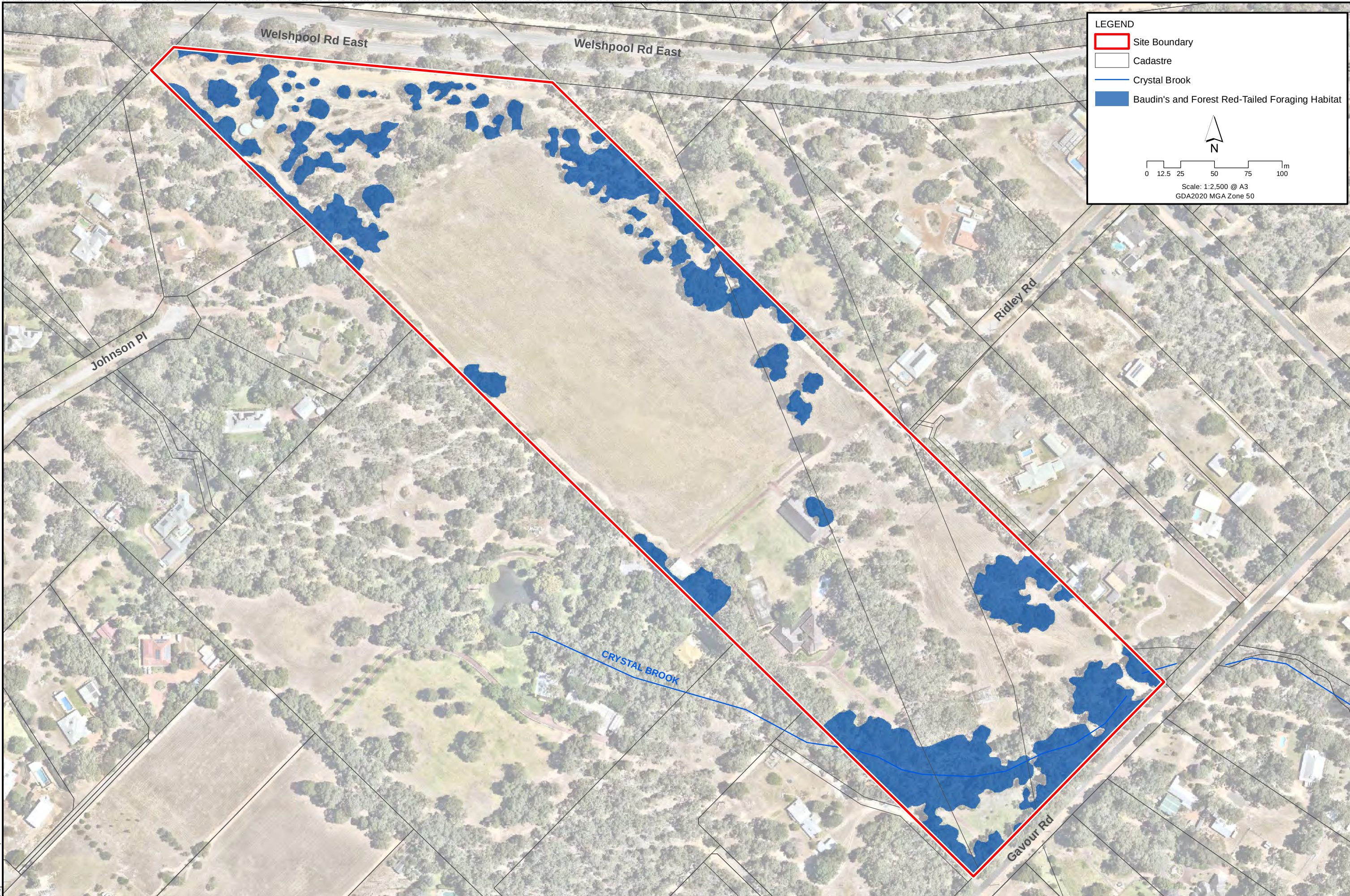
Job: PLFWAT02
Doc: 004
Date: 31/01/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Providence Lifestyle
ENVIRONMENTAL SUMMARY REPORT
LOT 500 GAVOUR ROAD, WATTLE GROVE

TREE MAPPING UNITS

Figure 4





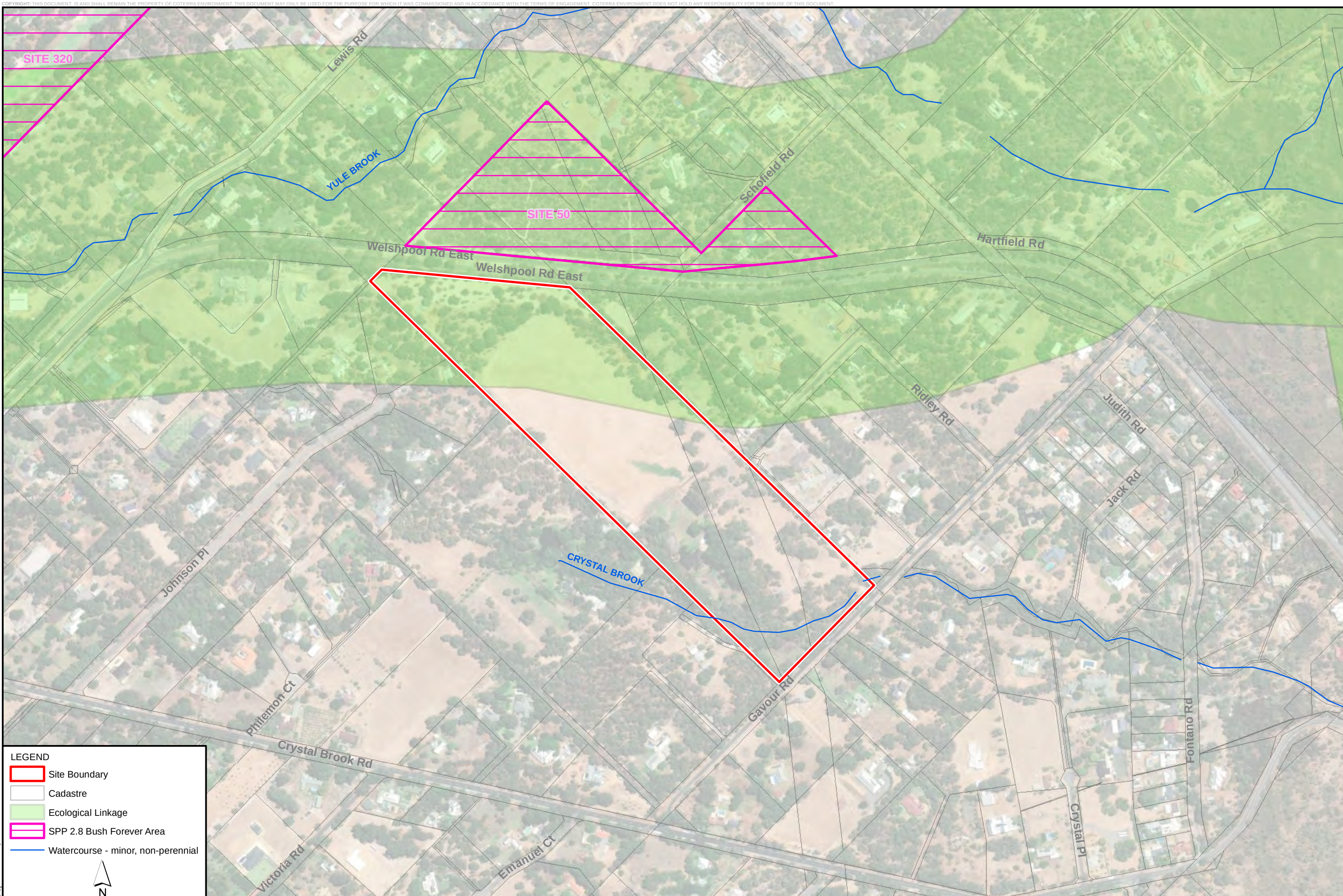
LEGEND

- Site Boundary
- Cadastral
- Crystal Brook
- Baudin's and Forest Red-Tailed Foraging Habitat

N

0 12.5 25 50 75 100m

Scale: 1:2,500 @ A3
GDA2020 MGA Zone 50



LEGEND

- Site Boundary
- Cadastral
- Ecological Linkage
- SPP 2.8 Bush Forever Area
- Watercourse - minor, non-perennial

0 25 50 100 150 200m

Scale: 1:5,000 @ A3
GDA2020 MGA Zone 50

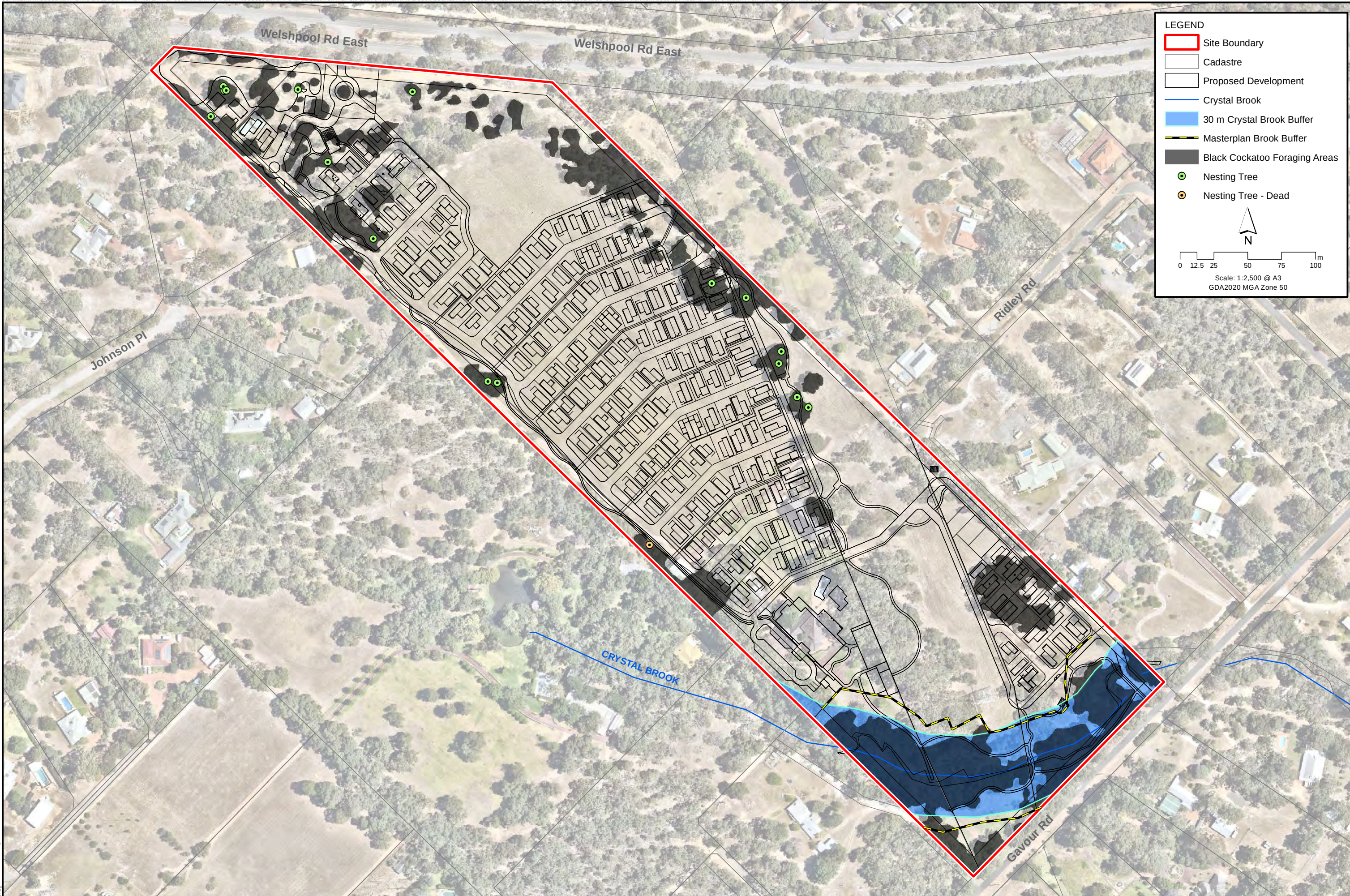
Source: Cadastre - Landgate | Ecological Linkages - WALGA
Bush Forever - DLPH | Orthophoto - NearMaps, 07.12.24

Job: PLFWAT03
Doc: 007
Date: 10/02/2025
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ENVIRONMENTAL SUMMARY REPORT
LOT 500 GAVOUR ROAD, WATTLE GROVE

CONSERVATION AREAS

Figure 7



LEGEND

- Site Boundary
- Cadastre
- Proposed Development
- Crystal Brook
- 30 m Crystal Brook Buffer
- Masterplan Brook Buffer
- Black Cockatoo Foraging Areas
- Nesting Tree
- Nesting Tree - Dead

Scale: 1:2,500 @ A3
GDA2020 MGA Zone 50

Source: Cadastre - Landgate
Orthophoto - NearMaps, 07.12.24
Proposed Development - Richard Hammond, 02.07.25

COTERRA
ENVIRONMENT

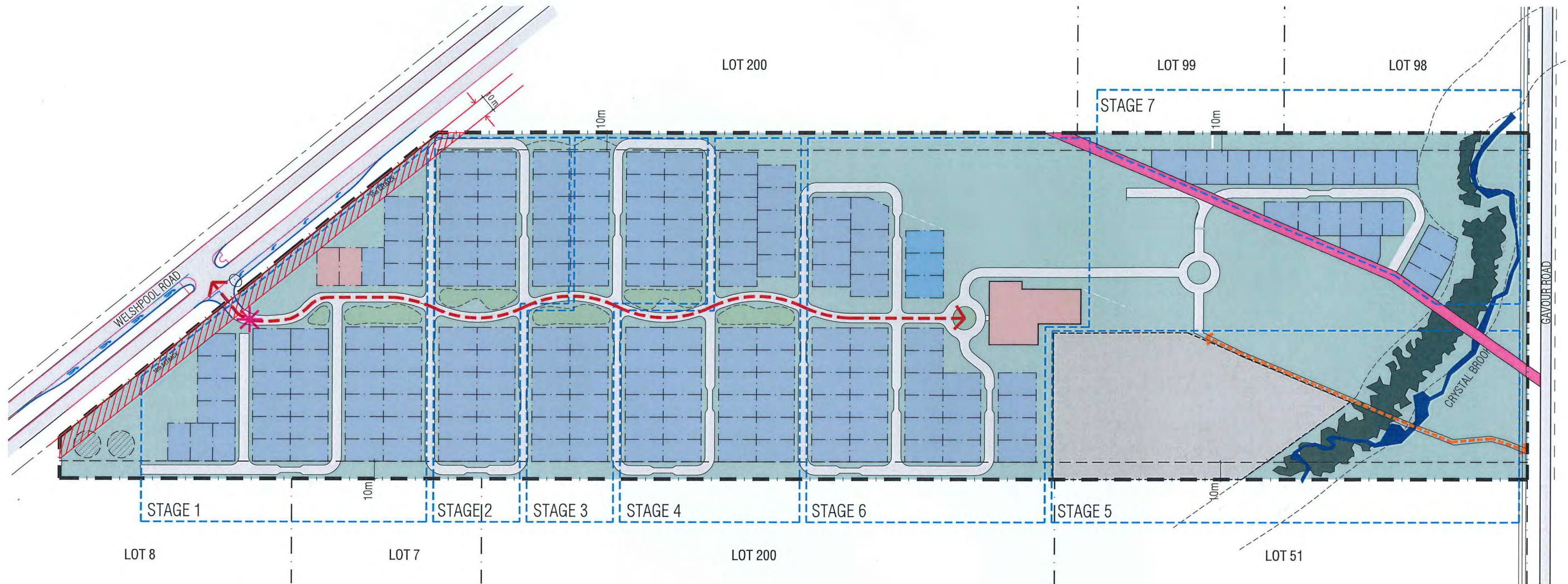
Job: PLFWAT02
Doc: 008
Date: 31/07/2025
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Providence Lifestyle
ENVIRONMENTAL SUMMARY REPORT
LOT 500 GAVOUR ROAD, WATTLE GROVE

KEY ENVIRONMENTAL AREAS

Figure 8

Appendix 1 City of Kalamunda Local Development Plan



LEGEND

- | | | | |
|--|---|--|--|
| | SUBJECT SITE | | CLUBHOUSE |
| | PRIMARY VEHICLE ACCESS ROUTE | | LANDSCAPE ZONES
(REFER TO LANDSCAPE MASTERPLAN) |
| | SECONDARY EMERGENCY ACCESS ROUTE
(EXISTING DRIVEWAY) | | EXISTING VEGETATION TO BE MAINTAINED |
| | ENTRY STATEMENT
(SEE LANDSCAPE MASTER PLAN) | | 10m MINIMUM SETBACK |
| | INDEPENDENT LIVING SITES | | DEVELOPMENT APPLICATION STAGING |
| | AGED CARE FACILITY SITE | | WASTE WATER TREATMENT PLANT |
| | | | POSSIBLE FUTURE PUBLIC ROAD |

LOCAL DEVELOPMENT PLAN PROVISIONS:

This Local Development Plan (LDP) applies to Lot 500 (#32) Gavour Road, Wattle Grove. Unless otherwise varied by this LDP, development proposed shall be designed and assessed in accordance with the City of Kalamunda Local Planning Scheme No. 3, the Special Use zone requirements and any applicable Local Planning Policies. The following design requirements shall apply in conjunction with the requirements annotated on the plan:

1. Staging of development should be undertaken as generally shown on the LDP.
2. No development is to occur within the 80m wide Western Power easement other than landscaping, communal facilities (including caravan/boat parking, gardens/orchards, tennis courts, bowling green, etc) and vehicle access ways.
3. Fencing along the Welshpool Road property boundary and entry statement should be detailed in the Stage 1 Development Application.
4. Fencing along all other property boundaries is to be of post and wire construction.
5. Vehicle access to Welshpool Road and traffic issues should be assessed through a Traffic Impact Assessment at Development Application stage(s).
6. No development other than vehicle and pedestrian access ways permitted in areas in excess of BAL-29 bushfire zones (refer BAL Contour Plan and Bushfire Management Plan).
7. A Bushfire Management Plan is to be submitted with each Development Application for the relevant stage(s).
8. The Aged Care Facility is to be maximum two storey in height and detailed at the relevant Development Application stage.
9. The secondary vehicle access way to Gavour Road is for emergency access only and can be used by construction vehicles during staged development.
10. Landscaping areas are to be generally in accordance with the Landscape Master Plan. Further detail is required for landscaping at the relevant Development Application stage.
11. Rehabilitation of the Crystal Brook vegetation environment is to be detailed at the relevant Development Application stage. Existing vegetation associated with Crystal Brook to be retained where possible.

This Local Development Plan has been adopted by the City of Kalamunda in accordance with Clause 6.2.6 of Local Planning Scheme No. 3.

LDP APPROVAL NOTES:

1. An independent Road Safety Audit of the entry point at Welshpool Road East is to be conducted and any resultant road design adjustments made to the median and slip lane based on the recommendations of the Road Safety Audit prior to the lodgement of the Stage 1 development application. Any proposed works in relation to this will need to be undertaken at the time of implementation of Stage 1 of the development at the Applicant's cost.
2. The requirements of the Department of Fire and Emergency Services shall be addressed at Stage 1 of the development application process.
3. The 'future possible public road' identified on the Local Development Plan is subject to further investigation as part of any future Structure Planning for the area and surrounding land as required by Table 7: Implementation actions of the North East Subregional Planning Framework (2018) of the Western Australian Planning Commission.

Signature

Date

MJA studio

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Before any construction, alteration or other work is commenced the contractor must check all drawings and specifications against the latest of the drawings and to verify the responsibility of any discrepancies or omissions which will prevent or inhibit the satisfactory completion of the work. Details indicated on this document apply only to this project. Such details must be checked and verified in the field before any work is commenced and any discrepancies must be reported to the person responsible for the original design. Copyright in this drawing is reserved by MJA Studio and must not be reproduced or republished without their written permission. This is a CAD drawing. All rights reserved.

REV.	DATE	AMENDMENT	INIT.
-	23.05.18	ISSUE FOR SUBMISSION	SB
-	12.11.18	UPDATED ISSUE	SB
-	14.12.18	UPDATED ISSUE	SB
-	07.02.19	UPDATED ISSUE	SB
-	04.06.19	UPDATED ISSUE	JL

REV.	DATE	AMENDMENT	INIT.

CLIENT

R. LEIGHTON

PROJECT

WATTLEGROVE RETIREMENT
PROJECT ADDRESS
LOT 500 GAVOUR RD
WATTLE GROVE

MJA PROJECT NUMBER

18002

PROJECT STATUS

LDP APPLICATION

TRUE NORTH



SCALE

1:1000 @ B1

PROJECT NORTH



0 10 20 50

DRAWING

LOCAL DEVELOPMENT PLAN

DRAWING NO.

A1.01

DRAFTER

SB

CHECKED

WB

REV.

-

Appendix 2 Site Masterplan

Appendix 3 Geotechnical Investigation (Galt, 2021)

A large, decorative graphic on the left side of the page, consisting of a blue area with a green curved border that tapers towards the bottom right.

Report on

GEOTECHNICAL STUDY

WATTLE GROVE RETIREMENT VILLAGE

LOT 500 GAVOUR ROAD

WATTLE GROVE

Submitted to:

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J2101290 001 R Rev0

21 December 2021

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FIGURES

FIGURE 1:	SITE AND LOCATION PLAN
FIGURE 2:	SITE CLASSIFICATION PLAN

APPENDICES

APPENDIX A:	SITE PHOTOGRAPHS
APPENDIX B:	CONE PENETRATION TEST RESULTS
APPENDIX C:	BOREHOLE REPORTS
APPENDIX D:	PERTH SAND PENETROMETER TEST RESULTS
APPENDIX E:	LABORATORY TEST RESULTS
APPENDIX F:	UNDERSTANDING YOUR REPORT

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics Pty Ltd's (Galt's) geotechnical study for the proposed retirement village on Lot 500 Gavour Road, Wattle Grove (the "site"). The location of the site relative to the surrounding area is shown on Figure 1, Site and Location Plan.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Based on the supplied information, the site covers a total area of about 15.2 ha. It is bounded by Welshpool Road to the north, Gavour Road to the southeast and rural lots on the other sides.

The site is currently vegetated with spreads of mature trees in the north and south with a large, grassed area (pasture) in the middle. There is a creek near the southeast boundary. There is a Western Power easement crossing the site in a roughly north-south alignment. We note that much of the central vegetation comprises mature trees with presumably large root systems.

We noted that many of the existing internal roads/driveways and slabs have substantial cracking that appears to be a result of shrink-swell movements and tree roots. There are some cracks in the existing buildings that may be due to ground movements.

The surface levels range from about RL 35 m AHD in the northwest to about RL 50 m in the southeast corner.

We understand that the proposed development will comprise:

- ✿ a retirement village with around 220 units;
- ✿ aged care facility in the southeast (covering about 1.3 ha);
- ✿ an apartment facility;
- ✿ a community centre;
- ✿ a combined easement/POS/sewage effluent treatment and disposal area (land application area); and
- ✿ various roads and other minor infrastructure.

We also understand that there will be an intersection at the entrance on Welshpool Road.

The site will be serviced by reticulated sewerage, which will be pumped by a small wastewater pump station to an on-site wastewater treatment plant. We understand sewer trenches will be less than 2 m deep. Treated effluent will be discharged on a land application area (LAA) within the power line easement.

We understand that the lots (typically ~200 m²) would be developed with single or double storey residential type structures. The aged care facility, apartment building and community centre may be up to 3 storeys high. Basements are not anticipated.

3. PROJECT OBJECTIVES

The objectives of the study were to:

- ✿ Provide guidance on preparation of soil under pavements, roads and car parking areas, including CBR for design purposes.
- ✿ Provide design parameters for retaining structures and batter slopes.
- ✿ Provide design parameters for shallow foundations (strip and pad footings) including allowable bearing pressures and settlement estimates.
- ✿ Provide a site classification/s to AS 2870-2011 in its current condition.

- ✦ Specify remediation works / fill requirements to ensure that the site will have a site classification of A or S if applicable.
- ✦ Describe subsurface soil conditions, soil properties, ground water level and comment on optimum finished ground level and how it may influence the design and construction of foundations.
- ✦ Provide guidance for on-site storm water disposal by infiltration including design permeability rates.
- ✦ Provide advice on site preparation, compaction, re-use of in situ soil including collapsing potential.
- ✦ Comment on topsoil re-use and blending requirements.
- ✦ Comment on possible presence of shallow rock / limestone.
- ✦ Conduct a desk study assessment and comment on the possible presence of acid sulphate soils (ASS) and other environmentally sensitive issues apparent from geotechnical investigation that may need further detailed investigation.
- ✦ Advise on design permeability rates for the on-site disposal of treated effluent.
- ✦ Provide any other information deemed necessary for development.

4. FIELDWORK

The fieldwork was carried out on 16, 17 and 18 November 2021 and comprised:

- ✦ a walkover and inspection of the site including taking photographs;
- ✦ cone penetration tests at 9 locations (CPT01 to CPT08 and CPT10), extending to depths of between 1.0 m and 6.2 m;
- ✦ drilling of boreholes at 27 locations (BH01 to BH27), extending to depths of between 1.3 m and 3.0 m;
- ✦ installation of slotted PVC standpipes in 3 of the boreholes for ongoing groundwater level measurement (BH11, BH17 and BH24) at a depth of between 2.4 m and 2.8 m below current ground level;
- ✦ Perth sand penetrometer (PSP) testing adjacent to each borehole, extending to depths of up to 1.0 m;
- ✦ infiltration tests using the “inverse auger hole” technique at 9 locations (IT01 to IT09) at a depth of about 1 m below ground level in each instance; and
- ✦ constant head permeability testing using a Guelph permeameter at 5 locations (P01 to P05), at depths of about 0.5 m below ground.

General

Test locations were selected and positioned by a geotechnical engineer from Galt. The geotechnical engineer conducted the walkover and inspection of the site, observed the CPTs, drilled the auger boreholes and logged the materials encountered, and performed the penetrometer, permeability and infiltration tests.

The approximate test locations are shown on Figure 1, Site and Location Plan. Photographs of the site taken during the fieldwork are presented in Appendix A, Site Photographs.

Cone Penetration Tests

Cone penetration tests (CPTs) were undertaken using a 12-tonne truck-mounted CPT rig supplied and operated by Probedrill Pty Ltd. The results of the CPTs are provided in Appendix B, Cone Penetration Test Results along with a method of interpretation proposed by Robertson et al (1986)¹.

The CPTs were pre-drilled (through gravelly soils) to the depths as noted on the CPT reports.

¹ Robertson, P.K., Campanella, R.G., Gillespie, D. and Grief, J. (1986) “Use of Piezometer Cone Data”.

Boreholes

Boreholes were drilled using a utility mounted Melville drill rig equipped with a 90 mm diameter solid auger. The drill was supplied and operated by Galt Borehole reports including a list of notes and abbreviations and the method of soil description used on the reports are included in Appendix C, Borehole Reports.

Perth Sand Penetrometer Tests

Perth sand penetrometer (PSP) tests were conducted in accordance with AS 1289.6.3.3 although to a greater depth than the 0.45 m covered by the standard, and blow counts were recorded in 0.15 m intervals. Results of the PSP testing are presented in Appendix D, Perth Sand Penetrometer Test Results.

Constant Head Permeability Tests

Constant head permeability tests were carried out at a depth of 0.50 m in each instance. The results of the Constant head permeability tests are presented below.

Table 1: Constant Head Permeability Test Results

Test Location	Description	Depth (m)	Saturated Hydraulic Conductivity, k (m/day)
P01	Gravelly SAND	0.50	0.58
P02	Clayey SAND	0.50	0.40
P03	Clayey SAND	0.50	0.79
P04	SAND	0.50	0.04
P05	Silty SAND	0.50	0.56

Infiltration Tests

Infiltration tests were carried out using the 'inverse auger hole' method described by Cocks². The results of the infiltration testing are presented below.

Table 2: Infiltration Test Results

Test Location	Description	Pipe Embedment (m)	Minimum Unsaturated Conductivity, k (m/day)
IT01/BH02	SAND	1.03	7.0
IT02/BH03	SAND	0.85	>15
IT03/BH04	SAND	1.07	11.5
IT04/BH05	Gravelly SAND	0.85	2.6
IT05/BH06	Gravelly SAND	1.03	1.9
IT06/BH07	Gravelly SAND	1.03	2.5
IT07/BH08	Clayey SAND	0.90	0.8
IT08/BH12	Sandy GRAVEL	0.73	3.5
IT09/BH22	SAND	0.95	3.4

5. LABORATORY TESTING

Laboratory testing was undertaken by Western Geotechnical & Laboratory Services (WGLS) in their NATA accredited laboratory. Testing comprised determination of:

- ☞ particle size distribution on 11 samples;
- ☞ Atterberg limits and linear shrinkage on 3 samples;

² Cocks, G (2007), "Disposal of Stormwater Runoff by Soakage in Perth Western Australia", Journal and News of the Australian Geomechanics Society, Volume 42 No. 3, pp 101-114.

- dry density-moisture content relationship on 2 samples;
- California bearing ratio (CBR) on 2 remoulded samples;
- organic content on 3 samples
- pH, electrical conductivity, sodicity, phosphorous retention index and Emerson class number on 4 samples.

The results of the tests are presented in Appendix E, Laboratory Test Results, and summarised in the tables below.

Table 3: Summary of Chemical Laboratory Test Results

Test Location	Depth (m)	Phosphorous Retention Index (PRI)	Emerson Class Number	pH	Electrical Conductivity (µS/cm)
BH15	0.2-0.6	13.3	5	7.7	21
BH21	0.2-0.7	20.4	5	6.1	41
P01	0.35-0.5	11.0	5	6.2	15
P02	0.35-0.5	35.1	5	4.8	86

Table 4: Summary of Physical Laboratory Test Results

Test Location	Depth (m)	Gravel (%)	Sand (%)	Fines (%)	LL (%)	PI (%)	LS (%)	MMDD (t/m³)	OMC (%)	CBR (%)	CBR Swell (%)	Organic Content (%)
BH03	0.1-0.5	0	94	6				1.82	11.0	16	0	
BH05	0.3-0.8	37	51	12								
BH08	0.1-0.4	9	82	9								1.7
BH10	0.7-1.3	55	34	11								
BH11	0.8-1.4	44	39	17	26	11	6.0					
BH20	0.6-1.2	18	56	26	30	15	5.0					2.9
BH21	0.2-0.7	9	68	23								
BH22	0.1-0.4							2.07	7.0	60	0.0	
BH24	2.2-2.6	26	37	37	38	25	10.0					
P01	0.35-0.5	37	55	8								
P02	0.35-0.5											1.7

Notes: LL – Liquid Limit PI – Plasticity Index LS – Linear Shrinkage
MMDD – Maximum Modified Dry Density OMC – Optimum Moisture Content
CBR – California Bearing Ratio (4 day soak, sample compacted to 95% MMDD, saturated, 4.5 kg surcharge)

6. SITE CONDITIONS

6.1 Geology

The Armadale sheet of the 1:50,000 scale Environmental Geology series map indicates that the area is underlain by the following soil units:

Northern part and northeastern boundary: Gravelly SILT – strong brown, tough, common pebbles of fine to coarse grained, subrounded granite, some dolerite and rare sandstone, variable sand content;

Southern part: SAND – structureless, yellow, fine-grained, subangular and medium to coarse grained subrounded to rounded quartz, feldspar and heavy minerals common, minor silt and clay;

Northwestern part: Bassendean Sand overlying sandy clay to clayey sand of the Guildford Formation.

The ground conditions at the north are in general accordance with geological mapping, but the balance of the site was noted to comprise gravelly and clayey sand soils in contrast to the mapping. In the south and southeast of the site the fines content appears to increase with depth, while the gravel content decreases with depth.

6.2 Subsurface Conditions

The subsurface conditions at the site are highly variable, but can be summarised as comprising:

North Area (BH01-BH04)

- ✦ SAND (SP) – fine to coarse grained, sub-angular to sub-rounded, pale brown becoming yellow-brown, trace fines, trace rootlets in top 100 mm, typically loose becoming medium dense below about 1 m to 2 m depth, dry becoming moist with depth, present to the maximum investigated depth of 3 m.

Balance of Site

- ✦ SAND/Gravelly SAND (SP-SC) – fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, with fines, with gravel, dry, dense to very dense, present to typical depths of between 0.5 m to 1.5 m; overlying
- ✦ Gravelly Clayey SAND (SC)/Clayey SAND (SC) – fine to medium grained, sub-angular to sub-rounded, brown to orange, 15-20% low to medium plasticity fines, pisolitic gravel, moist, stiff to very stiff, present to depths of between 1.5 m to greater than 3 m; overlying
- ✦ Sandy CLAY/Gravelly CLAY/CLAY (CL-CH)/ – low to medium plasticity, becoming high plasticity with depth, brown, pisolitic gravel, 10-30% sand, moist, very stiff, present to the maximum investigated depth of 6.2 m.

- Notes:**
1. Soil descriptions below 3.0 m are based on interpretation of CPT data in accordance with Robertson et al (1986).
 2. An approximate delineation of these zones is given on Figure 2, with the north area being referred to as the “Class A” area and the balance of the site “Class S”, as discussed later in this report.

6.3 Groundwater

The Perth Groundwater Atlas (2004) shows the summer groundwater level to be around RL 17 m AHD. This is about 18 m below the lowest part of the site. Shallow perched groundwater is, however, likely during winter.

We encountered water at three CPT locations, at the following depths:

- ✦ CPT01 – 4.8 m
- ✦ CPT03 – 2.2 m
- ✦ CPT07 – 5.2 m

The water encountered is assumed to be perched water on impermeable layers. Standpipes were installed at 3 locations, as previously discussed. We recommend that the perched water levels in these standpipes are monitored over Winter 2022 to determine the likelihood of water impacting on both design and earthworks.

7. GEOTECHNICAL ASSESSMENT

7.1 Key Outcomes

The key outcomes of the investigation are:

Variable Geological Conditions

The site appears to be at the interface of two geological processes:

- ✦ A Bassendean dune system, deposited by aeolian processes over Guildford Formation soils at the north of the site; and

- Colluvial/alluvial deposition of weathered rock at the south of the site (towards the Darling Scarp) resulting in variable gravel/sand/fine contents.

The result is two distinct areas, with a “mottled” central zone. For the purposes of design, we consider that the sandy area at the north can be treated as “Class A” area (AS2870-2011), while the balance of the site is a “Class S” area. This is shown on Figure 2 and discussed in Section 7.2.

In addition, to the Site Classification differentiation, the sandy northern soils are considered relatively permeable, while the soils across the balance of the site are less permeable to impermeable. Careful design of drainage for this area will be required.

Loose Sand at the Northwest

Based on the results of our PSP testing, there appears to be loose sand to a depth of up to 2 m at the northwest (BH01 and BH02). Additional over-excavation may be required during earthworks here. We suggest that at the beginning of earthworks:

- A geotechnical engineer attends site and carries out extended PSP testing across the area to determine the physical extent and depth of loose sand.
- The contractor over-excavates to a depth of 0.5 m above the top of the loose layer.
- The loose sand is proof compacted, and the excavated material replaced in 0.3 m layers to the proposed finished level.

This additional assessment would only be required if development for structures or pavements is proposed. Landscaped areas or stormwater disposal areas would not require this additional preparation.

7.2 Site Classification

We consider that the site is geotechnically capable of supporting the proposed development.

We have assessed the site classification in accordance with AS 2870-2011 “Residential Slabs and Footings”. Two areas have been delineated, and are shown on Figure 2, Site Classification Plan. The northern area as shown is considered to be “Class A”, and the balance of the site considered to be “Class S”.

These classifications are provided under the assumption that normal site preparation as presented in Section 7.4 is undertaken prior to construction.

The “Class S” area may be improved to “Class A” where there is a minimum of 1.8 m of inert sand. In this case, we do not consider that the in situ material is inert (due to elevated fines contents) and it will not contribute to the inert thickness (i.e. the inert sand layer would have to comprise entirely imported fill).

- Notes**
1. AS 2870 is limited to single and double storey residential buildings with normal shallow footings with a maximum bearing pressure of 100 kPa and is not strictly applicable for the proposed multi-storey development.

7.3 Site Subsoil Class

We have assessed the site subsoil class in accordance with AS 1170.4-2007, “Earthquake Design Actions in Australia”. We consider that a site subsoil class of “Ce” is appropriate for the site.

7.4 Site Preparation

The site preparation measures outlined below are required prior to construction of structures including on-ground slabs, shallow footings, retaining walls and pavement subgrades. Landscaped areas (if any) will not require this preparation.

- ✦ Demolish existing structures and pavements, including removal of all buried services and footings and dispose off-site.
- ✦ Remove any demolition debris and other deleterious material from site including old footings, slabs, soak wells, buried services, paving and building rubble.
- ✦ Strip any uncontrolled fill from the site (where encountered) and, if suitable, stockpile it for potential re-use as non-structural fill. If contaminated, dispose off-site. We did not encounter uncontrolled fill during the investigation.
- ✦ Strip and stockpile topsoil from unpaved areas of the site for potential re-use in non-structural applications or for possible processing and blending with clean sand. The topsoil strip is only necessary to remove roots and we recommend a 100 mm topsoil strip or as otherwise necessary to remove all roots from the soil. All tree roots must be removed, this may result in significant excavation in places.
- ✦ Excavate to the required level. Stockpile suitable excavated material for potential re-use as fill (see Section 7.7) and remove unsuitable or excess material off-site.
- ✦ Moisture condition and compact the exposed sandy ground to achieve the level of compaction specified in Section 7.6 as follows:
 - “Class A” (sand) areas: to a depth of at least 0.9 m (taking into account the need to delineate loose zones below structural areas as discussed in Section 7.1 and below);
 - “Class S” (gravelly sand, etc) areas: to a depth of at least 0.3 m.
- ✦ Any areas of loose sand or unsuitable material must be removed and replaced with approved fill as outlined in Section 7.7.
- ✦ Where fill is required to build up levels, use approved fill (see Section 7.7), placed and compacted in layers of no greater than 300 mm loose thickness.
- ✦ Excavate for pad and strip footings and compact the exposed bases to achieve the density specified in Section 7.6 to a depth of at least 0.9 m (“Class A” zone) or 0.3 m (“Class S” zone) below the underside of all footings. Remove, replace and compact as required with approved fill any zone not compacted as specified in Section 7.6.

Northern Area (BH01-BH02) and Surrounds

- ✦ A geotechnical engineer should attend site to carry out extended PSP testing (depth of up to 3 m) to determine the depth of loose sand in this area, and the physical extent of this area.
- ✦ Over-excavate to a depth of 0.5 m above the loose sand (once determined by the geotechnical engineer), and proof compact to meet the level of compaction specified in Section 7.6.
- ✦ Replace and compact the excavated sand in loose layers not greater than 0.3 m loose thickness, to the level of compaction Specified in Section 7.6.

7.5 Drainage Control

In addition to the site preparation measures outlined in Section 7.4 we recommend careful control of surface water and stormwater to minimise the likelihood of clayey soils decreasing in strength and affecting the installed infrastructure. These measures include:

- ✦ The ground surface of clayey soils should be graded to drain any seepage away from structures and prevent standing water over the clayey soils. A grade of at least 1% is recommended.

- ☞ Pavements should be sealed to minimise water ingress.
- ☞ Stormwater disposal swales and basins should be located at least 10 m away from buildings, retaining walls and pavements.
- ☞ Runoff from hardstandings and pavements must either be collected and discharged via pipes into discrete locations (via swales or soakage basins) at least 10 m away from structures and pavements or alternatively discharged over a wide area, but not allowed to collect and discharge into concentrated areas, particularly near structures and pavements.
- ☞ Spoon drains should be used to collect water at the crest of slopes to capture surface runoff and direct it away from running directly down slopes or seeping into the ground behind slopes.

It may be beneficial to avoid carrying out earthworks in Winter and early Spring, when there may be perched layers of water. As discussed in Section 6.3, we recommend ongoing monitoring of perched water levels to determine what impact these might have on earthworks and design.

7.6 Compaction

The density and testing requirements are summarised below:

Table 5: Summary of Compaction Requirements

Soil Description	Soil Particle Limits	Where Present	Density Requirement (DDR)	QA/QC Test Method
Import Sand	<5% fines <5% gravel	Fill	95% MMDD	PSP
Import Gravel	<5% fines	Fill	95% MMDD	NDG
Natural Sand	<5% fines	"Class A" Sand Area	95% MMDD	PSP
Natural Sand with fines	<12% fines	"Class S" Area (Most of site)	95% MMDD	NDG Method Specification
Gravelly Soils	>5% Gravel	"Class S" area, typically at ~1 m depth	95% MMDD	NDG Method Specification
Clayey Soils	>12% fines	Typically, >1 m depth	92% MMDD; or 95% SMDD	NDG

Notes: 1. Fines – Material passing the 0.075 mm sieve. Gravel – Material retained on the 2.36 mm sieve.
 2. DDR – Dry Density Ratio
 3. MMDD – Modified maximum dry density SMDD – Standard maximum dry density
 4. PSP – Perth Sand Penetrometer NDG – Nuclear Density Gauge

Density Requirements

The following density requirements apply:

- ☞ Imported granular fill – 95% MMDD
- ☞ In situ sandy soils (i.e., the majority of the site surface), including with fines or gravel – 95% MMDD
- ☞ Natural clayey soils (if re-worked) – 92% MMDD or 95% SMDD

The SMDD/MMDD must be determined in accordance with AS1289.5.1.1/AS1289.5.2.1. Compaction of all soils must be carried out using suitable compaction equipment when the soil is at a moisture content of within 2% of the optimum moisture content.

Nuclear Density Gauge Testing

If a PSP cannot be used because the soil is unsuitable (>5% fines or >5% gravel), or there are issues with PSP testing, then compaction control must be done using a nuclear density gauge (NDG) in accordance with AS1289.5.8.1. NDG tests must be done to a depth of 0.3 m.

An NDG should be used on all in situ soils given the high variability of the natural sandy soils (including variable fines content).

Method Specification

Given that we do not recommend the use of a PSP for the testing of most of the in situ sand, we understand that the required NDG testing frequency may be quite high. We consider that the existing surface may be prepared using a method specification, provided that:

- ✦ The method specification is developed with a geotechnical engineer present on site.
- ✦ NDG testing is done during the trial:
 - Every 2 passes
 - Minimum 4 locations
- ✦ Method specification compliance is maintained for all prepared areas on a minimum 20 m grid, with compliance to include:
 - Roller used (weight, style, vibration)
 - Water application rate (per lift)
 - Layer thickness placed
 - Number of passes with roller

Perth Sand Penetrometer Testing

Where clean sand is used (<5% fines and <5% gravel), a Perth sand penetrometer (PSP) may be used for compaction control in accordance with AS1289.6.3.3. A PSP must not be used as the primary means of verifying the compaction of the in situ sand in the "Class S" area. The following minimum blow counts may be assumed to correlate to a DDR of 95% MMDD for any imported sand fill:

- ✦ Depth range 0 m to 0.15 m: SET
- ✦ Depth range 0.15 m to 0.45 m: 8 blows
- ✦ Depth range 0.45 m to 0.75 m: 10 blows
- ✦ Depth range 0.75 m to 1.05 m: 12 blows (or 6 blows for depth range 0.75 m to 0.9 m)

If difficulties are experienced recording the required blow counts, a site-specific PSP correlation should be carried out to determine the PSP blow count correlating to a DDR of 95% MMDD. In addition, a particle size distribution (PSD) test should be done to verify that the use of a PSP is suitable for the sands being tested. A site-specific PSP correlation must:

- ✦ be done on site;
- ✦ use the nuclear density gauge (NDG) to determine density at a minimum of 5 points with varying density to a depth of 300 mm below surface;
- ✦ include at least 1 point where the dry density ratio is in excess of 95% MMDD;
- ✦ use a calibrated PSP to determine the PSP blow count from 150 mm to 450 mm at each of the NDG test points; and
- ✦ be plotted on a chart of PSP blow count vs DDR.

Testing Frequency

After compaction, verify that the required level of compaction has been achieved by testing at the base of excavation and through the full depth of any fill, and to a minimum depth of 0.9 m (or 0.3 m if an NDG is used). The frequency of testing should be as follows:

- ✦ on each lift of fill at the rate of 1 test per 500 m³ or at least 2 tests per layer (4 tests per layer below the building footprint), whichever is greater;
- ✦ At each spread footing location;
- ✦ at 5 m centres along gravity retaining wall footings and strip footings (where present); and
- ✦ at 10 m centres below on-ground slabs and pavements.

The above testing does not apply for the in situ soils where a method specification is used.

General

Over-excavation and replacement of loose material must be done where the minimum DDR cannot be achieved.

Fill must be placed in horizontal layers of not greater than 0.3 m loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

Care will need to be taken if compacting in the vicinity of existing structures, such as the adjacent properties. This is particularly important if vibratory compaction is being carried out. Tynan (1973)³ provides guidance on the selection of compaction equipment for use adjacent to structures.

Large compaction equipment (self-propelled vibrating rollers, etc.) must not be used within 2 m behind retaining walls. Hand compaction plant (e.g., plate compactors) must be used.

7.7 Approved Fill

Imported granular fill must comply with the material requirements as stated in AS 3798-2007, "Guidelines on Earthworks for Commercial and Residential Developments".

Generally, the sandy soils at the site are considered suitable for re-use as structural fill, but we note that they may have a fines content greater than 5% and be relatively impermeable compared to clean sand fill.

Any other structural fill must meet the following requirements:

- ✦ Must not contain any putrescible deleterious inclusions or rubbish.
- ✦ Organic content must be less than 2% by weight.
- ✦ Must not contain any particles greater than 100 mm in size.
- ✦ Fines content of less than 5% ("Class A" area, 12% in "Class S" area).
- ✦ Minimum required saturated hydraulic conductivity (k) when compacted to 100% MMDD (if stormwater disposal is proposed, i.e., k=5 m/day if used in design).

The existing topsoil is shown to have an organic content of ~4%. We recommend that the topsoil (typically ~100 mm thick, although elevated fines contents may be found up to ~0.3 m deep) is re-used in non-structural areas. If it is proposed to be blended for re-use as structural fill, blending trials should be carried out to confirm the required blending ratio to consistently meet the organic content requirements. We would also recommend that the topsoil is screened

³ Tynan (1973) Ground Vibration and Damage Effects on Buildings, Australia Road Research Board, Special Report No. 11.

prior to re-use. An indicative blending ratio of 2:1 (parts clean import sand to screened topsoil) may be assumed for design purposes.

Where doubt exists, a geotechnical engineer must be engaged to inspect and approve the use of potential fill materials.

7.8 Excavations and Slopes

Based on the soil profile encountered, we consider that excavation should be readily achieved to a depth of at least 2.5 m using conventional earthmoving equipment (i.e., with a 15 tonne or larger excavator with a toothed bucket). The possible presence of obstructions such as buried services, cemented layers, old footings and slabs must be taken into account when selecting excavation equipment. We note that cemented horizons were encountered in the "Class S" area.

Excavations in sand are prone to instability unless support is provided. Care must be exercised in such excavations and appropriate safety measures adopted where necessary, particularly in the vicinity of existing structures and infrastructure.

Excavations must be battered at slopes no steeper than 1V:2H for temporary slopes and 1V:3H for permanent slopes where no external restraint is provided to the slope (suitable for slope heights up to 2 m with no surcharge at the crest of the slope). Even at these slope angles erosion and drilling may occur. Where steeper slopes are required, temporary or permanent slope retention must be employed.

Care must be taken to control moisture and water at any unsupported slope. This includes preventing erosion of the slope, as well as a build up of pore pressure on the slope face.

A geotechnical engineer must be consulted where there is any doubt regarding the safety of unsupported excavations.

Note: Where the above batters cannot be accommodated in the vicinity of existing footings and structures, temporary lateral support will be required. In addition, existing footings may require underpinning to minimise movement / settlement due to the excavation.

7.9 Shallow Footings

We consider the proposed structure may be founded on shallow pad and strip footings placed within the in-situ soils encountered across the site, provided the site preparation recommendations outlined in Section 7.4 are followed. Table 6 and Table 7 give allowable bearing pressures and estimated settlements for isolated pad footings and strip footings founded at embedment depths of 0.5 m and 1.0 m below the existing ground surface level. These values assume that the footing will be founded at or within at least sand or gravelly sand.

Table 6: Pad Footing Allowable Bearing Pressures and Estimated Settlements

Minimum Footing Embedment (m)	Minimum Footing Dimension (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5	200	<5
	1.0	250	5-10
	1.5	250	5-10
	2.0	250	10-15
	2.5	250	10-15
1.0	0.5	200	<5
	1.0	250	5-10
	2.0	250	10-15
	3.0	250	15-20

Table 7: Strip Footing Allowable Bearing Pressures and Estimated Settlements

Minimum Footing Embedment (m)	Footing Width (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5	150	<5
	1.0	200	5-10
	1.5	250	10-15
	2.0	250	15-20
	2.5	250	20-25
1.0	1.0	200	5-10
	2.0	250	15-20
	3.0	220	20-25

Allowable bearing pressures for footings of intermediate plan dimensions to those tabulated can be interpolated. Footings that have a plan dimension either smaller or larger than those covered by the tables above will need to be considered individually along with other embedment depths.

The allowable working bearing pressures are considered to be upper limits for shallow pad footings and strip footings to limit total and differential settlements. Footings carrying significant eccentric loading, such as below retaining walls, must be assessed separately.

The bearing pressures adopted for design will depend to a large extent on the magnitude of settlement that can be accommodated by the proposed structure. The settlement of the proposed structure will depend upon a number of factors including the applied pressures, footing size and base preparation. The estimates of settlement provided above assume that the site preparation measures detailed in Section 7.4 have been completed. The estimated settlements are for the working bearing pressure values shown.

Differential settlements of up to about 50% of the total estimated settlement values are likely between footings of similar sizes, loads and elevations.

The estimated settlements indicated in the tables do not include interaction effects from footings founded close to other footings. Interaction effects will need to be considered if the spacing between the edges of adjacent footings is less than the width of the footings (i.e. the centre-to-centre spacing of footings are less than twice the width of the footings). This could act to double the nominated settlements, dependent on the footing configuration.

About 70% of the settlement and differential settlement is expected to occur during construction.

All foundation excavations must be assessed by a competent person prior to blinding.

7.10 Retaining Structures

Retaining structures may be designed in accordance with AS 4678-2002 "Earth Retaining Structures". We recommend that all retaining walls at the site be backfilled with free-draining fill, e.g. sand (imported free draining sand fill with less than 5% fines).

We understand that it would be preferable to use the materials available at the site. **NOTE:** if clayey soils (including the gravelly clay present on site) are used for backfill behind the retaining walls, then the walls must be designed to accommodate full hydrostatic pressure, unless a geosynthetic drain or other drainage layer is used (we can provide further advice if this is required).

For the design of retaining structures, the parameters in Table 8 are considered appropriate for compacted sand and gravel backfill behind retaining walls.

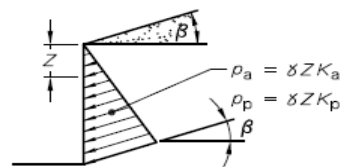
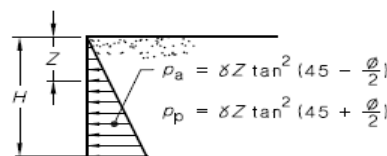
Table 8: Geotechnical Design Parameters for Retaining Structures

Layer Description	γ_b (kN/m ³)	ϕ' (°)	c' (kPa)	ϕ_u (°)	c_u (kPa)
Compacted imported inert sand fill in situ sand in "Class A" area	18	34	-	N/A	N/A
Compacted imported inert gravel fill	18	36	-	N/A	N/A
Compacted gravelly sand/sand with fines (site-derived material, "Class S" area)	18	33	-	N/A	N/A
Compacted Clayey Sand/Gravelly Clayey Sand (site-derived material)	19	27	3	N/A	30
Compacted Sandy Clay (site-derived material)	18	25	5	N/A	50

Notes: γ_b – bulk unit weight (kN/m³) ϕ' – effective soil friction angle
 c' – effective cohesion ϕ_u – undrained soil friction angle c_u – undrained cohesion

The undrained strength parameters indicated above should be used for analysis of short term stability, or stability under sudden loading of clayey soils.

The effective strength parameters should be used for analysis of free-draining granular soils and the long-term stability of clayey soils. The formulae for active and passive pressures are shown below for cohesionless and cohesive soil⁴.

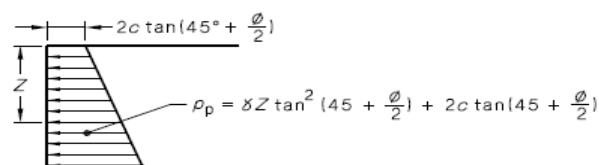
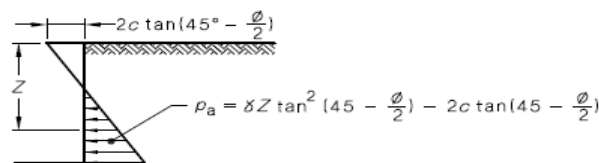


(a) Granular soil

$$K_a = \frac{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi}}{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi}}$$

$$K_p = \frac{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi}}{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi}}$$

$$K_a = \frac{1}{K_p}$$



(b) Cohesive soil

⁴ from AS4678-2002: Earth-retaining Structures.

Compaction plant can augment the lateral earth pressure acting on retaining walls. Hand operated compaction equipment is recommended within 2 m of any retaining walls to minimise compaction pressures.

It is important to note that some ground movement will occur behind any soil retaining system, including gravity retaining walls.

Where the clayey material is used as retaining wall backfill, a suitable drainage layer must be placed behind the wall such that a build-up of pore pressure is prevented. The retaining wall must be designed to accommodate water pressure behind the wall (10 kPa per metre height). In this instance, calculation of lateral earth pressures must include the addition of pore pressure (not required for retaining walls entirely within clean sand and sand fill with adequate drainage outlets). A separator geotextile (Bidim A24, or similar, or heavier) must also be used between the interface of any granular backfill and the clayey soil.

Where granular backfill is to be used, a 300 mm minimum wide layer of free-draining granular fill is to be installed. A slotted drain (wrapped in a geotextile) should be used at the base of the granular backfill to collect seepage and direct it to a collection point (either discharging by gravity away from the retaining wall or collecting at a sump fitted with an automatic pump system to ensure that it remains dry).

Retaining walls can move and rotate under imposed soil loading resulting in settlement behind the wall. This must be considered in the design and during construction of the retaining walls in order that adjacent infrastructure is not adversely affected.

Detailed design of retaining structures should be undertaken using methods appropriate to the proposed retention system.

7.11 Stormwater Disposal

We consider that the sands in the north of the site ("Class A" area) are suitable for the disposal of stormwater by infiltration by means of soak wells. Notwithstanding the results of the infiltration testing, we recommend a design value of hydraulic conductivity (k) of:

- ☞ "Class A" area – 5 m/day
- ☞ "Class S" area – 1 m/day

There may be opportunity to construct a larger drainage system (such as a POS-style drainage basin) at the north of the site in the more permeable sand area. We note that stormwater disposal in the "Class S" area will be significantly constrained by the presence of shallow clayey soils (circa 1.5 m deep, typically), as well as the elevated fines content of some of the sandy soil near surface. We generally recommend against the disposal of stormwater in the "Class S" area, particularly for soakwells (swales and the like may be possible, albeit with a low infiltration rate).

Any soak wells should be placed outside a line of 1V:2H extending below the edge of the nearest footing, subject to local council regulations. Discharge from soak wells has been known to promote densification of loose sandy soils, leading to settlements of footings and slabs. Soak wells should be carefully wrapped with geotextile to prevent migration of sand and fines into the soak well.

7.12 Pavement Design

A subgrade California bearing ratio (CBR) of 10% may be assumed for pavement thickness design provided that the site preparation requirements outlined in Section 7.4 have been carried out on the pavement subgrade.

Adequate drainage must be provided to all pavements, particularly those in the “Class S” area where there may be near-surface soils with high fines contents.

8. CLOSURE

We draw your attention to Appendix G of this report, “Understanding your Report”. The information provided within is intended to inform you as to what your realistic expectations of this report should be. This information is provided not to reduce the level of responsibility accepted by Galt, but to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing.

GALT GEOTECHNICS PTY LTD



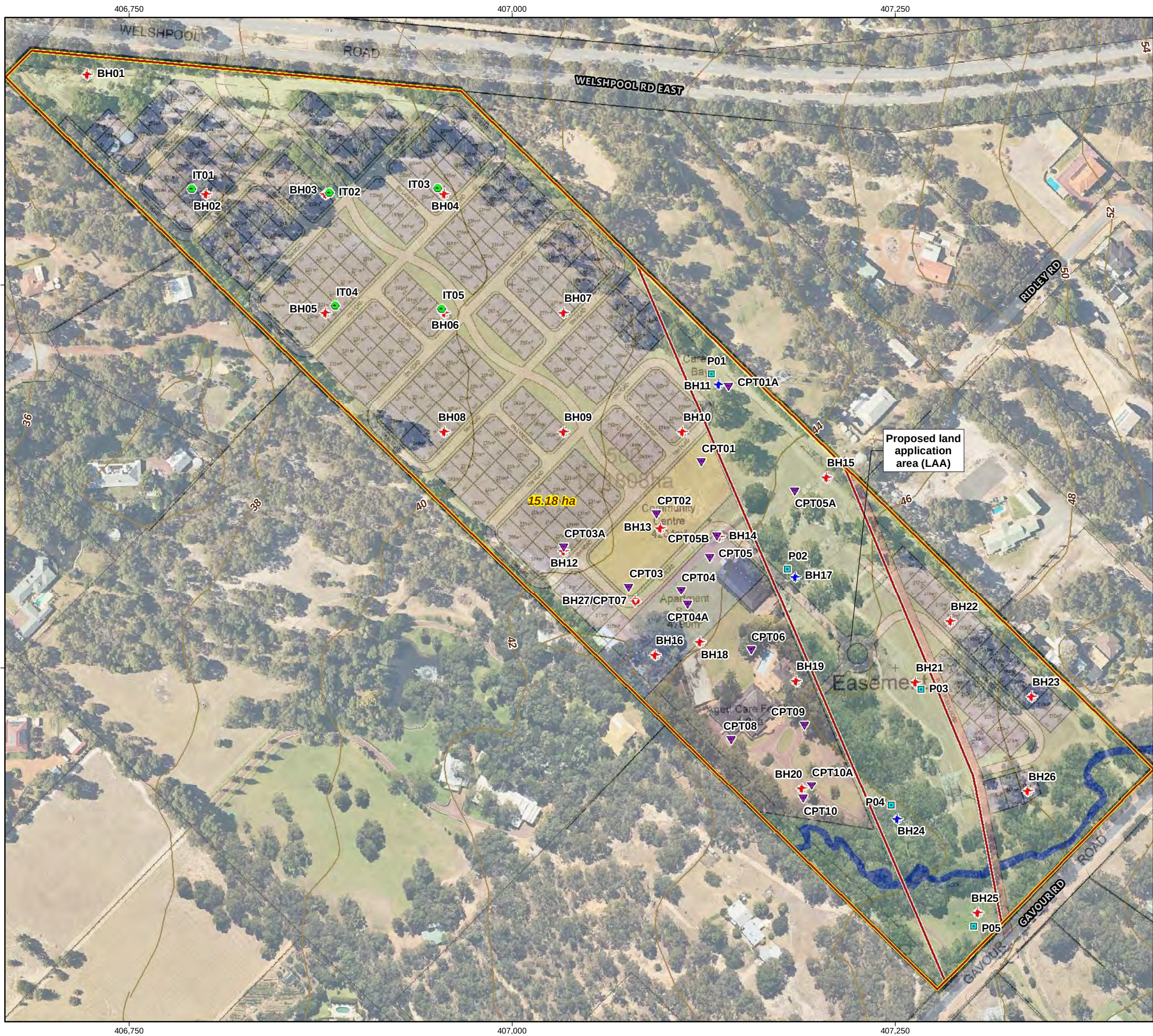
Sean Coffey CPEng
Geotechnical Engineer



Owen Woodland CPEng
Geotechnical Engineer

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Figures



Legend

- Site Boundary
- Borehole
- Borehole with Standpipe
- Borehole / Cone Penetration Test
- Cone Penetration Test
- Percolation Test
- Infiltration Test

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP

0 40 80 120 160 200
Meters

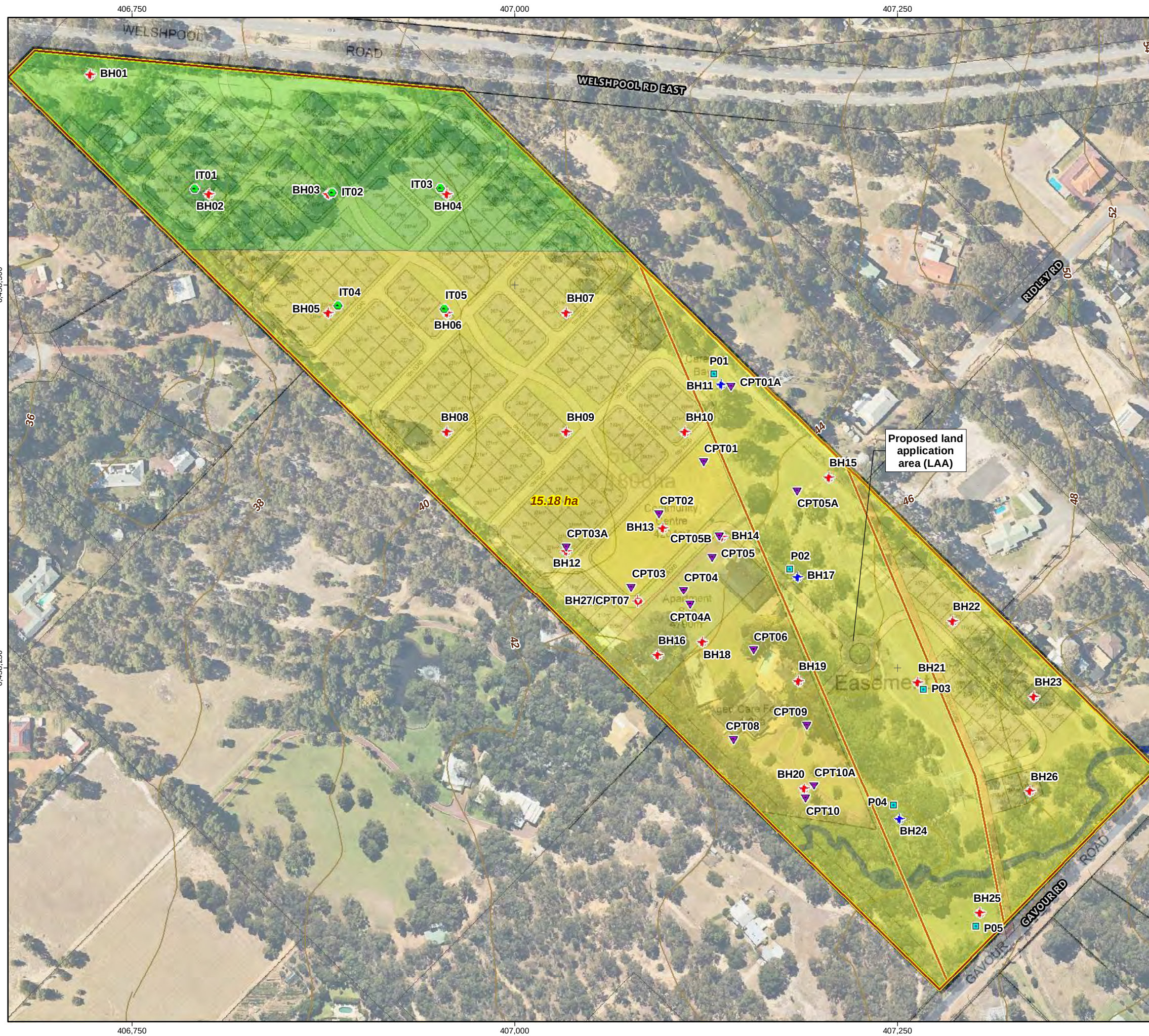
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	DATE CHECKED	—	
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Galt
GEOTECHNICS

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CLIENT	PRITCHARD FRANCIS		
PROJECT	WATTLE GROVE RETIREMENT VILLAGE		
LOCATION	LOT 500 GAVOUR ROAD WATTLE GROVE		
TITLE	SITE & LOCATION PLAN		
Job No	J2101290	Fig No	FIGURE 1
		Rev	A



Legend

- Site Boundary
- "Class A"
- "Class S"
- Borehole
- Borehole with Standpipe
- Borehole / Cone Penetration Test
- Cone Penetration Test
- Percolation Test
- Infiltration Test

0 40 80 120 160 200 Meters

N

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP

	SCALE	1:2,500	(A3)
	DRAWN	CED	
	DATE DRAWN	20/12/2021	
	CHECKED	—	
	DATE CHECKED	—	
PROJECTION		GDA 1994 MGA Zone 50	

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CLIENT	PRITCHARD FRANCIS				
PROJECT	WATTLE GROVE RETIREMENT VILLAGE				
LOCATION	LOT 500 GAVOUR ROAD WATTLE GROVE				
TITLE	SITE CLASSIFICATION (AS2870) PLAN				
Job No	J2101290	Fig No	FIGURE 2	Rev	A

Appendix A: Site Photographs



Photograph 1: Looking at vegetation and grassed are near the centre of the site



Photograph 2: Looking at existing creek through the site

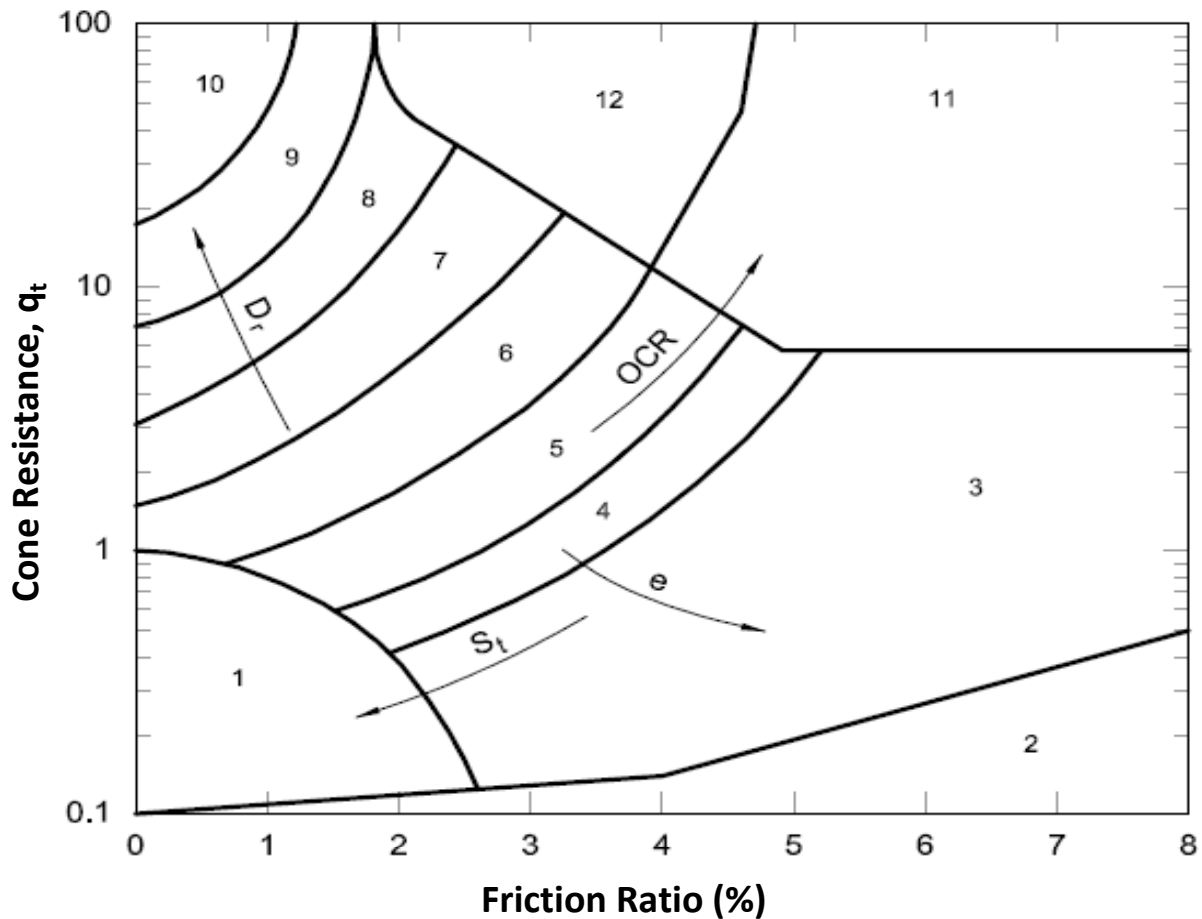


Photograph 3: Borehole drilling at the north of the site



Photograph 4: CPT testing near the centre of the site

Appendix B: Cone Penetration Test Results



DEFINITIONS

- q_t : Cone tip resistance corrected for pore water pressure
 S_t : Sensitivity
 e : Void ratio
 D_r : Relative density
 OCR : Overconsolidation ratio
 OC : Overconsolidated

SOIL BEHAVIOUR TYPE ZONES

- | | |
|------------------------------|--|
| 1. Sensitive fine grained | 7. Silty sand to sandy silt |
| 2. Organic material | 8. Sand to silty sand |
| 3. Clay | 9. Sand |
| 4. Silty clay to clay | 10. Gravelly sand to sand |
| 5. Clayey silt to silty clay | 11. Very stiff fine grained material (OC/cemented) |
| 6. Sandy silt to clayey silt | 12. Sand to clayey sand (OC/cemented) |

NOTES

- A. Some overlap in type zones is expected
 B. Local correlations are preferred and may indicate soil type boundaries that are different from those shown above

Reference: Robertson, P.K., Campanella, R.G., Gillespie, D. and Grieg, J. (1986) "Use of Piezometer Cone Data". Proceedings of the ASCE Speciality Conference In Situ '86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp 1263-80, American Society of Civil Engineers (ASCE)



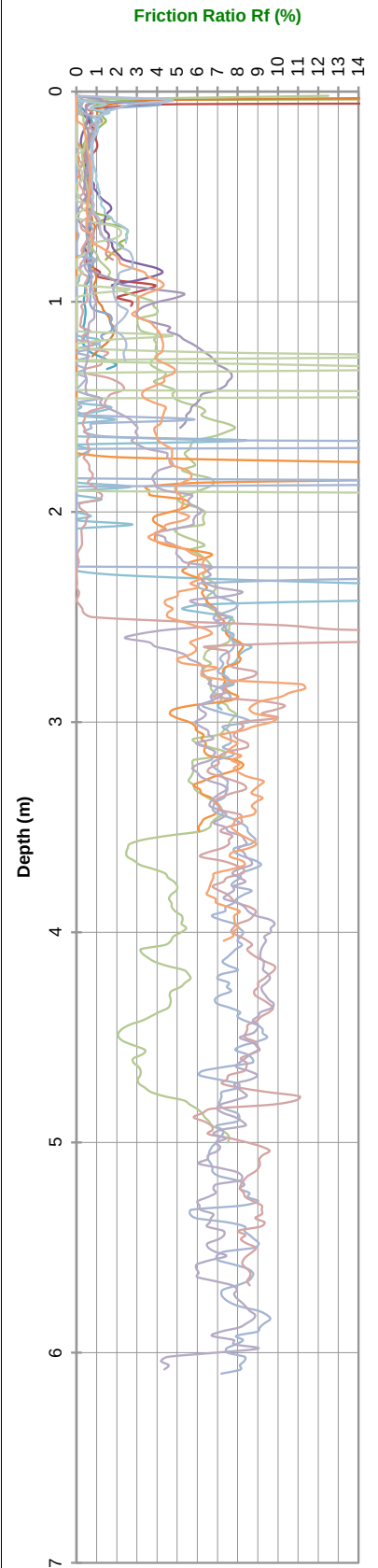
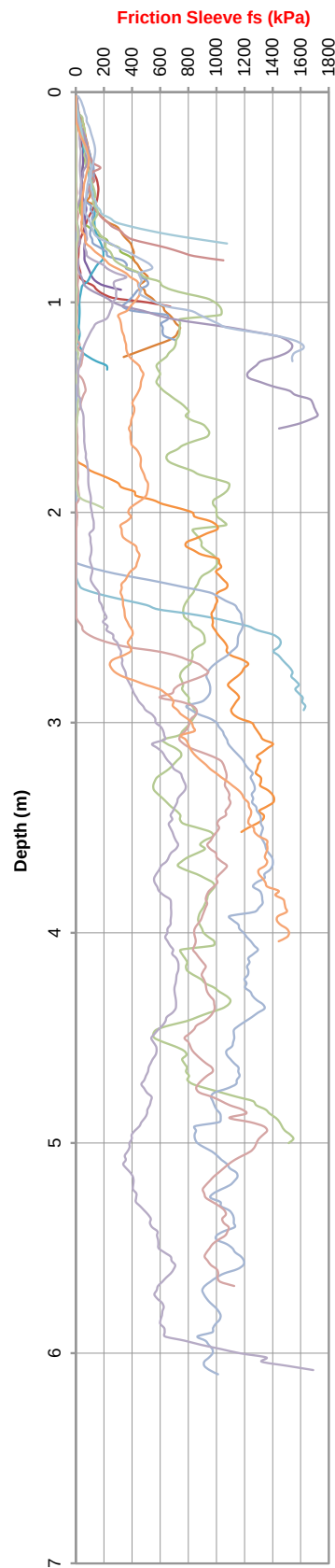
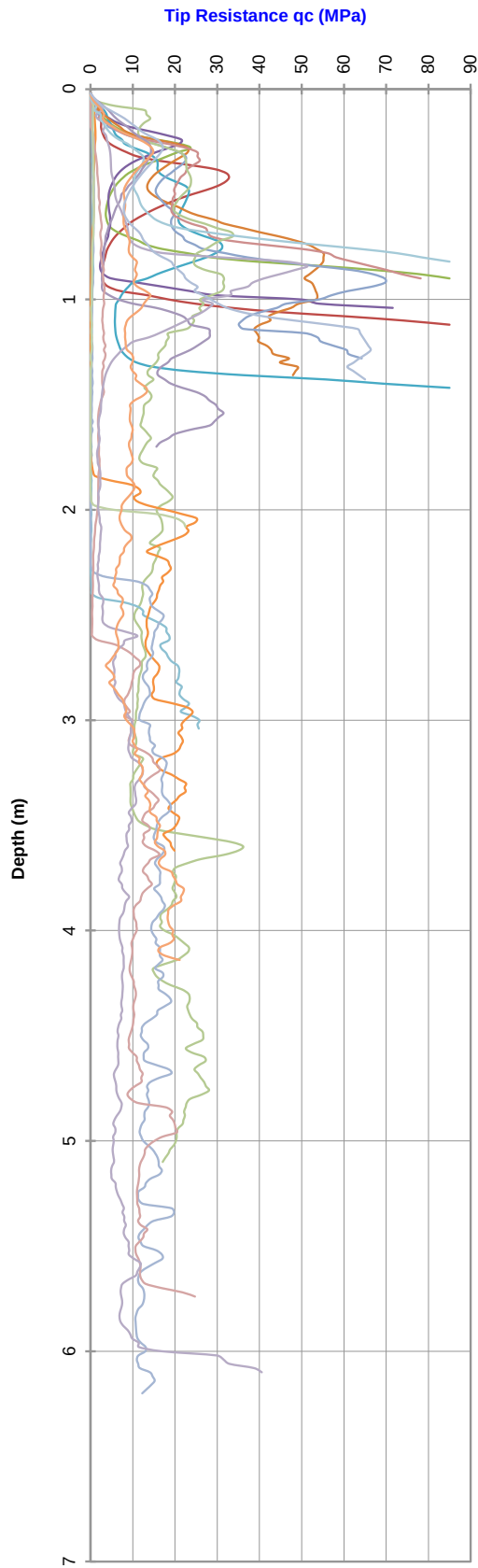
CONE PENETRATION TESTING (CPT) SOIL TYPE INTERPRETATION

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
Date/s: 18-Nov-2021

ALL DATA



ELECTRIC FRICTION-CONE PENETROMETER

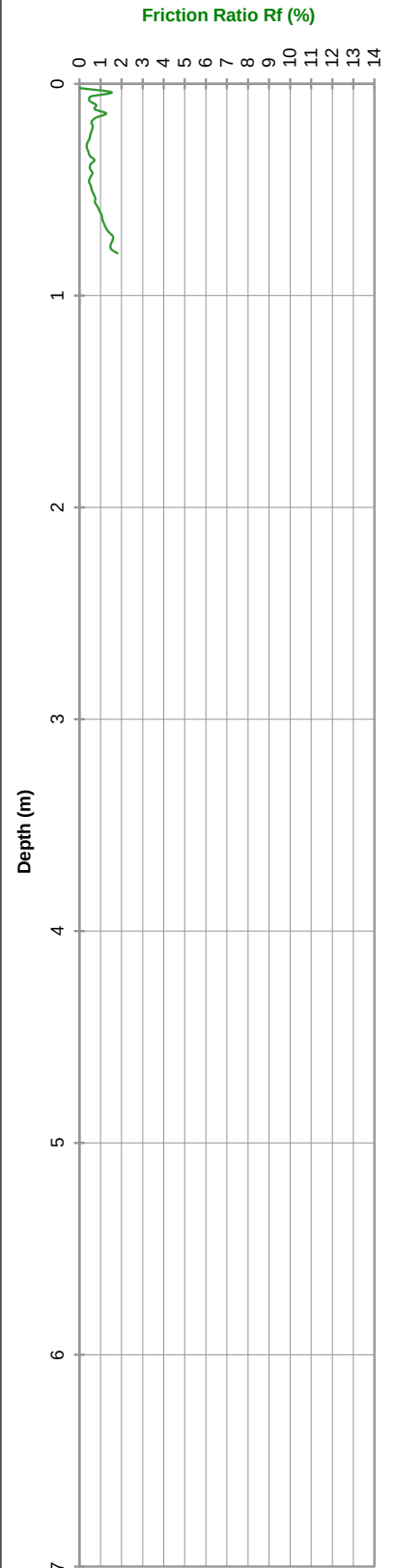
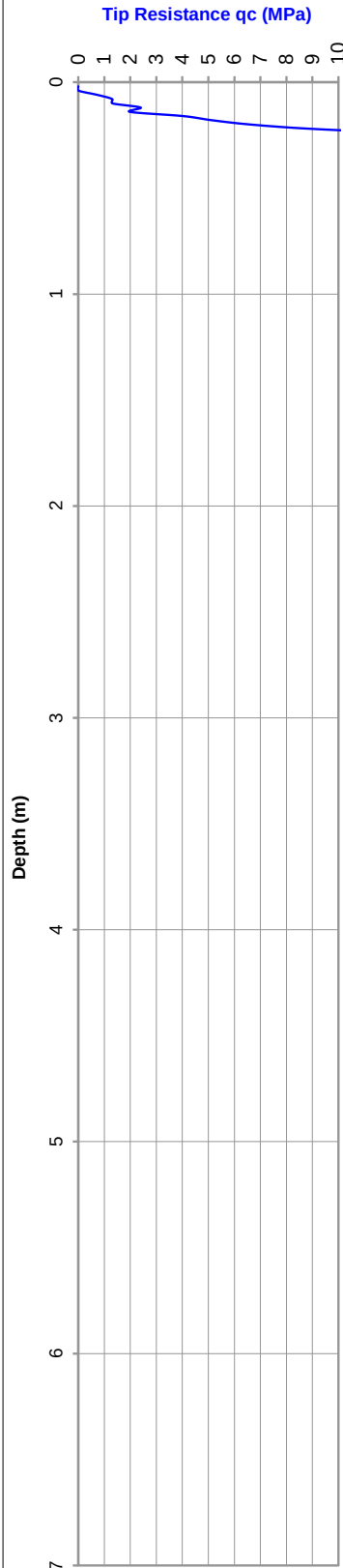
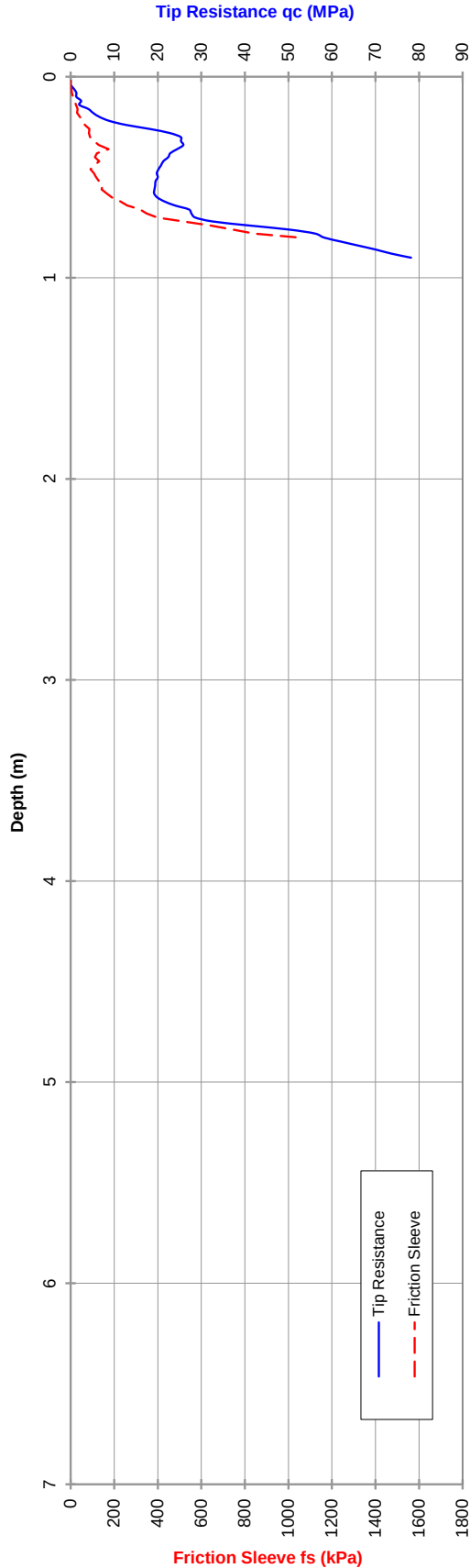
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 01

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999
and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.9

Dummy probe to (m):

Refusal:

Cone I.D.: EC05

File: GL0732M2

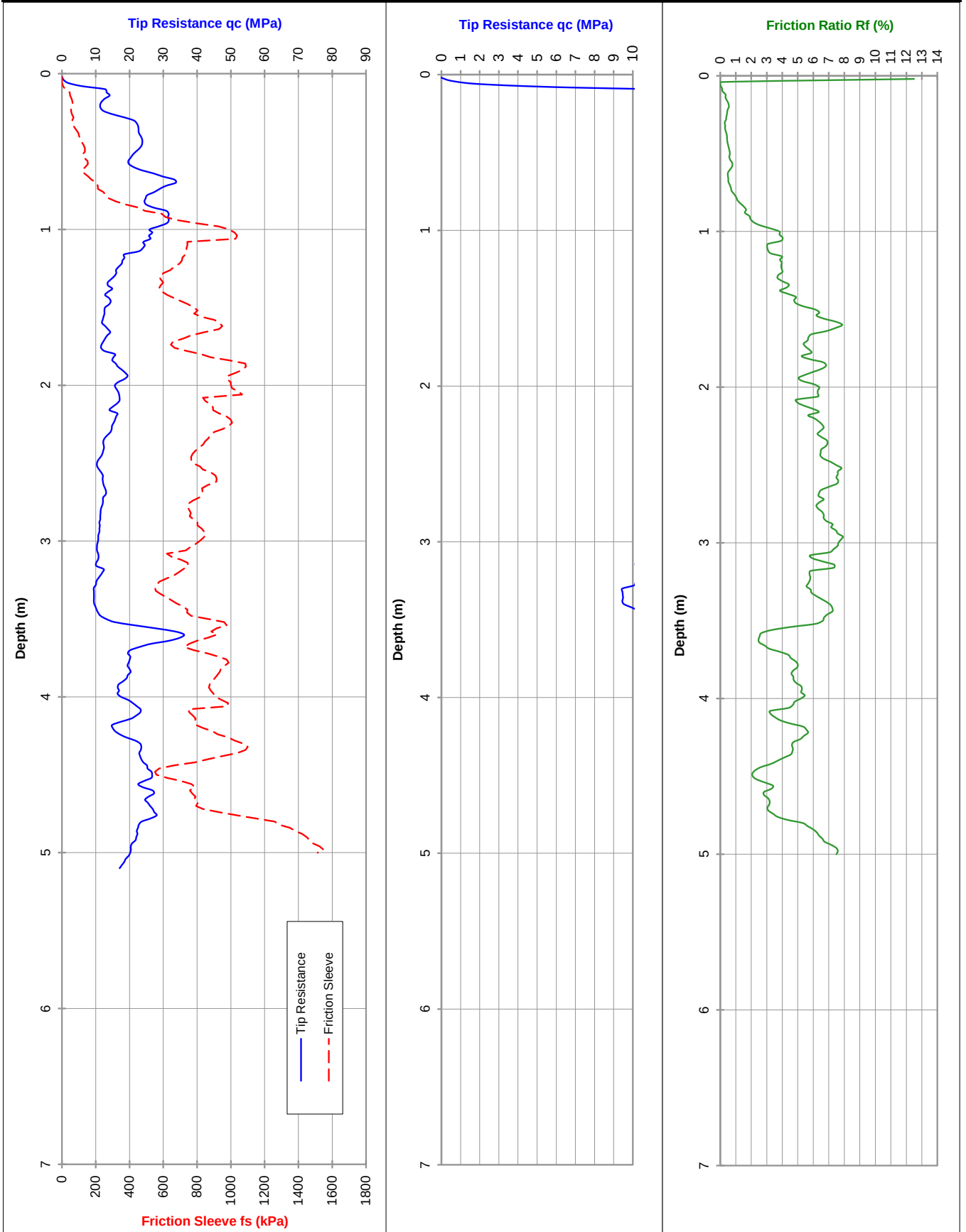
Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D
CPT 01A
18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTF 2001 for friction reducer

Approx. water (m): Dry to 4.8
Dummy probe to (m):
Refusal: Rod Friction

Cone I.D.: EC05
File: GL0733M2
Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Pritchard Francis

Job No.: J2101290

PROJECT: Wattle Grove Retirement Village

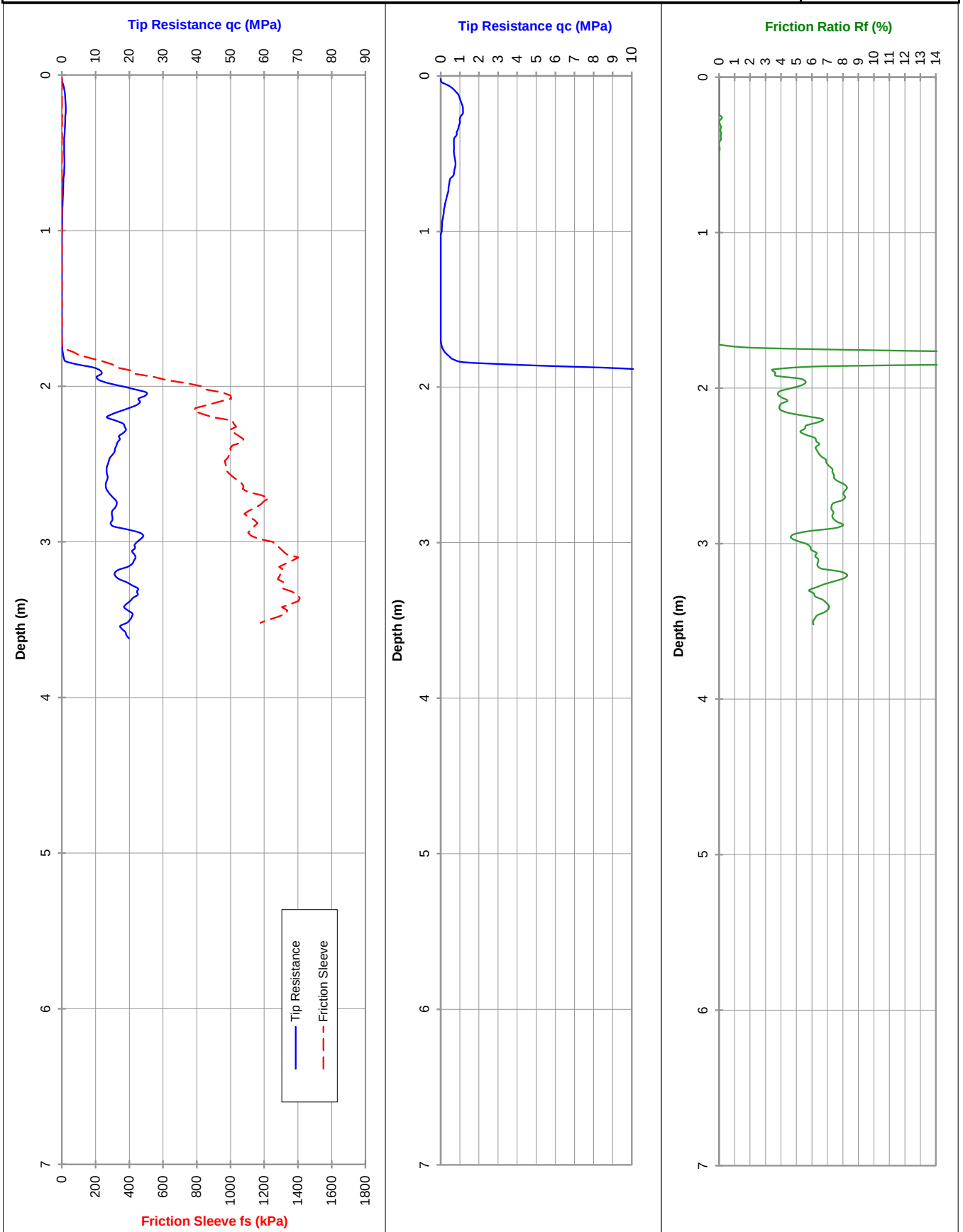
RL (m):

CPT 02

LOCATION: 32 Gavour Road, Wattle Grove

Co-ords:

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 3.4

BH13 to (m): 1.8

Refusal: Rod Friction

Cone I.D.: EC05

File: GL0736M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

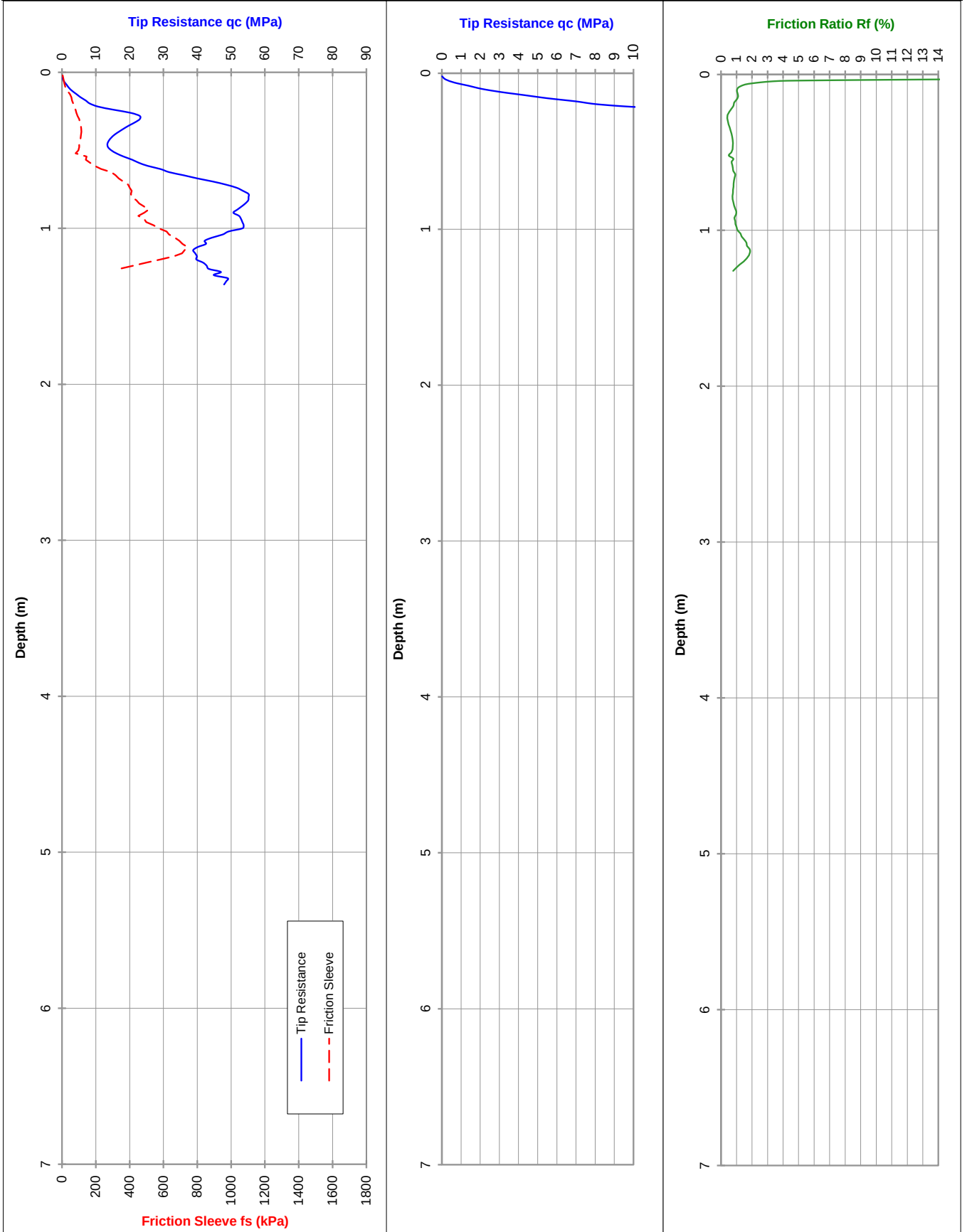
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 03

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 1.3

Dummy probe to (m):

Refusal: Rod Friction

Cone I.D.: EC05

File: GL0730M2

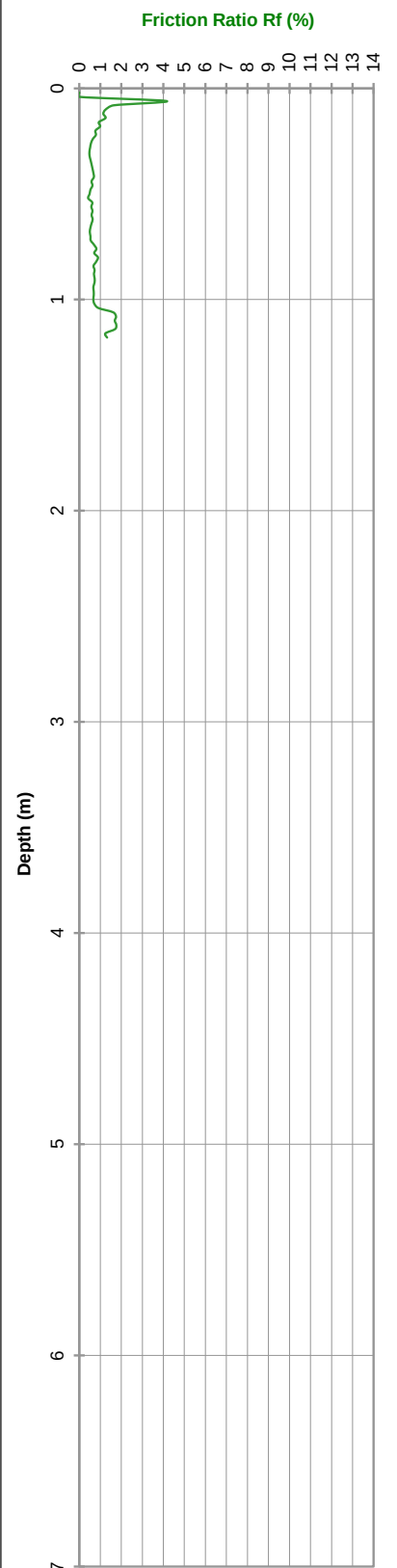
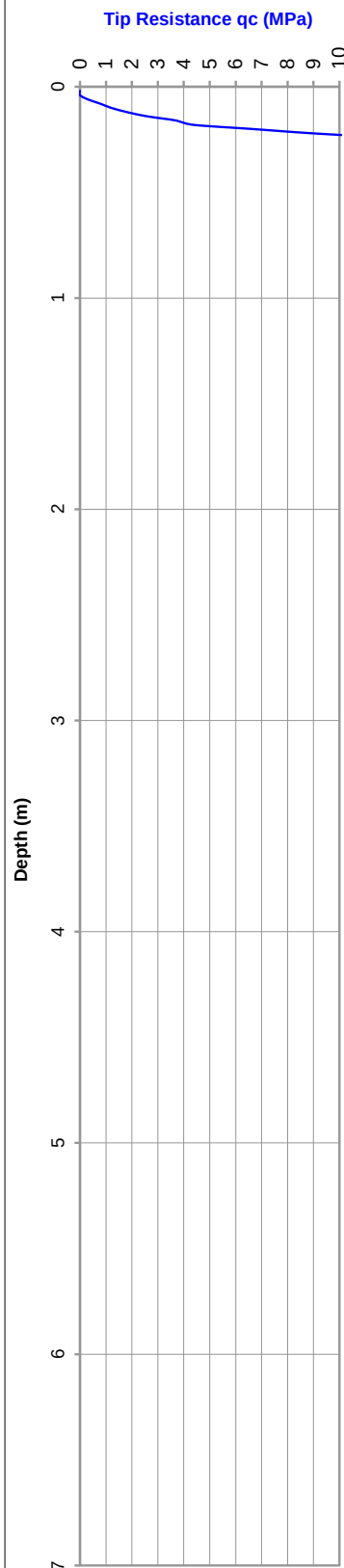
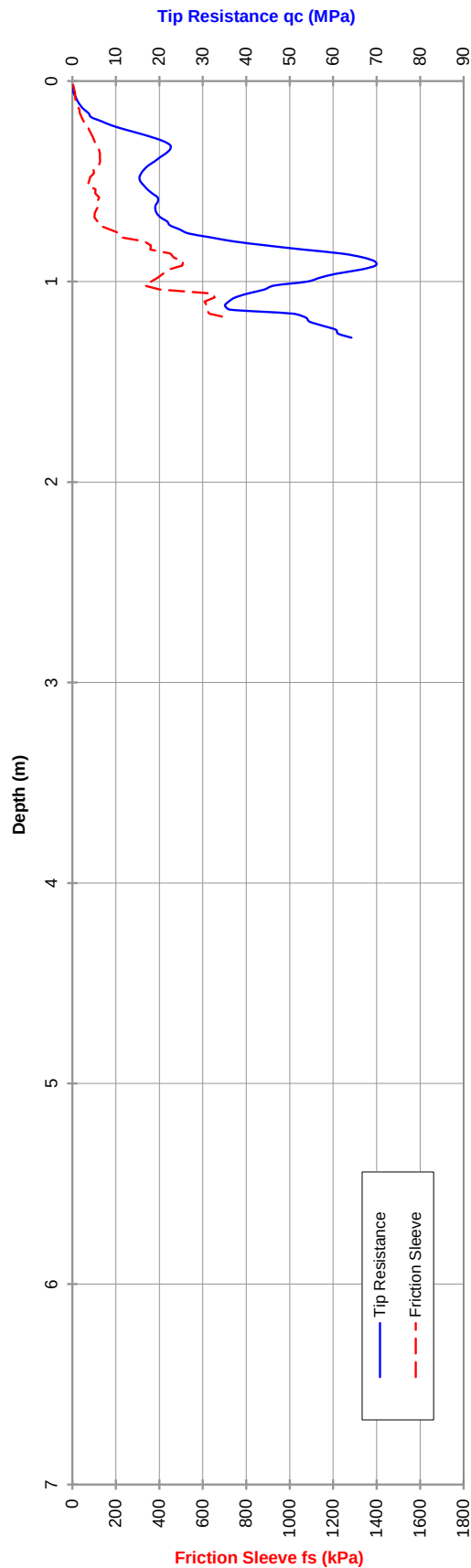
Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D
CPT 03A
18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999
and IRTP 2001 for friction reducer

Approx. water (m): Dry to 1.2
Dummy probe to (m):
Refusal: Rod Friction

Cone I.D.: EC05

File: GL0731M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

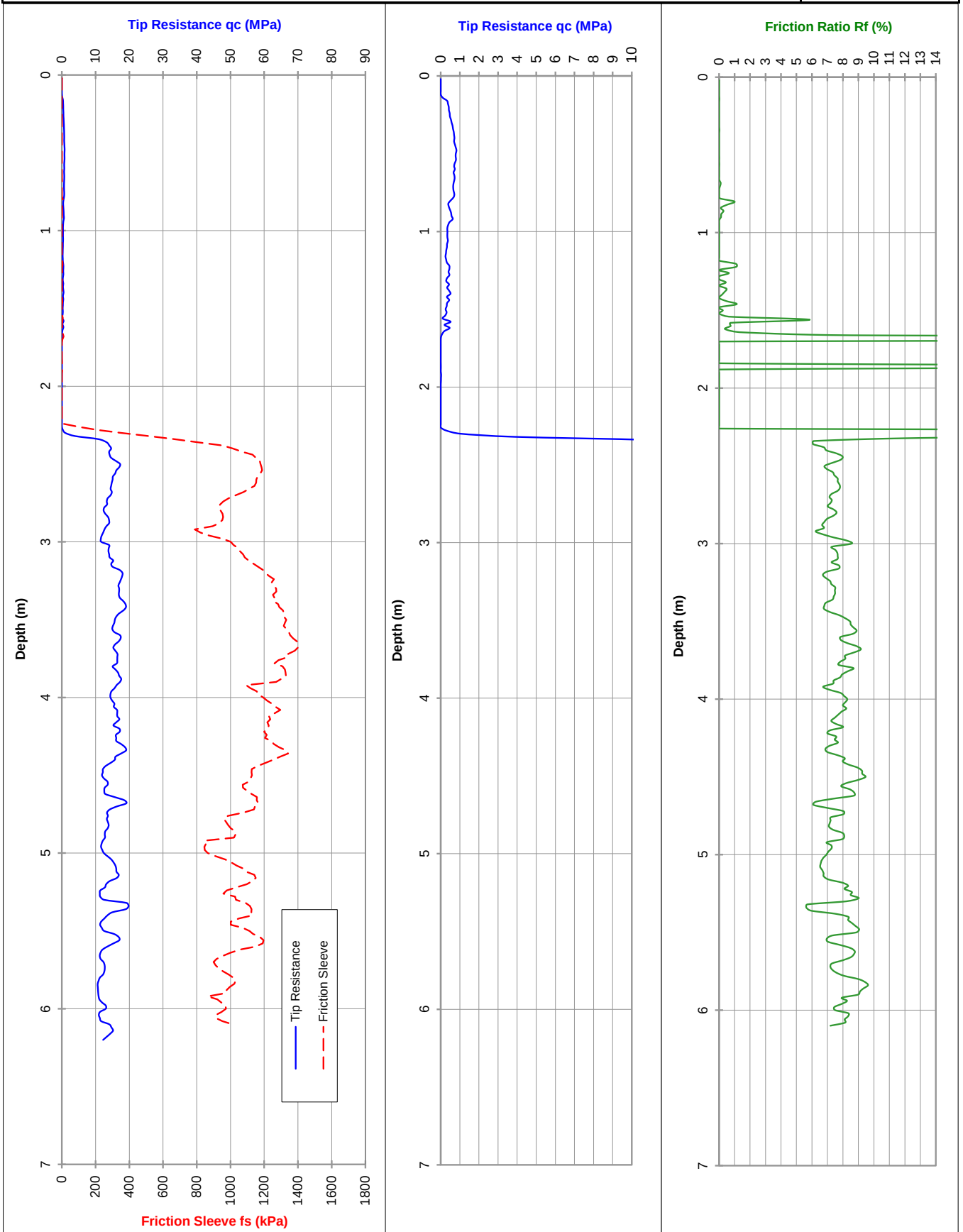
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 03B

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 2.2

BH12 to (m): 2.5

Refusal:

Cone I.D.: EC05

File: GL0737M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

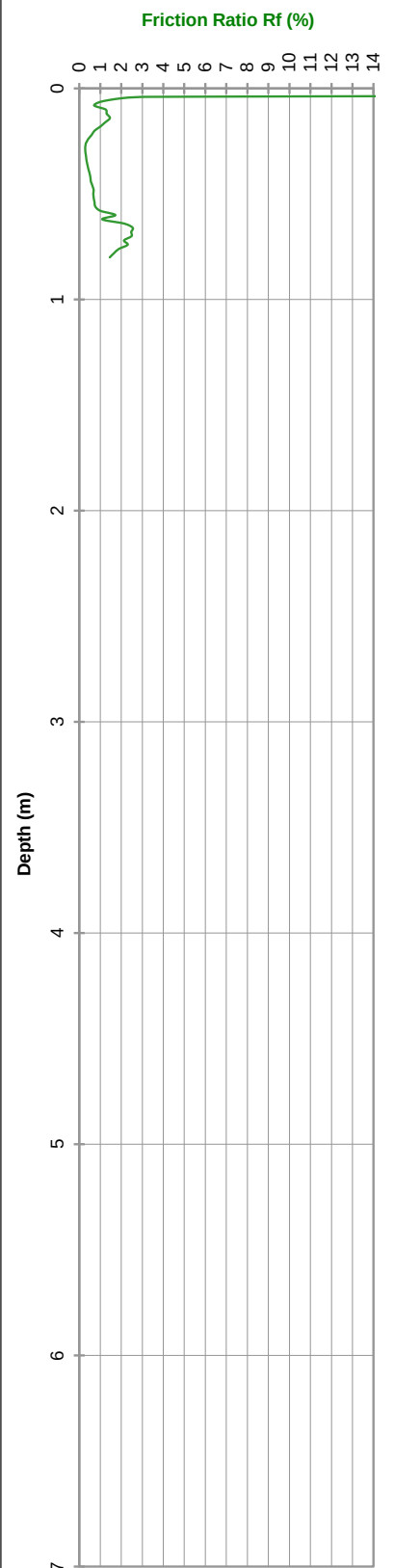
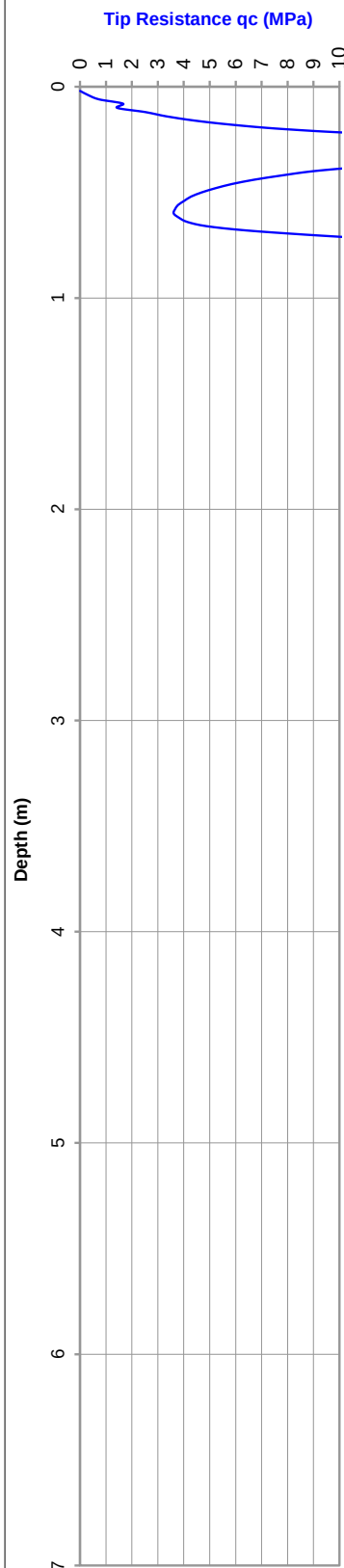
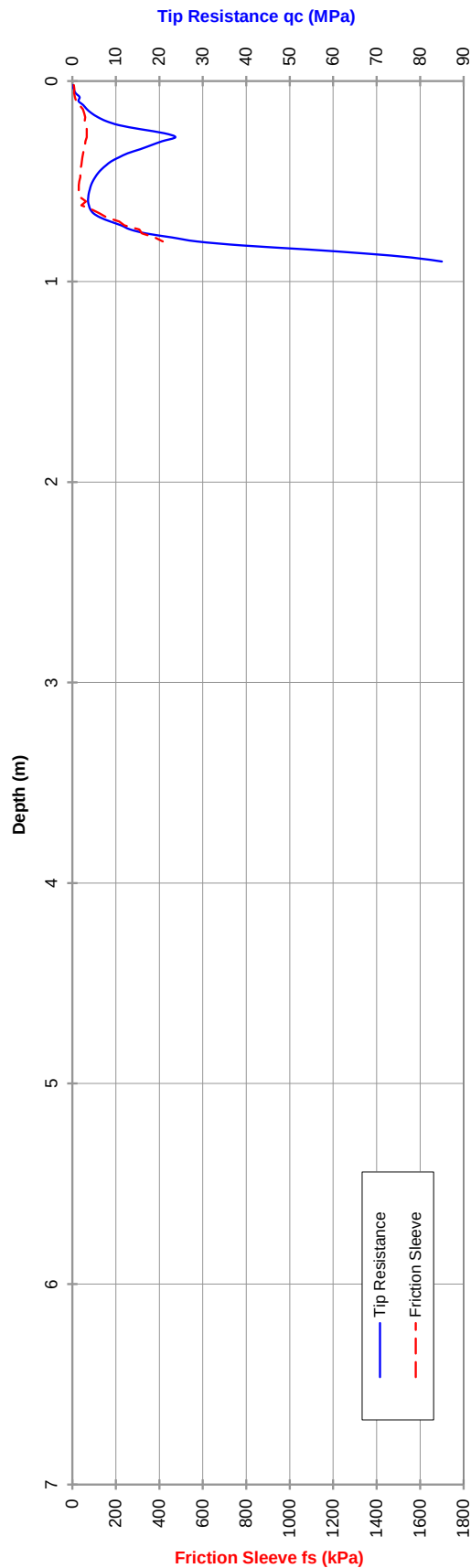
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 04

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999
and IRTF 2001 for friction reducer

Approx. water (m): Dry to 0.9

Dummy probe to (m):

Refusal: 85 MPa

Cone I.D.: EC05

File: GL0727M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Pritchard Francis

Job No.: J2101290

PROJECT: Wattle Grove Retirement Village

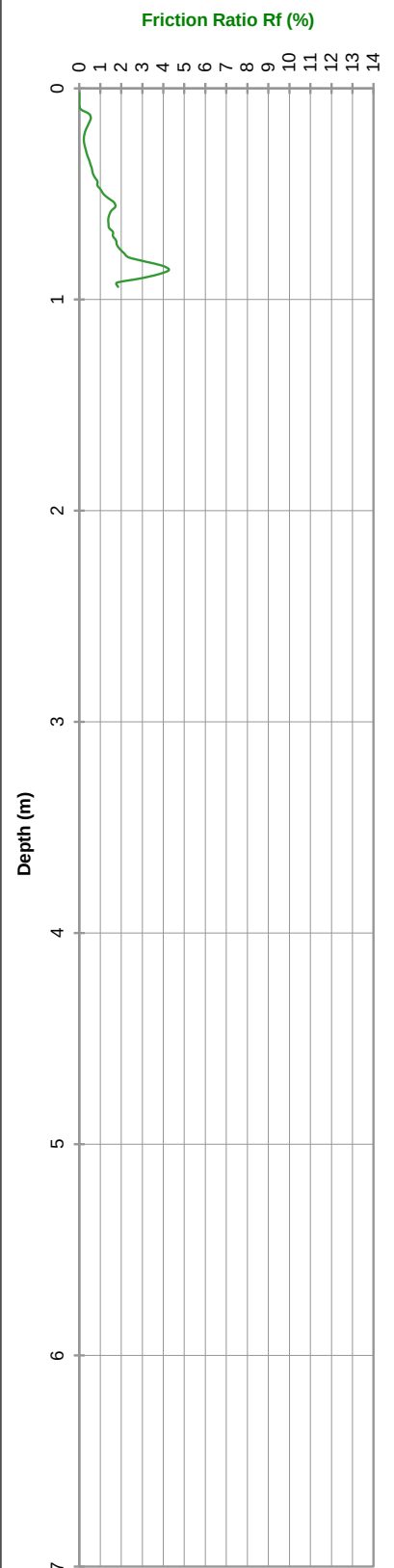
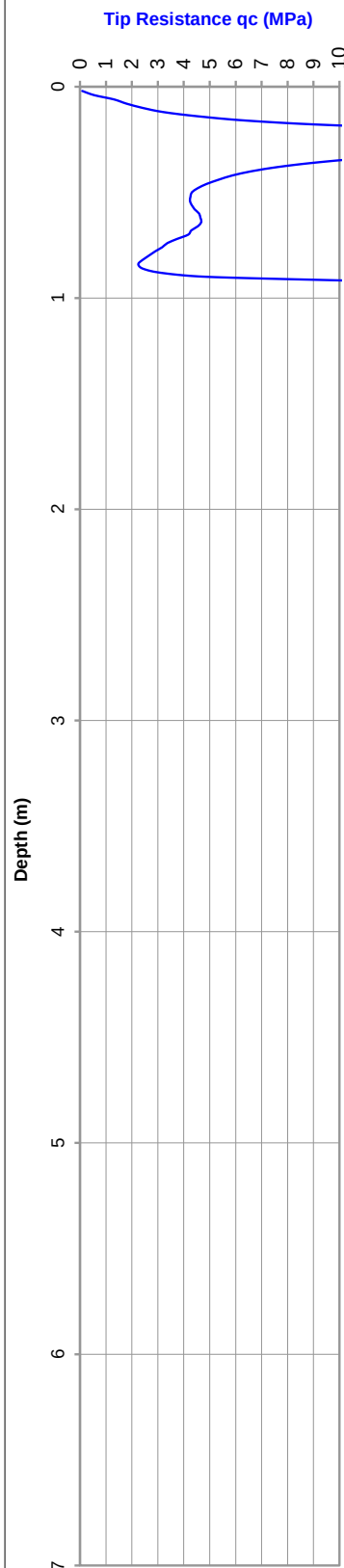
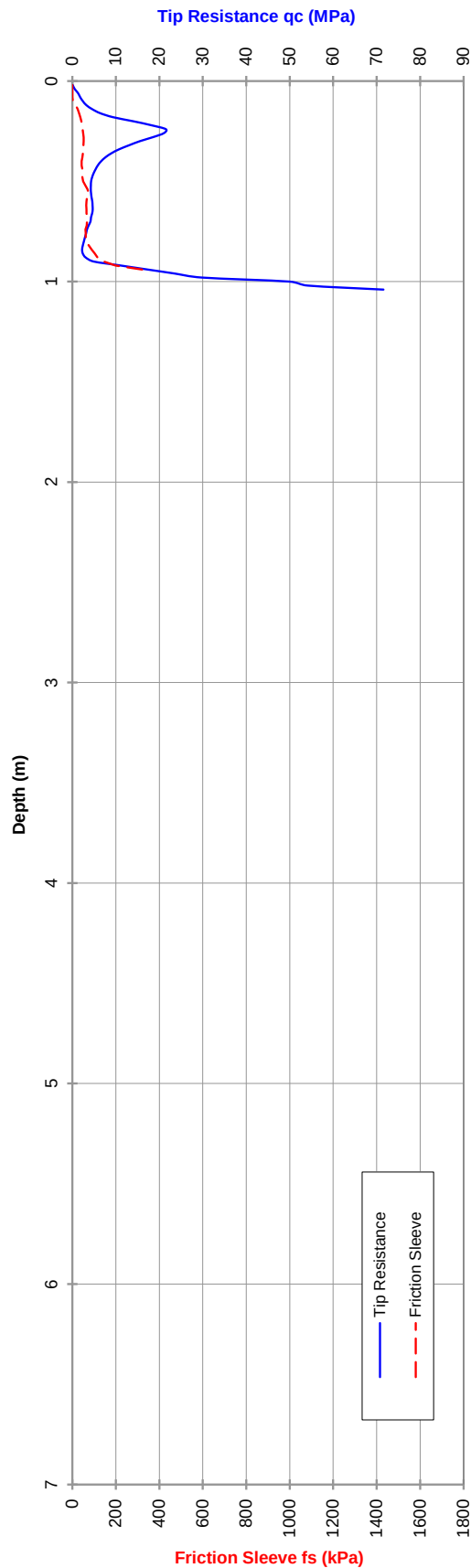
RL (m):

CPT 04A

LOCATION: 32 Gavour Road, Wattle Grove

Co-ords:

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999
and IRTF 2001 for friction reducer

Approx. water (m): Dry to 1.0

Dummy probe to (m):

Refusal: Inclination

Cone I.D.: EC05

File: GL0728M2

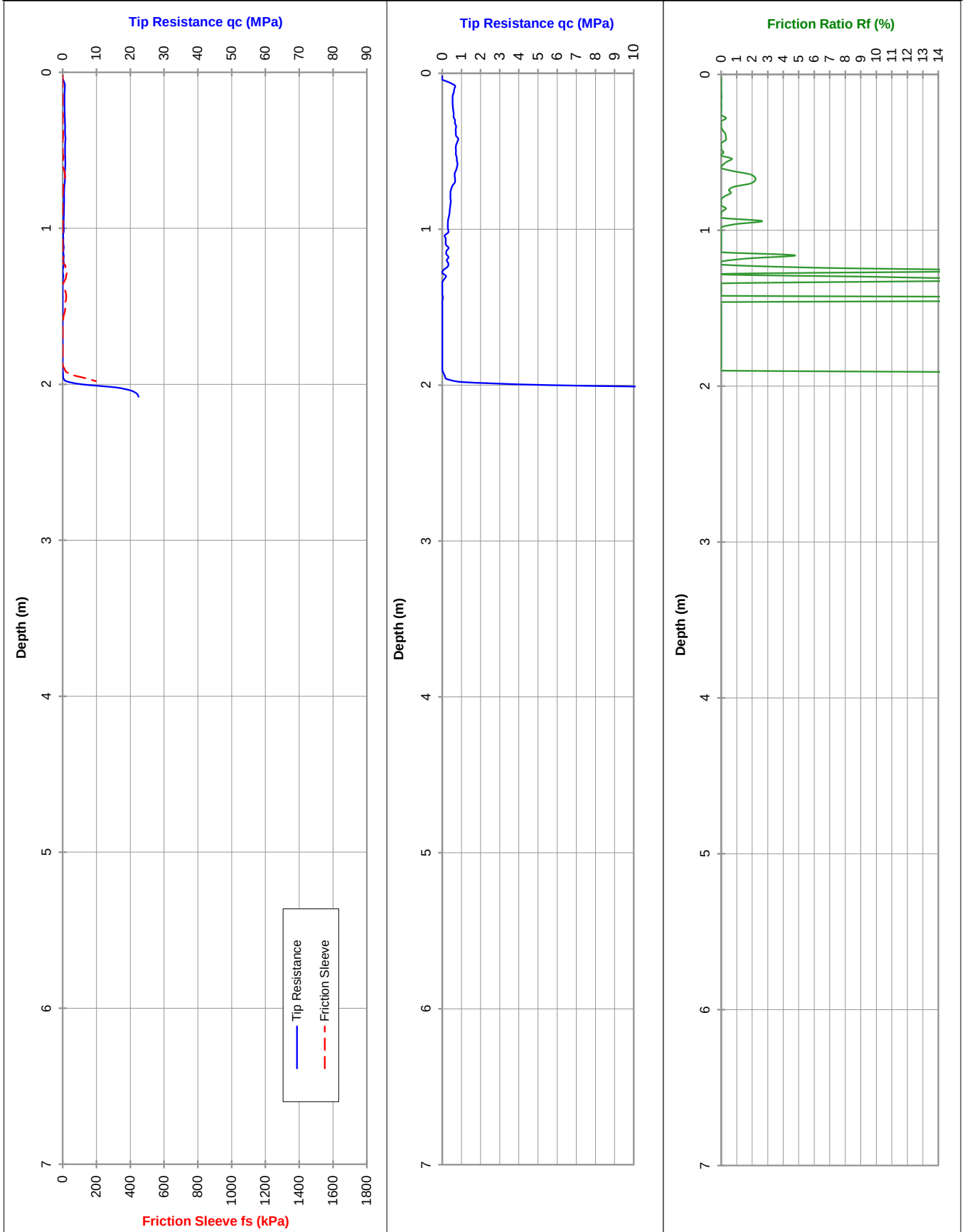
Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D
CPT 04B
18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 2.0
Predrilled to (m): 2.5
Refusal: Inclination

Cone I.D.: EC05

File: GL0739M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Pritchard Francis

Job No.: J2101290

PROJECT: Wattle Grove Retirement Village

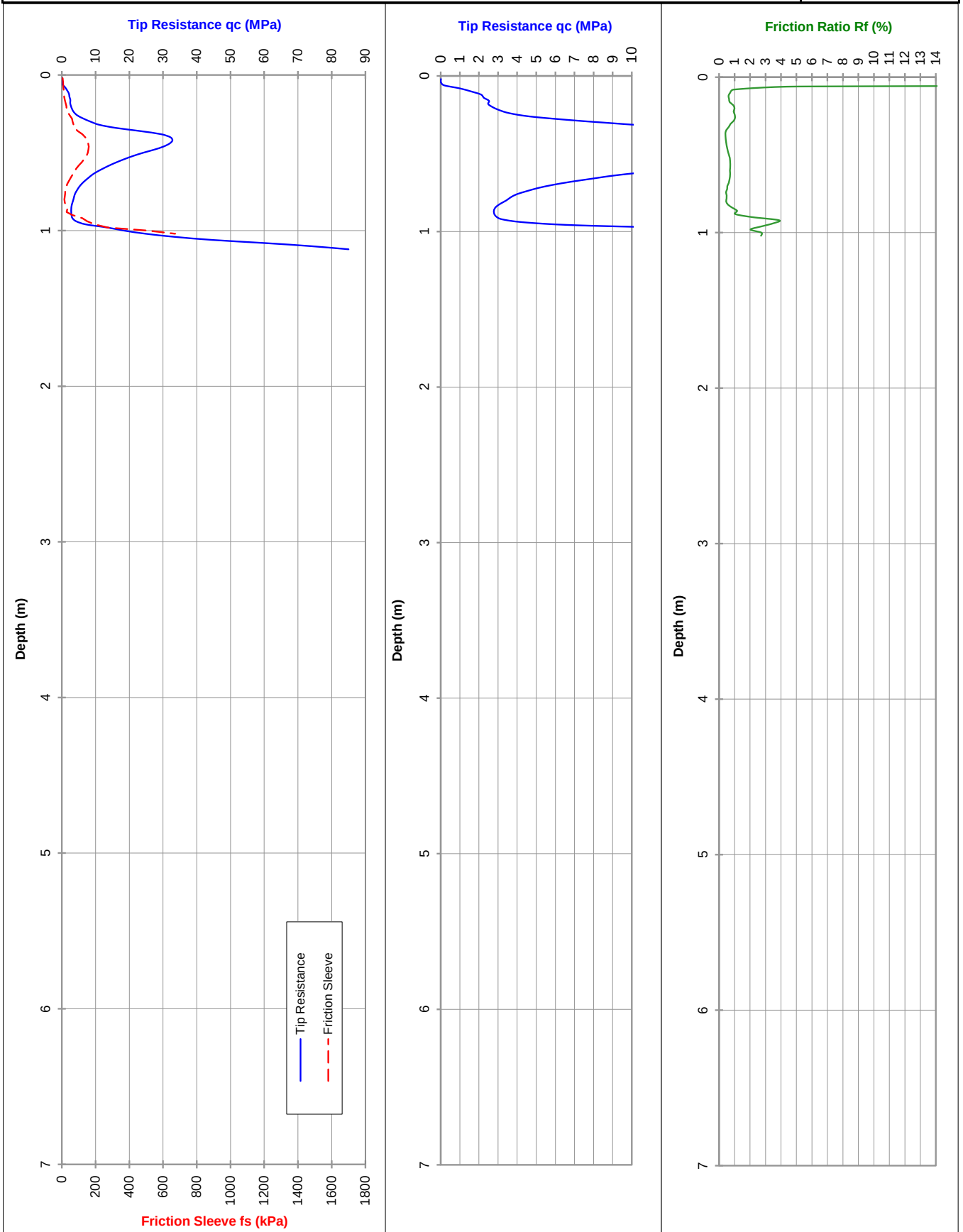
RL (m):

CPT 05

LOCATION: 32 Gavour Road, Wattle Grove

Co-ords:

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 1.1

Dummy probe to (m): 85 MPa

Refusal:

Cone I.D.: EC05

File: GL0726M2

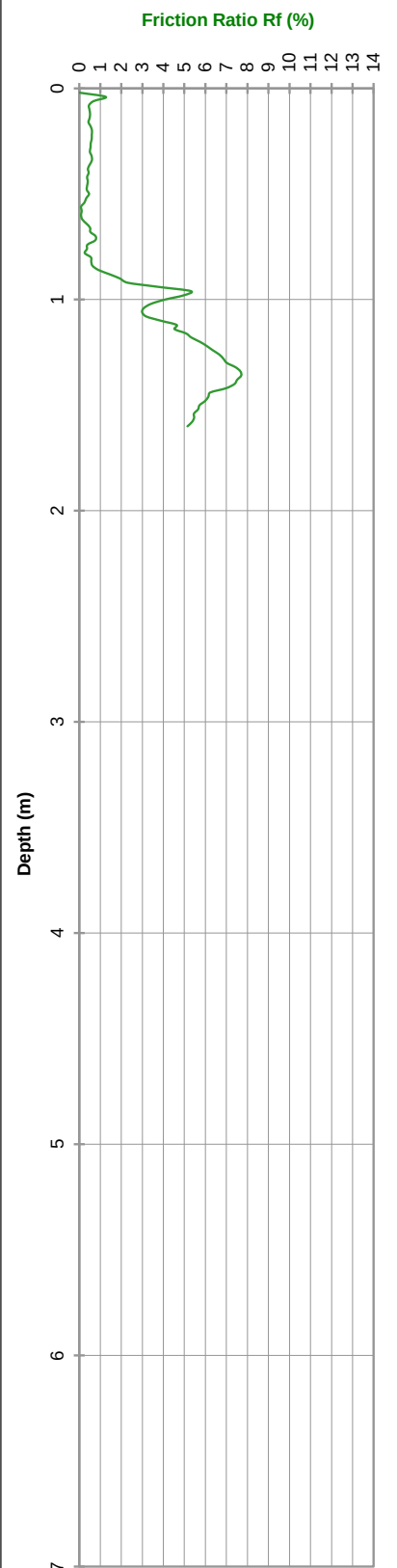
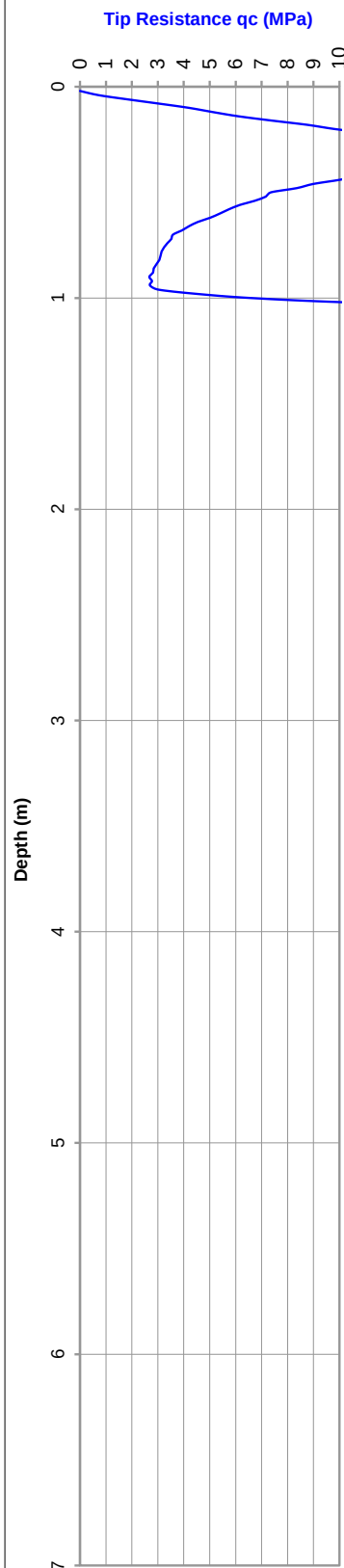
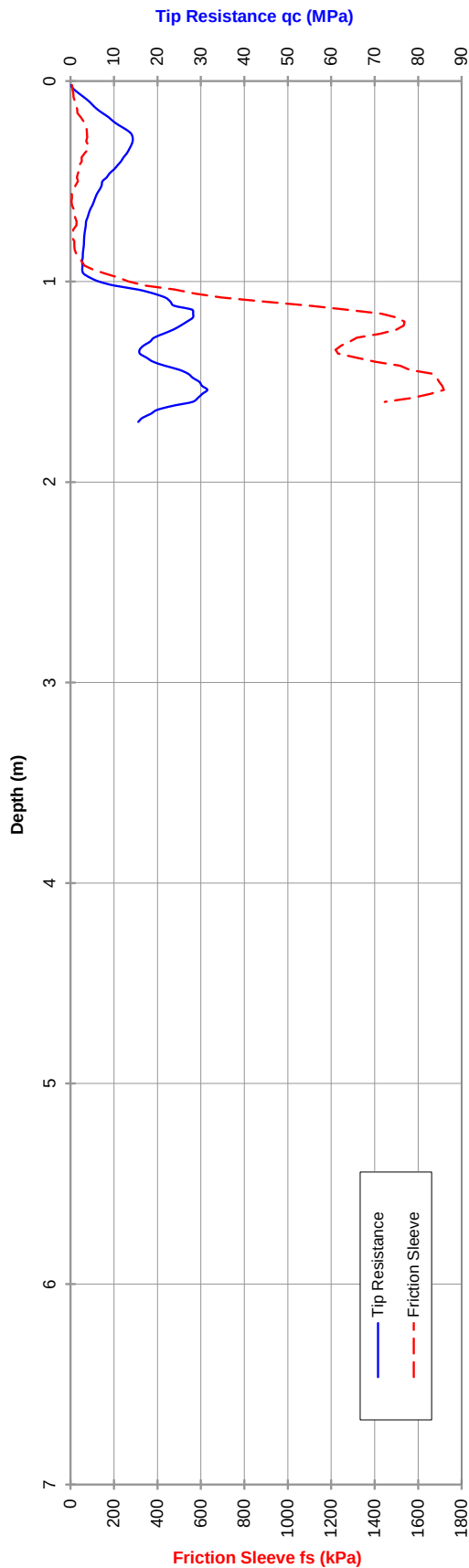
Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D
CPT 05A
18-Nov-21

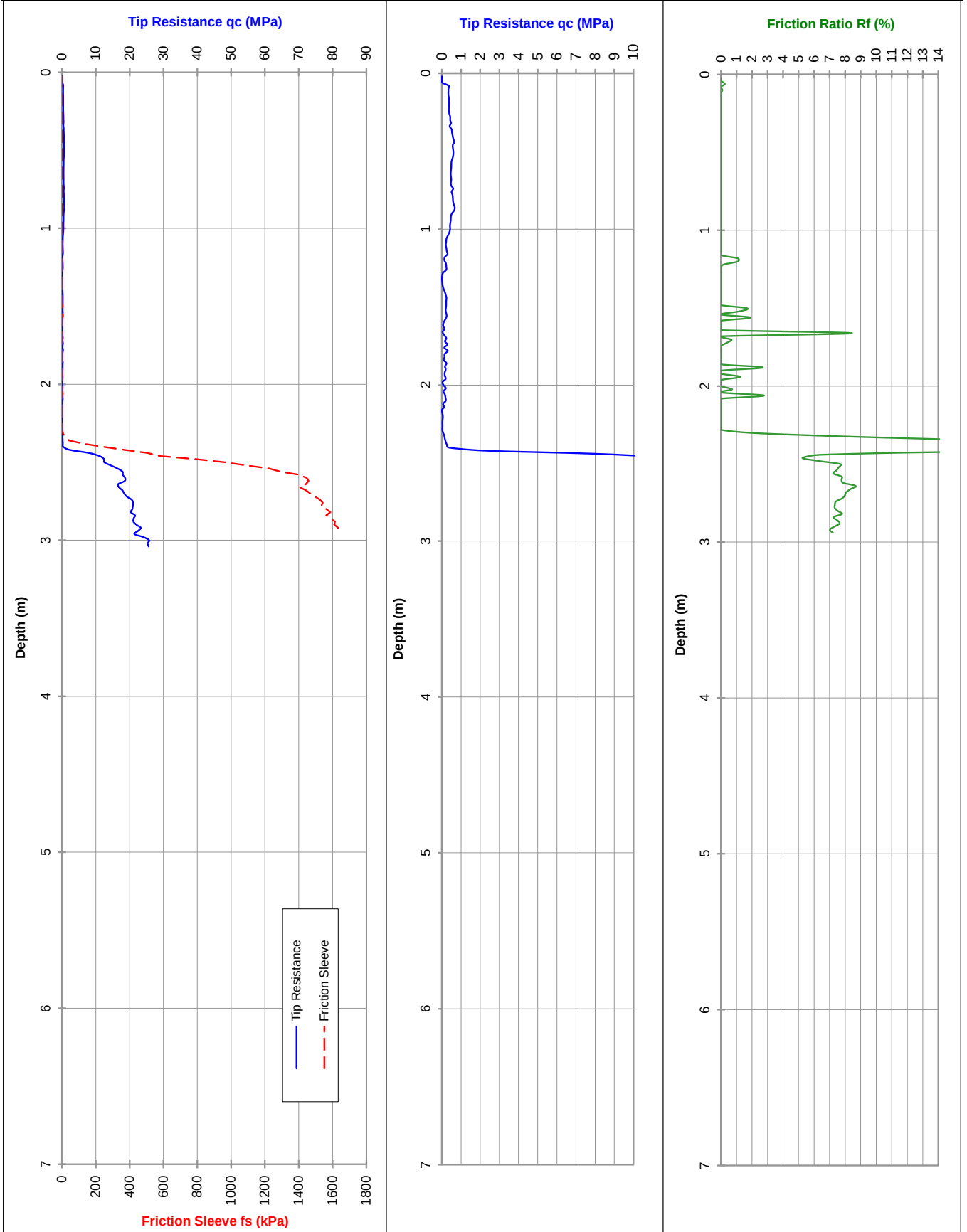


ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D
CPT 05B
18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 3.0
BH14 to (m): 2.5
Refusal: Rod Friction

Cone I.D.: EC05

File: GL0735M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

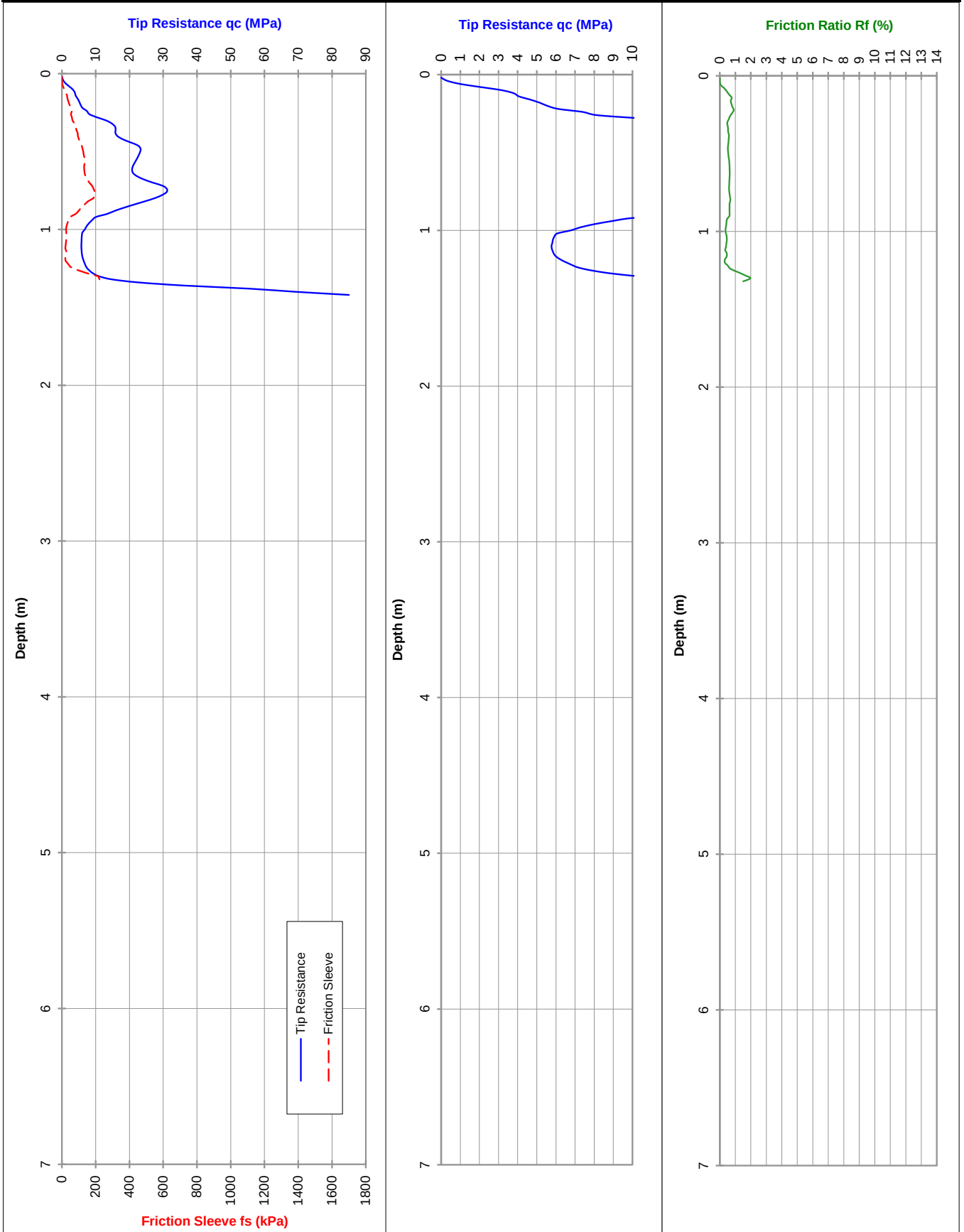
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 06

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTF 2001 for friction reducer

Approx. water (m): Dry to 1.4

Dummy probe to (m):

Refusal: 85 MPa

Cone I.D.: EC05

File: GL0729M2

Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

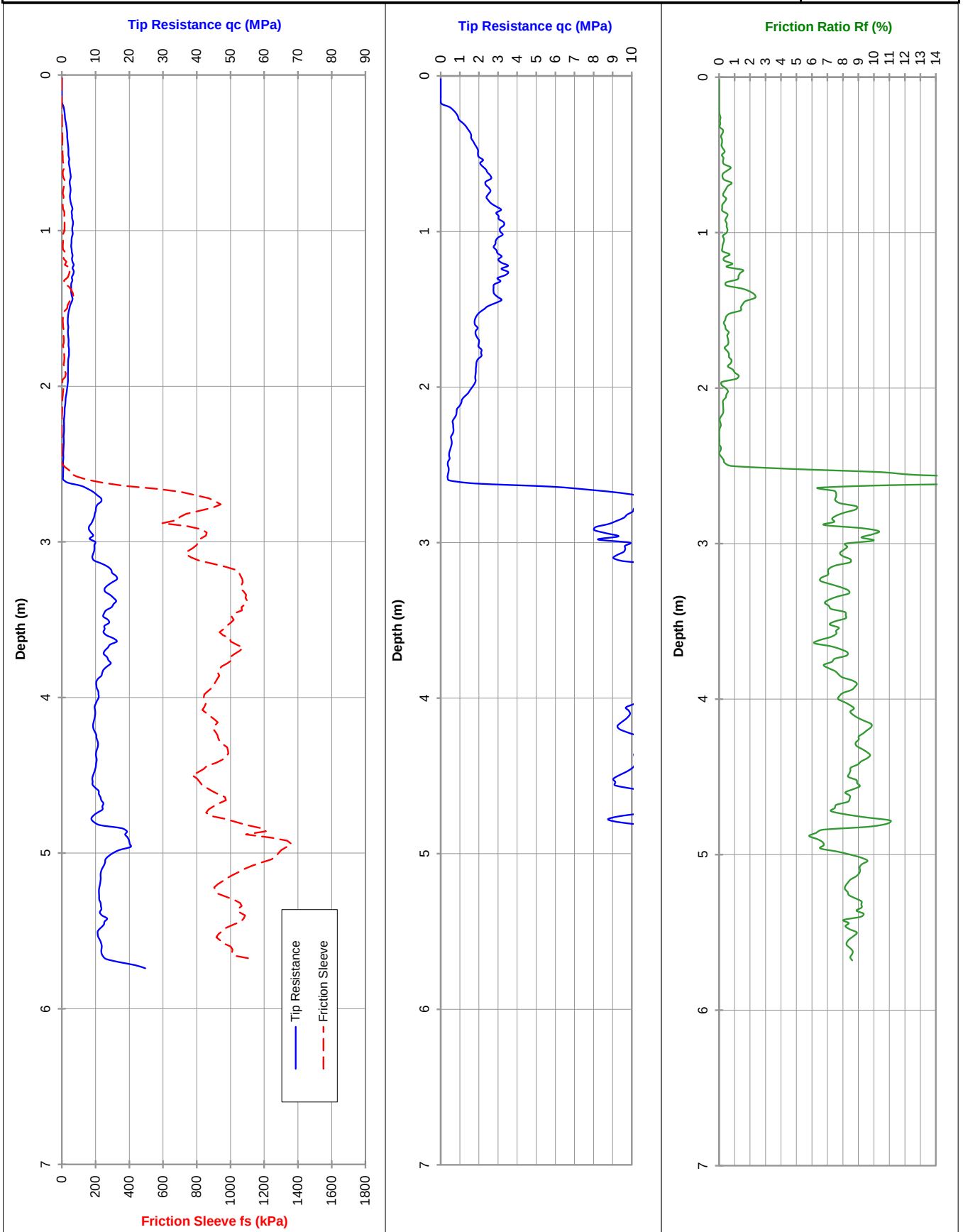
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 07

18-Nov-21



ELECTRIC FRICTION-CONE PENETROMETER

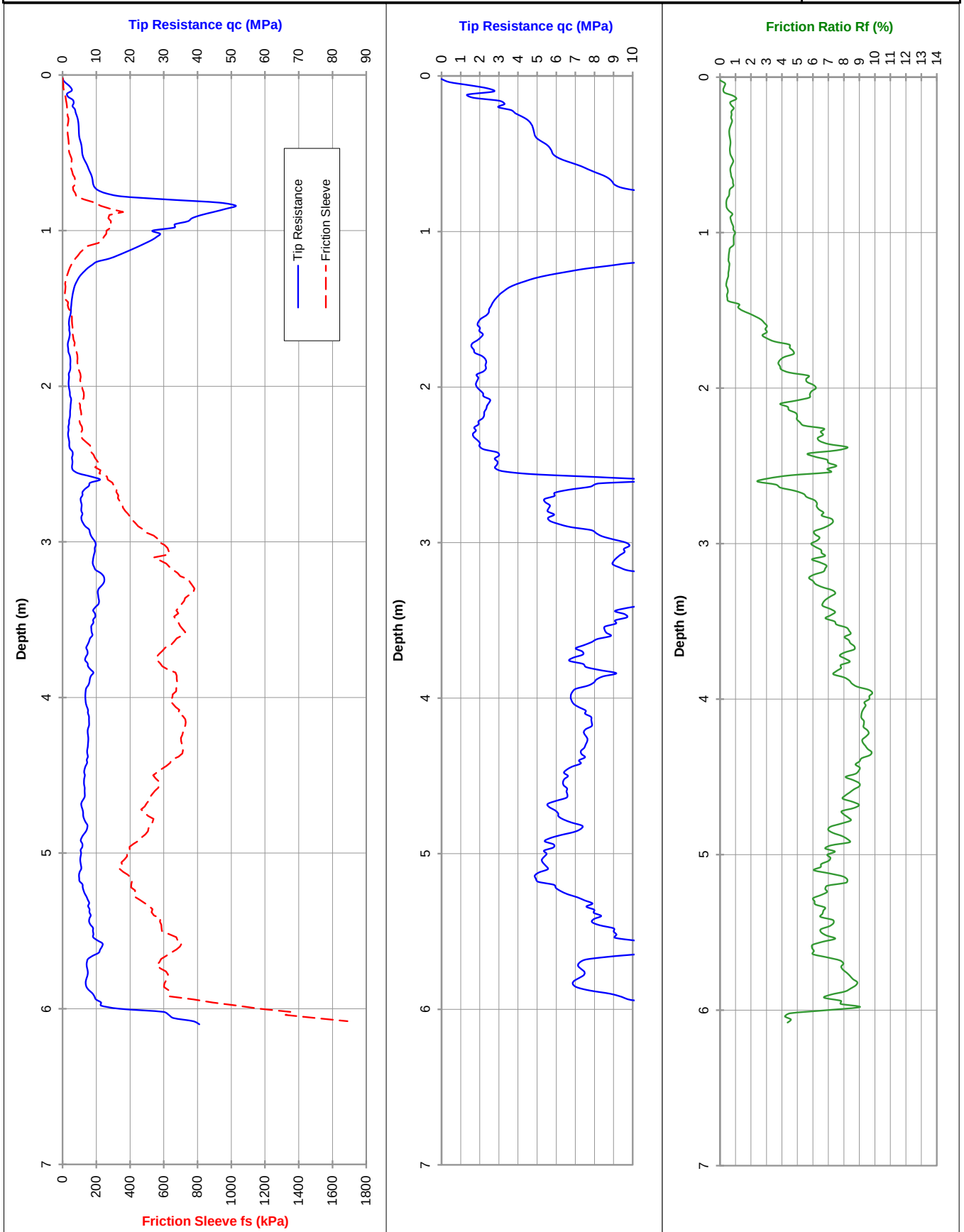
CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D

CPT 08

18-Nov-21



ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Pritchard Francis

Job No.: J2101290

PROJECT: Wattle Grove Retirement Village

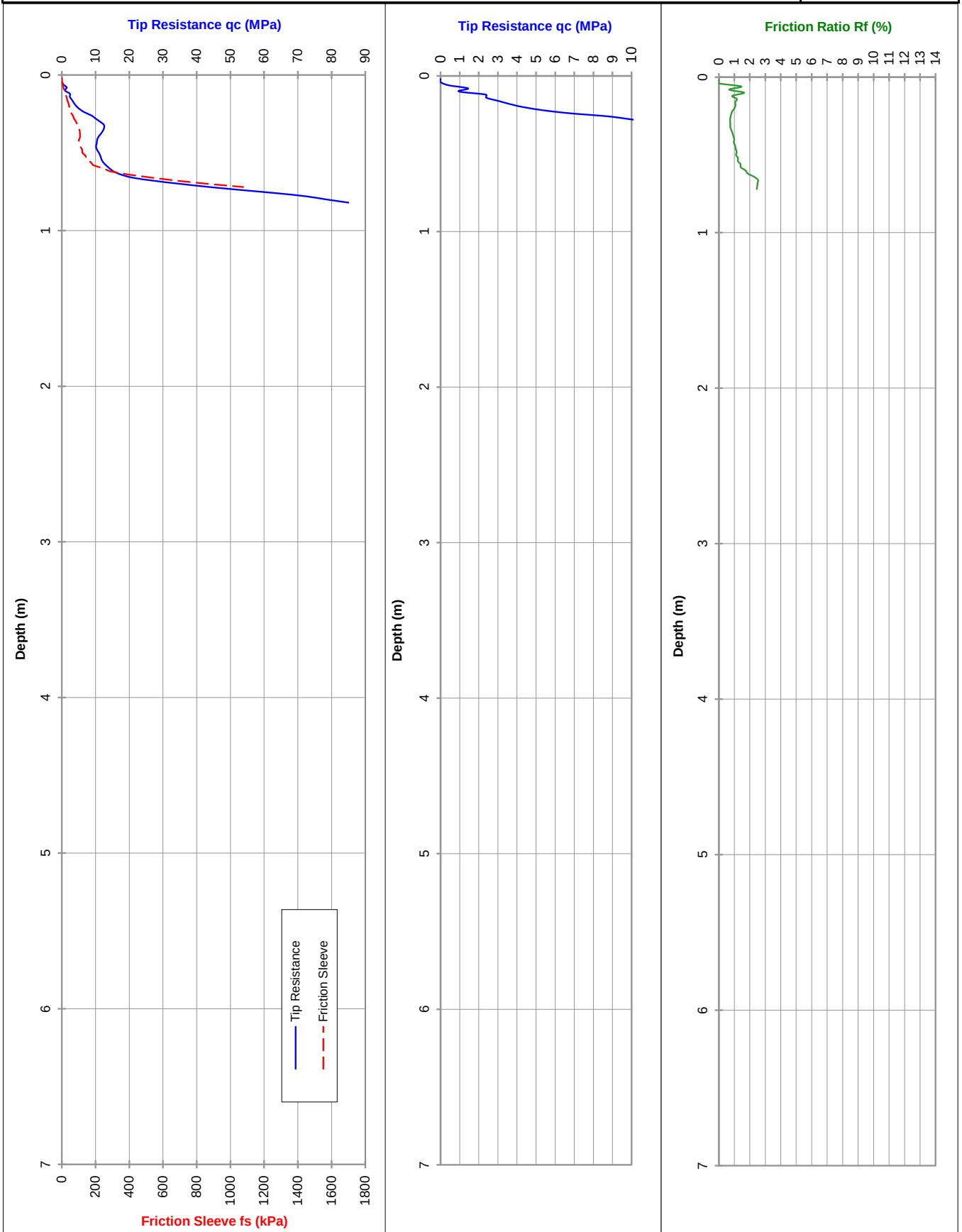
RL (m):

CPT 10

LOCATION: 32 Gavour Road, Wattle Grove

Co-ords:

18-Nov-21



Tested in accordance with AS 1289.6.5.1-1999 and IRTF 2001 for friction reducer

Approx. water (m): Dry to 0.8

Dummy probe to (m):

Refusal: 85 MPa

Cone I.D.: EC05

File: GL0741M2

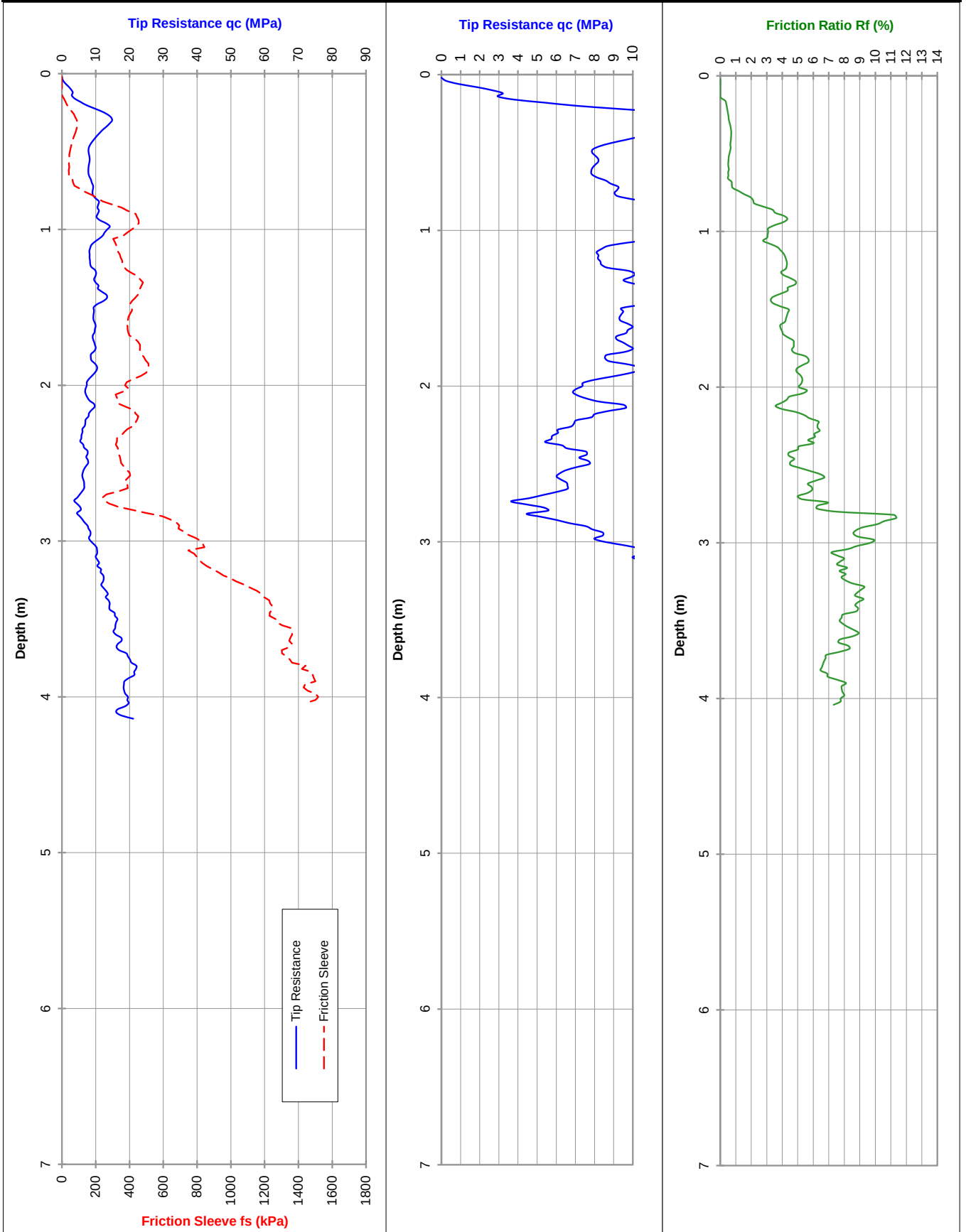
Rig Type: 11t track (M2)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Pritchard Francis
PROJECT: Wattle Grove Retirement Village
LOCATION: 32 Gavour Road, Wattle Grove

Job No.: J2101290
RL (m):
Co-ords:

Probe I.D
CPT 10A
18-Nov-21



Appendix C: Borehole Reports

METHOD OF SOIL DESCRIPTION BOREHOLE AND TEST PIT REPORTS



GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

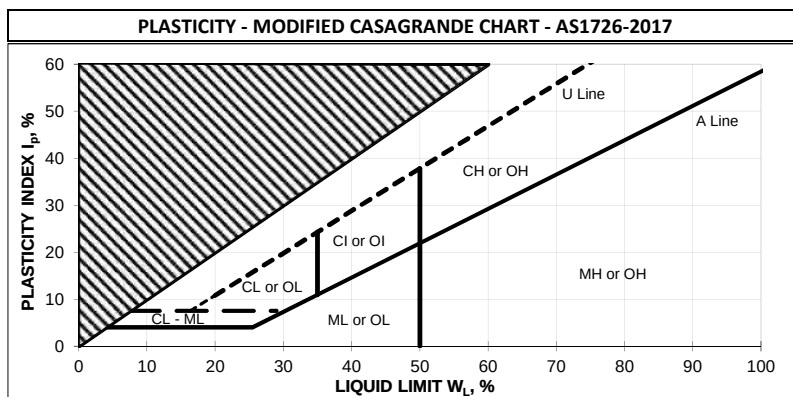
NOTE: Dual classification given for soils with a fines content between 5% and 12%.

SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE		
Soil Name	Particle Size (mm)	
BOULDERS	>200	
COBBLES	63 to 200	
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002



RESISTANCE TO EXCAVATION		
Symbol	Term	Description
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION	
Symbol	Term
D	Dry
M	Moist
W	Wet

CEMENTATION	
Cementation	Description
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY		
Symbol	Term	Undrained Shear Strength (kPa)
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS	
Material	Organic Content % of dry mass
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY		
Symbol	Term	Density Index (%)
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS



METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HMLC	HMLC Core Barrel	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering
---	-----------

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

▶	Water Inflow	▼	Water Level
◀	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

$$\text{TCR} = \text{Total Core Recovery (\%)} = \frac{\text{CRL}}{\text{TCL}} \times 100$$

$$\text{RQD} = \text{Rock Quality Designation (\%)} = \frac{\text{ALC} > 100}{\text{TCL}} \times 100$$

TCL Length of Core Run

CRL Length of Core Recovered

ALC>100 Total Length of Axial Lengths of Core Greater than 100 mm Long

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0					SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown becoming yellow-brown, trace fines, trace rootlets in top 100 mm	D		Density/consistency inferred from penetrometer testing
			0.5								
			1.0								
			1.5				SP		M	L - MD	
			2.0								
			2.5								
			3.0								
			3.5					Hole terminated at 3.00 m Target depth Groundwater not encountered			

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling				Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY
ADV	E		0.0					SAND: fine to coarse grained, sub-angular to sub-rounded, pale yellow becoming yellow-brown, trace fines, trace rootlets in top 100 mm	D	Density/consistency inferred from penetrometer testing
			0.5		B(BH02-1)				MD	
			1.0							
			1.5				SP		L - MD	
			2.0							
			2.5							
			3.0							
			3.5					Hole terminated at 3.00 m Target depth Groundwater not encountered		

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						SAND: fine to coarse grained, sub-angular to sub-rounded, pale yellow becoming yellow-brown, with 5-10% low plasticity fines, trace rootlets in top 100 mm	D		Density/consistency inferred from penetrometer testing
			0.5	B(BH03-1)						MD - D		
			1.0							MD		
			1.5					SP-SC		M		
			2.0									
			2.5									
			3.0									
			3.5						Hole terminated at 3.00 m Target depth Groundwater not encountered			

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0		B(BH04-1)	• •	SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale yellow becoming yellow-brown, trace fines, trace rootlets in top 100 mm	D	MD - D	Density/consistency inferred from penetrometer testing
			0.5			• •					
			1.0			• •				MD	
			1.5			• •			M		
			2.0			• •					
			2.5			• •					
			3.0			• •					
			3.5					Hole terminated at 3.00 m Target depth Groundwater not encountered			

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, with 30-40% gravel, with 5-15% low plasticity fines	D	VD	Density/consistency inferred from penetrometer testing
			0.5	B(BH05-1)								
	F			1.0	B(BH05-2)			SP-SC	Sandy CLAY: low to medium plasticity, orange, fine to medium grained sand, trace gravel, recovered as cemented clay nodules in a clayey sand matrix	M		
				1.5	B(BH05-3)							
			2.0					CL-CI				
			2.5						Becoming well cemented			
			3.0						Hole terminated at 2.60 m Refusal on hard ground Groundwater not encountered			
			3.5									

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	E		0.0		B(BH06-1)			SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, with 10-20% fine to medium grained, sub-angular to sub-rounded gravel, trace rootlets in top 100 mm, trace fines		Density/consistency inferred from penetrometer testing
			0.5						Increasing gravel content	VD	
			1.0		B(BH06-2)			SP-SC	SAND: fine to medium grained, brown, with low plasticity fines, trace to with gravels		
			1.5							D - M	
			2.0					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown to orange, 15-25% low plasticity fines, 10-20% fine to medium grained gravel		
			2.5								
			3.0						Hole terminated at 2.80 m Target depth Groundwater not encountered		
			3.5								

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling				Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	E		0.0					SP	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, brown, with 20-40% fine to coarse grained, sub-angular to sub-rounded pisolitic gravel, trace fines, trace rootlets in top 100 mm	D	Density/consistency inferred from penetrometer testing
			0.5						SAND: fine to coarse grained, sub-angular to sub-rounded, brown to orange-brown, with fine to coarse pisolitic gravel, with low plasticity fines	VD	
	F		1.0					SP-SC		M	
	H		2.0								
			2.5						Hole terminated at 2.20 m Refusal on hard ground Groundwater not encountered		
			3.0								
			3.5								

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

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Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0		B(BH08-1)		</					

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
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Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0					SP	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, with 30-40% fine to coarse grained gravel, trace rootlets in top 100 mm, trace fines	D	VD	Density/consistency inferred from penetrometer testing
	F											
	H		2.5									
			3.0						Hole terminated at 2.50 m Refusal on hard ground Groundwater not encountered			

Sketch & Other Observations



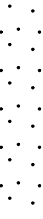
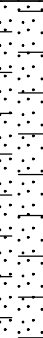
Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0		B(BH10-1)		SP-SC	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, with 30-40% fine to coarse grained gravel, trace rootlets in top 100 mm, trace to with fines (5-15%), with pockets of gravelly sand	D	VD	Density/consistency inferred from penetrometer testing	
			0.5									
			1.0									
			1.5									
	B(BH10-2)				SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown to orange, with 15-20% low plasticity fines, with fine to medium grained gravel	M					
2.0												
F	H	2.5					Hole terminated at 2.50 m Refusal on hard ground Groundwater not encountered					
			3.0									

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V			0.0					SP-SC	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, 40-50% fine to coarse grained, sub-angular to rounded gravel, pale brown, trace to with fines, trace rootlets to 100 mm	D	VD	Density/consistency inferred from penetrometer testing Slotted PVC standpipe installed to 2.8 m depth
			0.5					Becoming brown to orange				
			1.0		B(BH11-1)			SC	Clayey SAND: fine to medium grained, orange-brown, 15-20% low to medium plasticity fines, with fine to medium grained gravel	M		
			1.5									
			2.0									
			2.5									
			3.0									
			3.0						Hole terminated at 3.00 m Target depth Groundwater not encountered			

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, with 10-20% fine to coarse grained pisolitic gravel, trace fines, trace rootlets in top 100 mm	D	VD	Density/consistency inferred from penetrometer testing
			0.5				SP-SC	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, 40-50% fine to coarse grained, sub-angular to rounded pisolitic gravel, pale brown, trace to with fines, trace rootlets to 100 mm			
			1.0				SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, brown to red, with 15-20% low plasticity fines, with trace fine to coarse grained pisolitic gravel			
	F		2.0						M		
	H		2.5					Hole terminated at 2.50 m Refusal on hard ground Groundwater not encountered			
			3.0								
			3.5								

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling	Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV			0.0					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, with 10-20% fine to medium grained gravel, trace rootlets in top 100 m, trace fines	D	Density/consistency inferred from penetrometer testing
			0.5		B(BH13-1)				Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, 30-40% pisolitic gravel, with fines	VD	
			1.0					SP-SC		M	
			1.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, with 15-20% low plasticity fines, trace fine to medium grained gravel		
			2.0						Hole terminated at 2.00 m Refusal on hard ground Groundwater not encountered		
			2.5								
			3.0								
			3.5								

Sketch & Other Observations



Comments:

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Job Number: J2101290
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Project: Proposed Retirement Village
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Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, with fines, trace gravel, trace rootlets in top 100 mm	VD	Density/consistency inferred from penetrometer testing
			0.5					SP-SC		D	
			1.0					SC	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown becoming brown, fine to medium grained pisolitic gravel, with low plasticity fines	M	
	F		2.0					SC	Fines content increasing Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, with 15-20% low plasticity fines, 20-40% fine to medium grained gravel		
	H		2.5						Hole terminated at 2.50 m Refusal on hard ground Groundwater not encountered		
			3.0								
			3.5								

Sketch & Other Observations



Comments:

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Job Number: J2101290
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Project: Proposed Retirement Village
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Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
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Checked Date: 08/12/2021
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Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
ADV	E		0.0						Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, 20-40% fine to coarse grained pisolitic gravel, with fines	D	VD	Density/consistency inferred from penetrometer testing	
				B(BH15-1)									
			0.5										
				B(BH15-2)									
	1.0								Becoming brown	M			
	B(BH15-3)						Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, brown, with 15-20%, low to medium plasticity fines, with 20-40% fine to medium grained gravel						
	F	2.0							Hole terminated at 2.00 m Target depth Groundwater not encountered				
		2.5											
		3.0											
		3.5											

Sketch & Other Observations



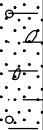
Comments:

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Job Number: J2101290
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Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	E		0.0				SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets in top 200 mm, trace fines, trace gravel	D	Density/consistency inferred from penetrometer testing		
			B(BH16-1)		MD							
					SC	Gravelly Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, 15-20% low to medium plasticity fines, 30-40% pisolitic gravel, brown to orange-brown	M	D				
	B(BH16-2)											
	F											
H												
		1.5						Hole terminated at 1.40 m Refusal on hard ground Groundwater not encountered				
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Sketch & Other Observations



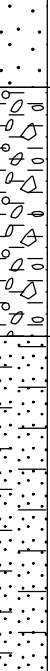
Comments:

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Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV			0.0					SP-SC	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, trace to with low plasticity fines, with gravel	D	VD	Density/consistency inferred from penetrometer testing Slotted PVC standpipe installed to 2.8 m depth
			0.5					GC	Sandy GRAVEL: fine to coarse grained rounded to sub-angular pisolitic gravels, pale orange-brown, fine to coarse grained sand, with fines			
			1.0					SC	Gravelly Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, 15-20% low to medium plasticity fines, 30-40% pisolitic gravel, brown to orange-brown	M		
			1.5									
			2.0									
			2.5									
			3.0						Hole terminated at 3.00 m Target depth Groundwater not encountered			
			3.5									

Sketch & Other Observations



Comments:

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Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace rootlets in top 100 mm, trace fines, trace gravel	D	VD	Density/consistency inferred from penetrometer testing
			0.5					SP				
	F		1.0		B(BH18-1)			Gravelly Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, 15-20% low to medium plasticity fines, 30-40% pisolitic gravel, brown-orange-brown	M			
			1.5					SC				
	H		2.0		B(BH18-2)							
			2.5						Hole terminated at 2.00 m Refusal on hard ground Groundwater not encountered			
			3.0									
			3.5									

Sketch & Other Observations



Comments:

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Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
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Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV			0.0								
					B(BH19-1)		SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown becoming grey, trace rootlets in top 100 mm, trace fines, trace gravel	D	VD	Density/consistency inferred from penetrometer testing
			0.5								
			1.0		B(BH19-2)			Gravelly Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, 15-20% low to medium plasticity fines, 30% pisolitic gravel, orange-brown			
			1.5				SP-SC	Becoming brown, increasing gravel and fines content	M		
			2.0								
			2.5								
			3.0					Hole terminated at 3.00 m Target depth Groundwater not encountered			
			3.5								

Sketch & Other Observations



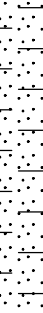
Comments:

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Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

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Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
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Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	E		0.0					SP-SC	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, trace rootlets in top 100 mm, with 5-10% low plasticity fines	D	VD	Density/consistency inferred from penetrometer testing
			0.5					B(BH20-1)	Becoming pale brown to brown Clayey SAND: fine to coarse gained, brown, low to medium plasticity fines, 10-20% fine to coarse grained pisolitic gravel Becoming pale brown to brown			
	1.0						SC	Gravelly CLAY: low to medium plasticity, brown, with 20-50% fine to coarse grained pisolitic gravel, with 10-30% fine to coarse grained sand	M			
	1.5											
	2.0						H		CL-CI			
		2.5						Hole terminated at 2.60 m Refusal on hard ground Groundwater not encountered				
			3.0									

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, with low plasticity fines, trace rootlets in top 100 mm	D	VD	Density/consistency inferred from penetrometer testing
			0.5		B(BH21-1)			SP-SC				
			1.0					SP-SC	Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, orange-brown, fine to medium grained gravel, with low to medium plasticity fines	M		
	F		1.5					SC	Clayey SAND: fine to coarse grained, brown, low to medium plasticity fines, 10-20% fine to coarse grained pisolitic gravel			
	H		2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered			
			2.5									
			3.0									
			3.5									
			4.0									
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			98.0									
			98.5									
			99.0									

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, with low plasticity fines, trace rootlets in top 100 mm	D	D	Density/consistency inferred from penetrometer testing
				B(BH22-1)								

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	E		0.0				</					

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0						SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to grey, trace gravel, trace to with low plasticity fines	D	VD	Density/consistency inferred from penetrometer testing Slotted PVC standpipe installed to 2.8 m depth	
					B(BH24-1)								
			0.5										
			1.0		B(BH24-2)			SP-SC					
	1.5												
	2.0						SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, orange, low to medium plasticity fines, with gravel	M				
	2.5			B(BH24-3)									
							CL-CI	Sandy CLAY: low to medium plasticity, orange, with 40-60% fine to medium grained sand, trace gravel, recovered as cemented clay nodules in a sandy matrix					
						Hole terminated at 3.00 m Target depth Groundwater not encountered							

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0									

Sketch & Other Observations



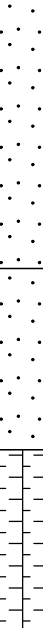
Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	E		0.0				SP-SC	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown to brown, trace rootlets in top 100 mm, trace to with low plasticity fines, trace gravel	D	D	Density/consistency inferred from penetrometer testing		
			Becoming brown					VD					
			SP-SC					Gravelly SAND: fine to coarse grained, sub-angular to sub-rounded, brown, with 20-30% fine to coarse grained pisolitic gravel, with low plasticity fines	M				
	CL-CI						Gravelly CLAY: low to medium plasticity, brown, with 20-50% fine to coarse grained pisolitic gravel, with 10-30% fine to coarse grained sand						
	H		3.0						Hole terminated at 2.80 m Target depth Groundwater not encountered				

Sketch & Other Observations



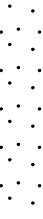
Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Job Number: J2101290
Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Lot 500 Gavour Road, Wattle Grove

Contractor: Galt
Drill Rig: Melville
Inclination: -90°
Hole Dia: 90 mm

Date: 17/11/2021
Logged: MDS
Checked Date: 08/12/2021
Checked By: SC

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	E		0.0					SP-SC	SAND: fine to coarse grained, sub-angular to sub-rounded, pale yellow to pale orange, trace rootlets in top 100 mm, trace to with low plasticity fines, trace gravel	D	VD	Density/consistency inferred from penetrometer testing
			0.5									
	F		1.0					SC	Gravelly Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, 20-30% low to medium plasticity fines, 30-40% pisolitic gravel, brown to orange-brown, recovered with cemented clay nodules in a gravelly sand matrix	M		
			1.5									
H	2.0											
		2.5							Hole terminated at 2.40 m Refusal on hard ground Groundwater not encountered			
	3.0											

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Appendix D: Perth Sand Penetrometer Test Results

PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Gavour Road, Wattle Grove

Job No: J2101290
Date: 17-18 Nov 2021
Engineer: MDS/EC



Test No:								
Location:	BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08
Depth (mm)	N° of Penetrometer Blows per 150 mm Depth Interval							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	2	4	8	13	13	14	10HB	12
300-450	1	4	6	11	16	15		16
450-600	1	3	4	9	27	10		26R
600-750	2	2	3	6	R	11		
750-900	1	2	3	5		15		
900-1050	2	2	3	6				
1050-1200	2	2						
1200-1350	2	2						
1350-1500	2	2						
1500-1650	3	2						
1650-1800	3	2						
1800-1950	3	3						
1950-2100	3	2						

Test No:								
Location:	BH09	BH10	BH11	BH12	BH13	BH14	BH15	BH16
Depth (mm)	N° of Penetrometer Blows per 150 mm Depth Interval							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	16	15R	20	15HB	4	10R	21	2
300-450	20		27		20		17	3
450-600	22		19		15		18	8
600-750	27		30R		7		13HB	12
750-900	22				6			12
900-1050	20				10			11
1050-1200					10R			
1200-1350								
1350-1500								
1500-1650								
1650-1800								
1800-1950								
1950-2100								

Test No:								
Location:	BH17	BH18	BH19	BH20	BH21	BH22	BH23	BH24
Depth (mm)	N° of Penetrometer Blows per 150 mm Depth Interval							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	15	22	16	25R	12	8	7	14
300-450	24	16	19		9	7	5	16
450-600	11	11	22		6	7	6	22
600-750	7	11	R		12	11	6	32R
750-900	10	HB			22	24R	11	
900-1050	15				R		21	
1050-1200	15HB							
1200-1350								
1350-1500								
1500-1650								
1650-1800								
1800-1950								
1950-2100								

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)

HB: Hammer bounce (refusal)

0 = Penetration due to hammer weight only

R: Refusal

PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client: Pritchard Francis
Project: Proposed Retirement Village
Location: Gavour Road, Wattle Grove

Job No: J2101290
Date: 17-18 Nov 2021
Engineer: MDS/EC



Test No:								
Location:	BH25	BH26	BH27					
Depth (mm)	N° of Penetrometer Blows per 150 mm Depth Interval							
0-150	SET	SET	SET	SET				
150-300	24R	6	27R					
300-450		6						
450-600		4						
600-750		6						
750-900		13						
900-1050		18						
1050-1200								
1200-1350								
1350-1500								
1500-1650								
1650-1800								
1800-1950								
1950-2100								

Test No:								
Location:								
Depth (mm)	N° of Penetrometer Blows per 150 mm Depth Interval							
0-150								
150-300								
300-450								
450-600								
600-750								
750-900								
900-1050								
1050-1200								
1200-1350								
1350-1500								
1500-1650								
1650-1800								
1800-1950								
1950-2100								

Test No:								
Location:								
Depth (mm)	N° of Penetrometer Blows per 150 mm Depth Interval							
0-150								
150-300								
300-450								
450-600								
600-750								
750-900								
900-1050								
1050-1200								
1200-1350								
1350-1500								
1500-1650								
1650-1800								
1800-1950								
1950-2100								

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)

HB: Hammer bounce (refusal)

0 = Penetration due to hammer weight only

R: Refusal

Appendix E: Laboratory Test Results

CERTIFICATE OF ANALYSIS 272702**Client Details**

Client	Western Geotechnical & Laboratory Services
Attention	Brooke Elliott
Address	235 Bank Street, Welshpool, WA, 6101

Sample Details

Your Reference	<u>S4797/ J2101290/</u>
Number of Samples	4 Soil
Date samples received	23/11/2021
Date completed instructions received	23/11/2021
Location	Proposed Wattle Grove Retirement Village

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	30/11/2021
Date of Issue	30/11/2021
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Michael Mowle, Metals/Inorganics Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

Miscellaneous Inorg - soil					
Our Reference		272702-1	272702-2	272702-3	272702-4
Your Reference	UNITS	WG21.15177	WG21.15178	WG21.15179	WG21.15180
Depth		0.1-0.5	0.2-0.7	0.2-0.7	0.2-0.7
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	25/11/2021	25/11/2021	25/11/2021	25/11/2021
Date analysed	-	25/11/2021	25/11/2021	25/11/2021	25/11/2021
pH	pH Units	7.7	6.1	6.2	4.8
Electrical Conductivity (EC)	µS/cm	21	41	15	86

ESP/CEC					
Our Reference		272702-1	272702-2	272702-3	272702-4
Your Reference	UNITS	WG21.15177	WG21.15178	WG21.15179	WG21.15180
Depth		0.1-0.5	0.2-0.7	0.2-0.7	0.2-0.7
Type of sample		Soil	Soil	Soil	Soil
Date digested	-	29/11/2021	29/11/2021	29/11/2021	29/11/2021
Date analysed	-	29/11/2021	29/11/2021	29/11/2021	29/11/2021
Calcium	mg/kg	170	100	110	<50
Potassium	mg/kg	110	200	140	130
Magnesium	mg/kg	<50	71	<50	<50
Sodium	mg/kg	<50	<50	<50	<50
Aluminium	mg/kg	<10	<10	<10	<10
Exchangeable Ca	meq/100g	0.9	0.5	0.6	<0.25
Exchangeable K	meq/100g	0.3	0.5	0.4	0.3
Exchangeable Mg	meq/100g	<0.41	0.6	<0.41	<0.41
Exchangeable Na	meq/100g	<0.22	<0.22	<0.22	<0.22
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	1	2	<1	<1
ESP	%	<1	<1	<1	<1

Method ID	Methodology Summary
INORG-001	pH - Measured using pH meter and electrode base on APHA latest edition, Method 4500-H+. Please note that the results for water analyses may be indicative only, as analysis can be completed outside of the APHA recommended holding times. Soils are reported from a 1:5 water extract unless otherwise specified.
INORG-002	Conductivity and Salinity - measured using a conductivity cell at 25°C based on APHA latest edition Method 2510. Soils reported from a 1:5 water extract unless otherwise specified.
METALS-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
METALS-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
METALS-020	Determination of various metals by ICP-AES.

QUALITY CONTROL: Miscellaneous Inorg - soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			25/11/2021	1	25/11/2021	25/11/2021		25/11/2021	[NT]
Date analysed	-			25/11/2021	1	25/11/2021	25/11/2021		25/11/2021	[NT]
pH	pH Units		INORG-001	[NT]	1	7.7	7.0	10	103	[NT]
Electrical Conductivity (EC)	µS/cm	1	INORG-002	<1	1	21	19	10	105	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			29/11/2021	[NT]	[NT]	[NT]	[NT]	29/11/2021	[NT]
Date analysed	-			29/11/2021	[NT]	[NT]	[NT]	[NT]	29/11/2021	[NT]
Calcium	mg/kg	50	METALS-020	<50	[NT]	[NT]	[NT]	[NT]	106	[NT]
Potassium	mg/kg	50	METALS-020	<50	[NT]	[NT]	[NT]	[NT]	109	[NT]
Magnesium	mg/kg	50	METALS-020	<50	[NT]	[NT]	[NT]	[NT]	108	[NT]
Sodium	mg/kg	50	METALS-020	<50	[NT]	[NT]	[NT]	[NT]	108	[NT]
Aluminium	mg/kg	10	METALS-020	<10	[NT]	[NT]	[NT]	[NT]	109	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.



95386
Western Geotechnical & Laboratory Servic

	Lab No	7TS21152	7TS21153	7TS21154	7TS21155
	Name	P01 - S01 0.35-0.5m	P02 - S01 0.35-0.5m	BH21 - S01 0.2-0.7m	BH24 - S01 0.2-0.7m
	Code	WG21/15177	WG21/15178	WG21/15179	WG21/15180
	Customer	Western Geotechnical & Laboratory Services	Western Geotechnical & Laboratory Services	Western Geotechnical & Laboratory Services	Western Geotechnical & Laboratory Services
	Depth	0-10	0-10	0-10	0-10
Phosphorus Retention Index		11.0	35.1	13.3	20.4



SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15170-15178_1_OI
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21/15170-15178
Location:	Lot 500 Gavour Road, Wattle grove	Date Sampled:	Not Specified
Sample Identification:	Various - See Below	Date Tested:	23/11/2021

TEST RESULTS - Organic Content

Sampling Method:

Sampled by Client, Tested as Received

Testing Completed By:

WGLS - JG

Furnace Temperature (°C):

440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG21/15170	BH08 - Bulk - 0.1-0.4m	98.3	1.7
WG21/15174	BH20 - S01 - 0.6-1.2m	97.1	2.9
WG21/15178	P02 - S01 - 0.35-0.5m	98.3	1.7

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 23/November/2021



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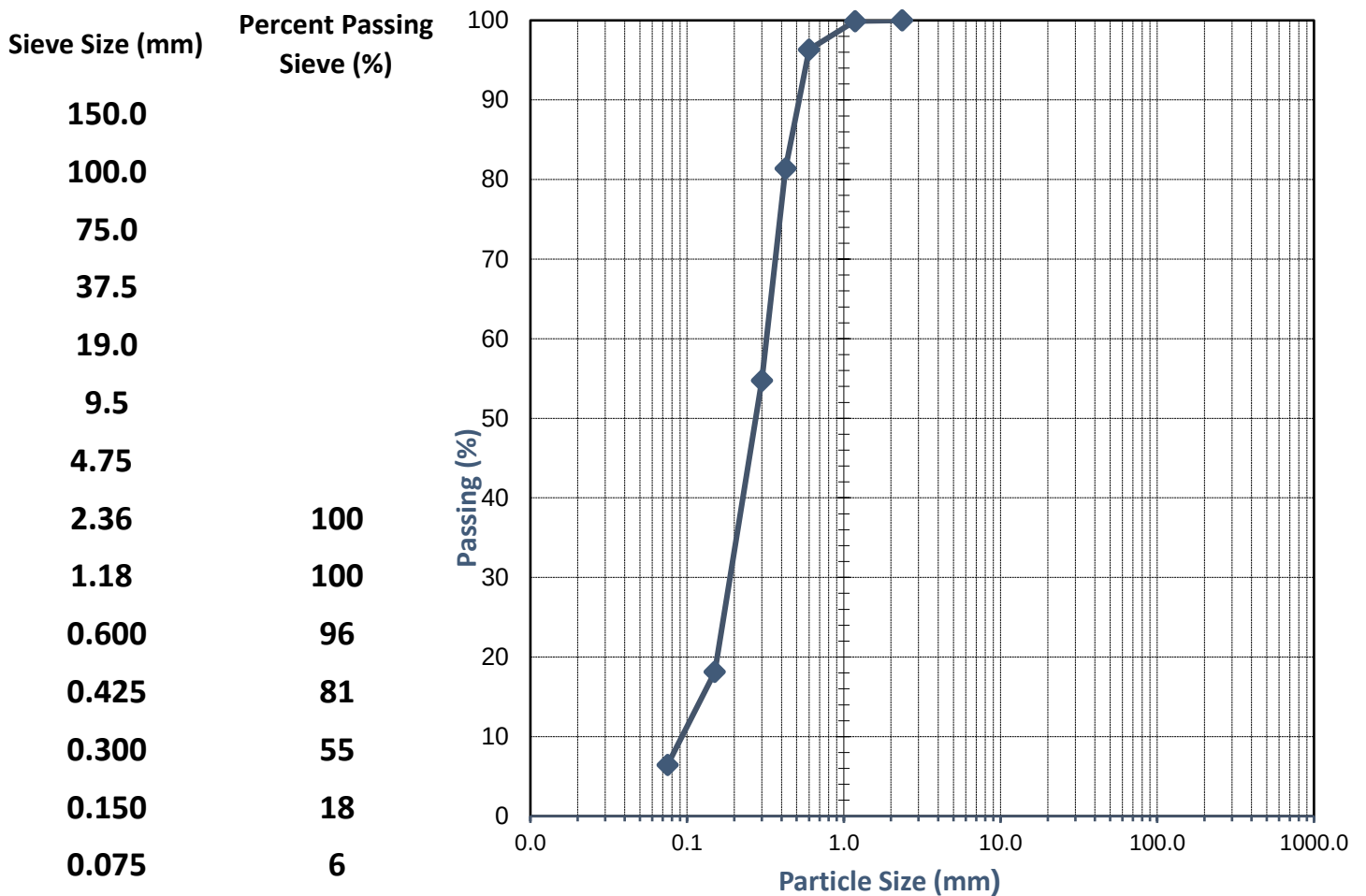
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15168_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15168
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH03 - 0.1-0.5m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 24/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15168_1_MMDD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21/15168
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH03 - 0.1-0.5m	Date Tested:	22/11/2021

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

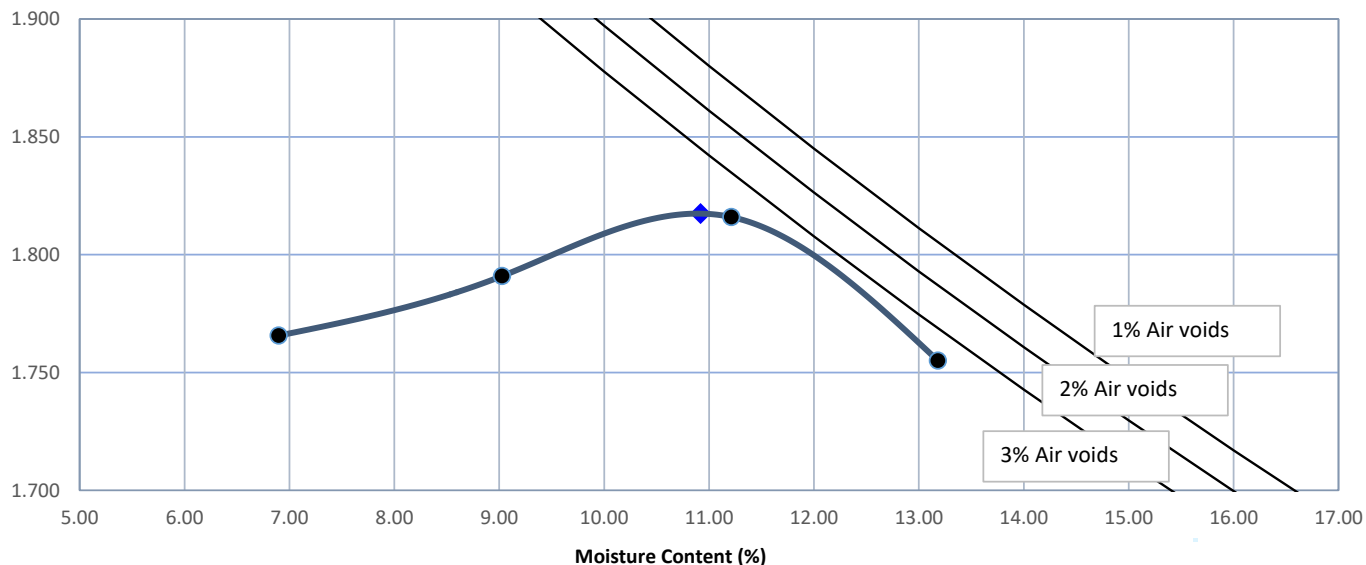
0

Material + 37.5mm (%):

-

Moisture Content (%)	6.9	9.0	11.2	13.2	
Dry Density (t/m ³)	1.766	1.791	1.816	1.755	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.82

Optimum Moisture Content (%)

11.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.4 t/m³

Approved Signatory:

Name: Natasha Bielawski

Date: 23/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15168_1_SCBR
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21/15168
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH03 - 0.1-0.5m	Date Tested:	22/11-28/11/21

TEST RESULTS - CALIFORNIA BEARING RATIO

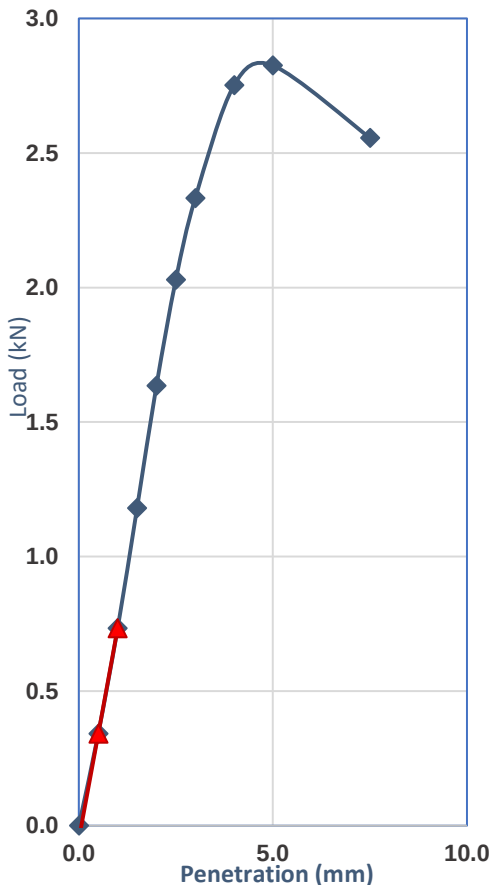
Sample Description:

Sand

Sampling Method:

Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.82	Optimum Moisture (%)	11.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m ³)	1.73	Moisture Content (%)	10.4
Density Ratio (%)	95.5	Moisture Ratio (%)	95.5

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.73	Dry Density Ratio (%)	95.5
Moisture Content (%)	15.3	Moisture Ratio (%)	140.5

Specimen Conditions After Test

Top 30mm Moisture (%)	14.0	Remaining Depth (%)	15.8
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Correction applied to Penetration: 0.1mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 16%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 29/November/2021



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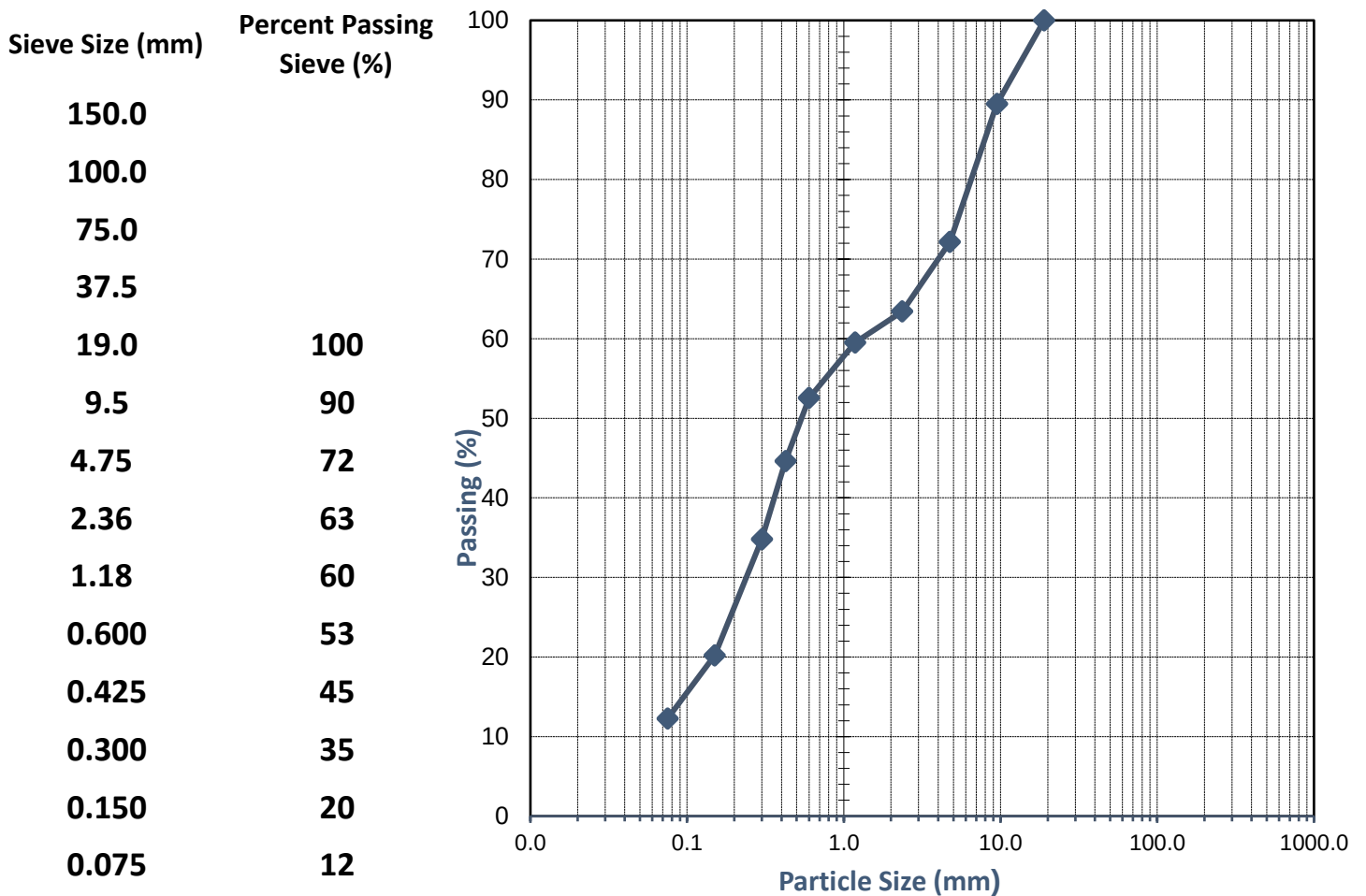
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15169_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15169
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH05 - 0.3-0.8m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 24/November/2021



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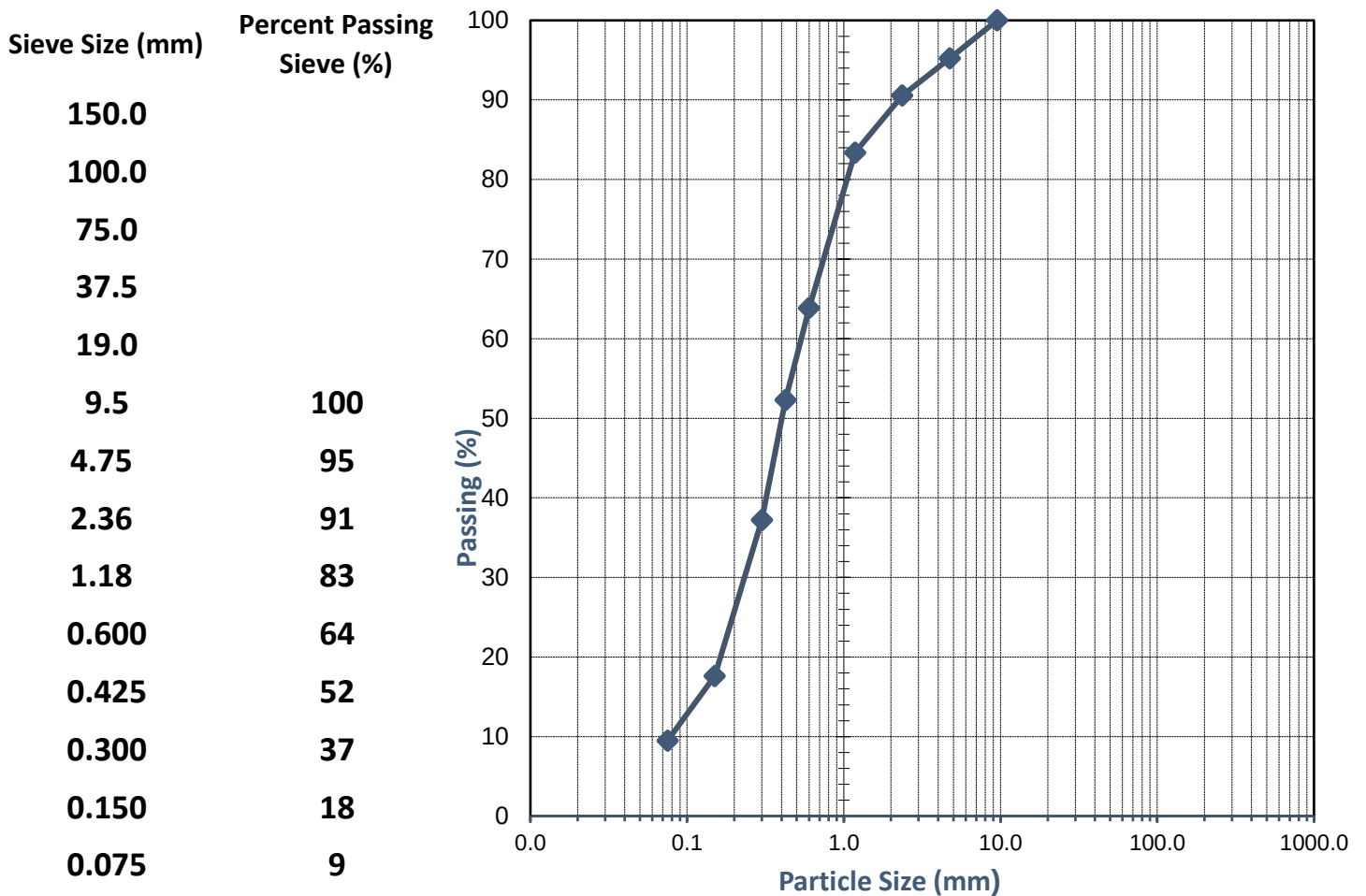
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15170_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15170
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH08 - 0.1-0.4m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 24/November/2021



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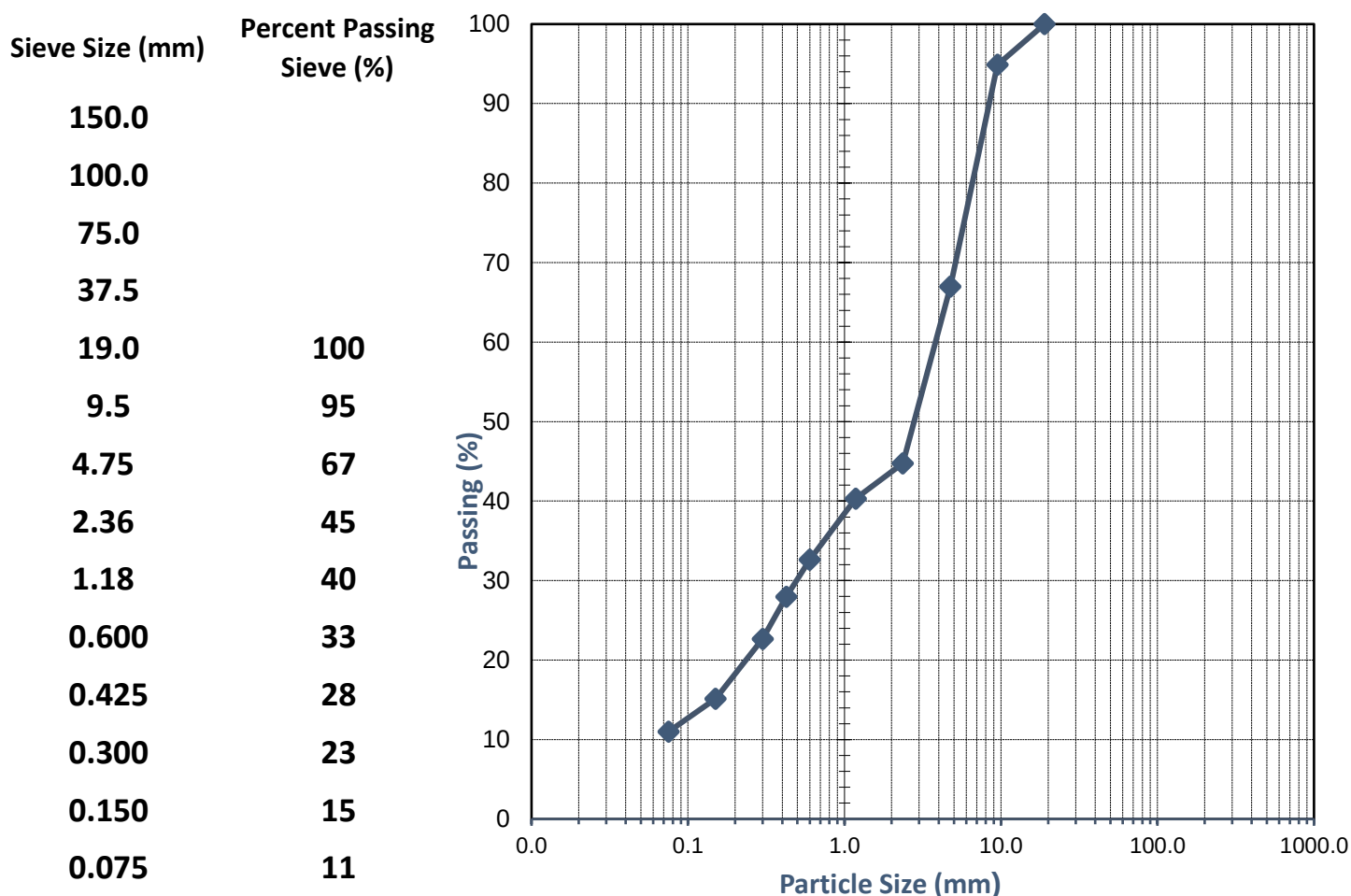
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15171_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15171
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH10 - 0.7-1.3m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 24/November/2021



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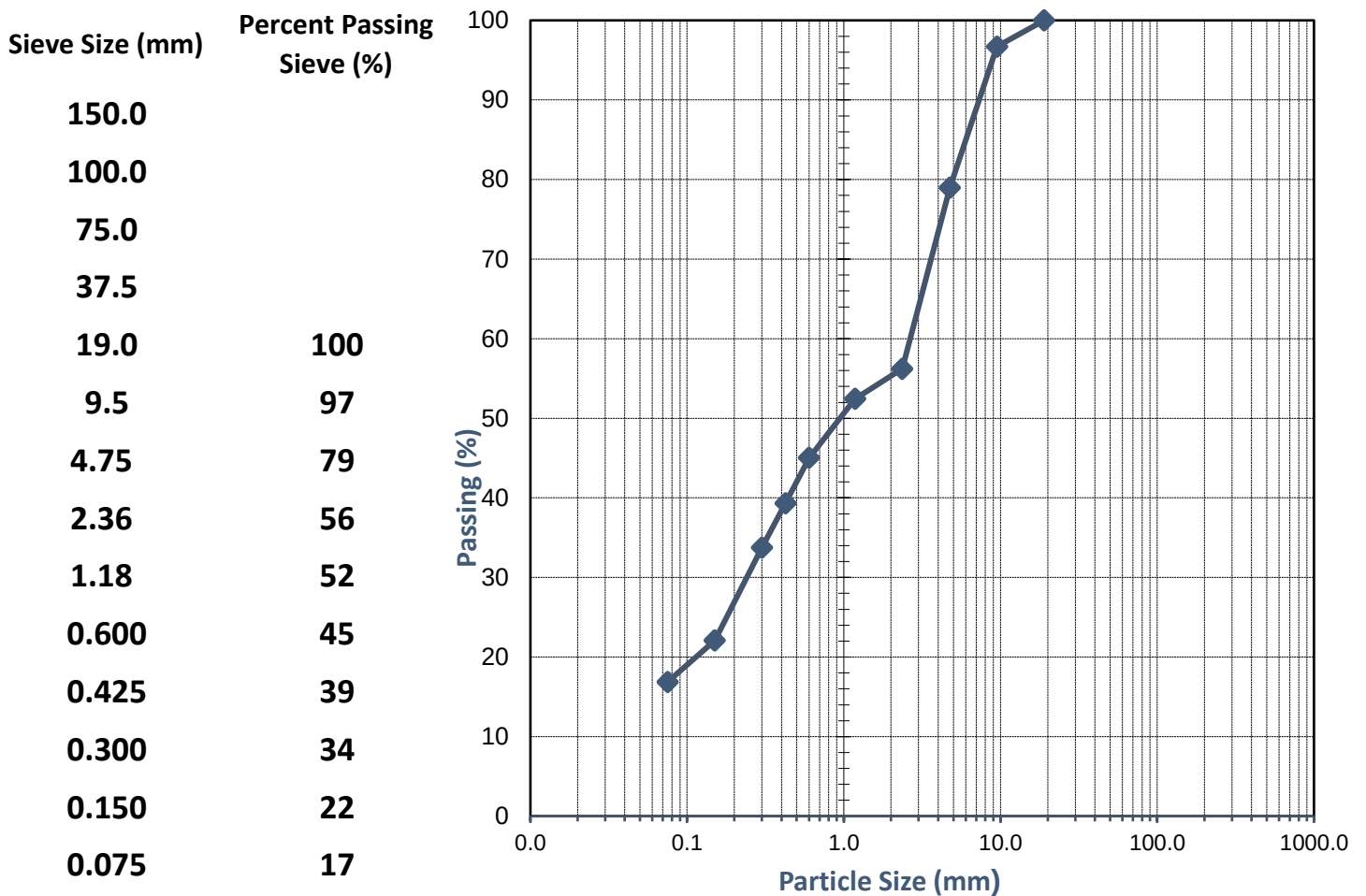
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15172_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15172
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH11 - 0.8-1.4m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 24/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15172_1_PI
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15172
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not specified
Sample Identification:	BH11 - S01 - 0.8-1.4m	Date Tested:	24-11-2021

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:

Sampled by Client, Tested as Received

History of Sample:

Oven Dried <50°C

Method of Preparation:

Dry Sieved

AS 1289.3.1.1	Liquid Limit (%)	26
AS 1289.3.2.1	Plastic Limit (%)	15
AS 1289.3.3.1	Plasticity Index (%)	11
AS 1289.3.4.1	Linear Shrinkage (%)	6.0

AS 1289.3.4.1	Length of Mould (mm)	250
AS 1289.3.4.1	Condition of Dry Specimen:	Cracked

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 25-November-2021



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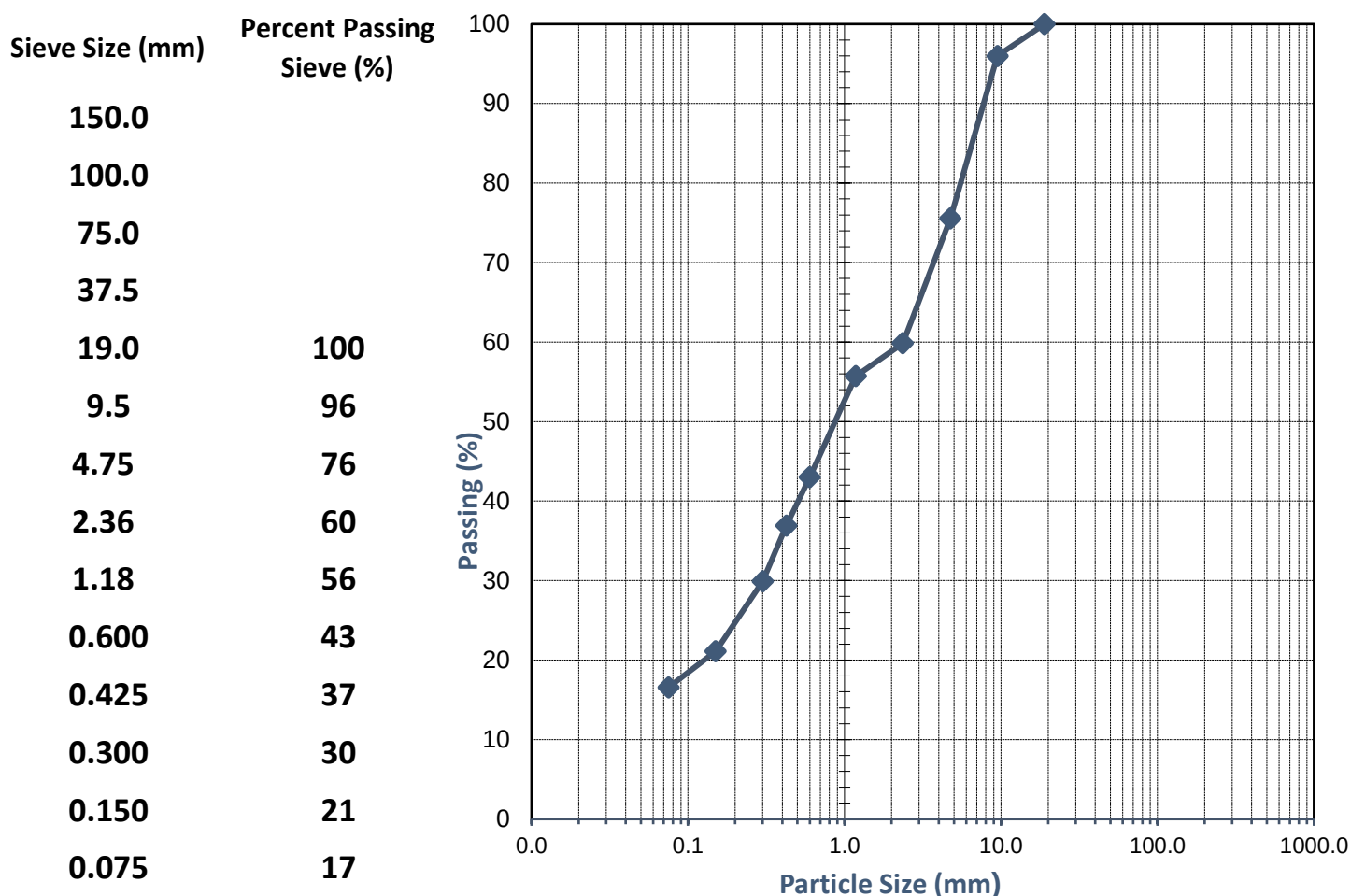
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15173_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15173
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH18 - 1.0-1.6m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 24/November/2021



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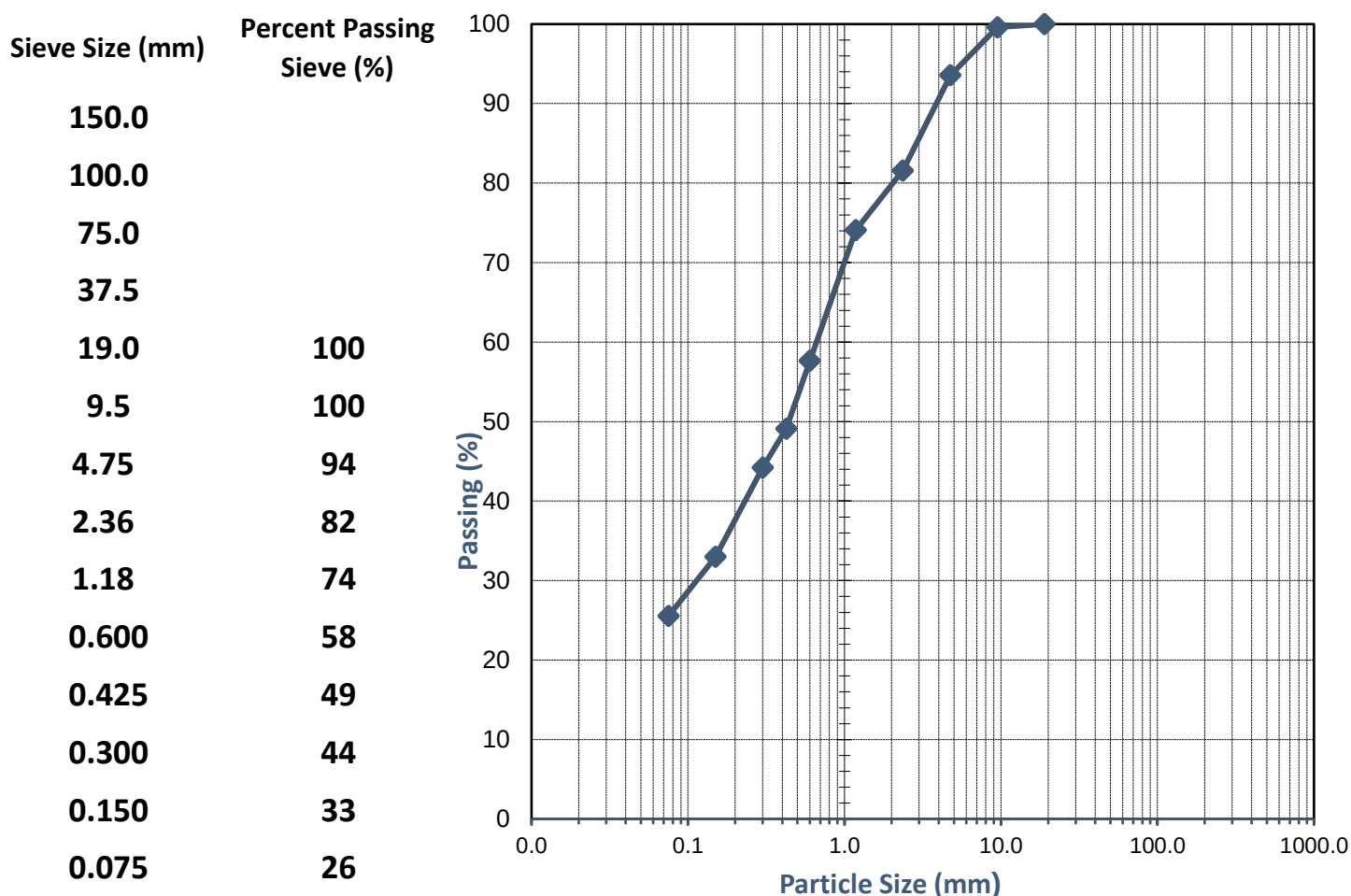
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15174_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15174
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH20 - 0.6-1.2m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 24-November-2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15174_1_PI
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15174
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not specified
Sample Identification:	BH20 - S01 - 0.6-1.2m	Date Tested:	24-11-2021

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:

Sampled by Client, Tested as Received

History of Sample:

Oven Dried <50°C

Method of Preparation:

Dry Sieved

AS 1289.3.1.1	Liquid Limit (%)	30
AS 1289.3.2.1	Plastic Limit (%)	15
AS 1289.3.3.1	Plasticity Index (%)	15
AS 1289.3.4.1	Linear Shrinkage (%)	5.0
AS 1289.3.4.1	Length of Mould (mm)	250
AS 1289.3.4.1	Condition of Dry Specimen:	-

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 25-November-2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15175_1_MMDD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21/15175
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH22 - 0.1-0.4m	Date Tested:	22/11/2021

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

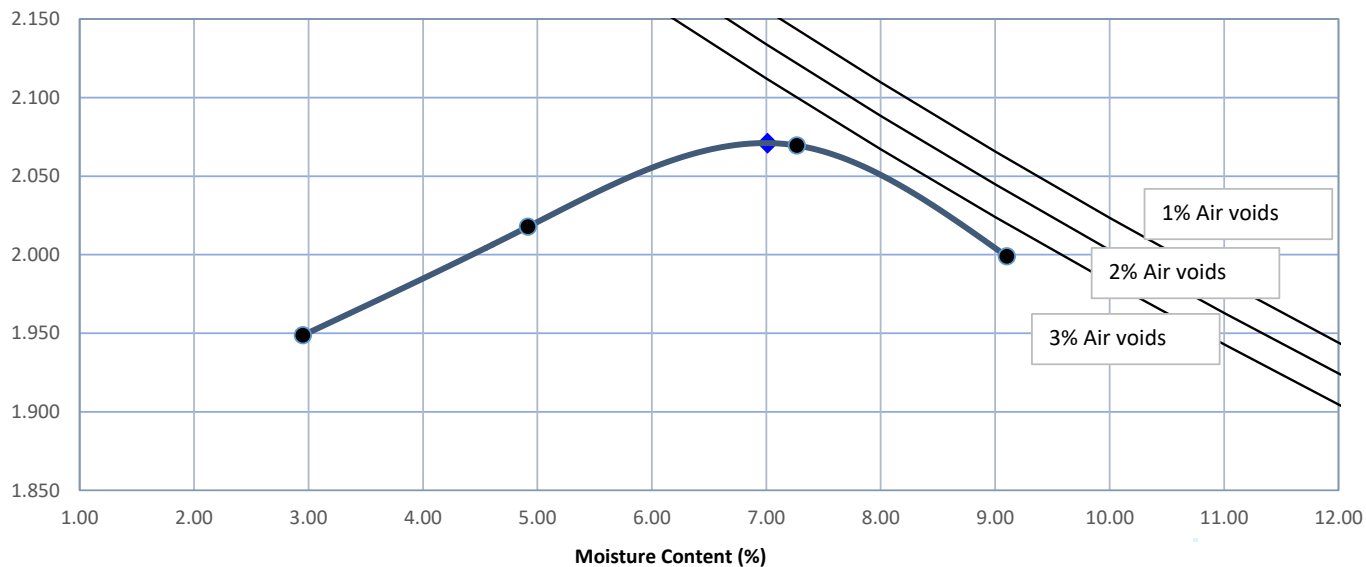
0

Material + 37.5mm (%):

-

Moisture Content (%)	2.9	4.9	7.3	9.1	
Dry Density (t/m ³)	1.949	2.018	2.070	1.999	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

2.07

Optimum Moisture Content (%)

7.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.569 t/m³

Approved Signatory:

Name: Natasha Bielawski

Date: 23/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15175_1_SCBR
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21/15175
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH22 - 0.1-0.4m	Date Tested:	22/11 - 28/11/2021

TEST RESULTS - CALIFORNIA BEARING RATIO

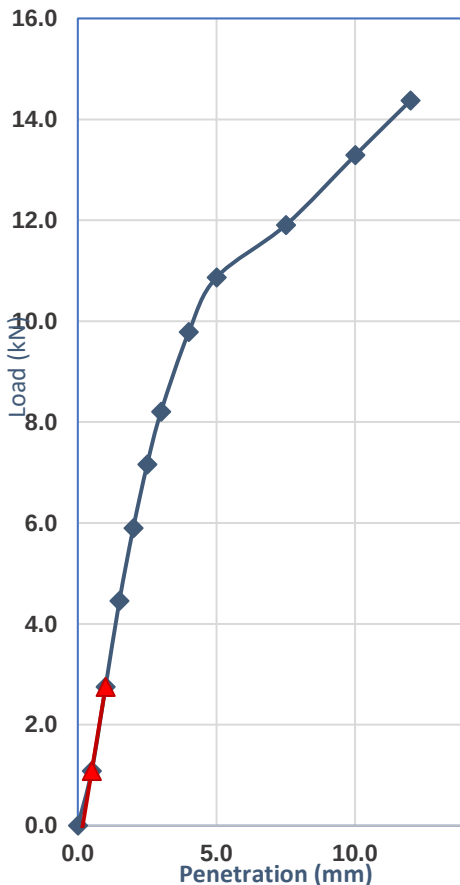
Sample Description:

Sand trace Gravel

Sampling Method:

Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	2.07	Optimum Moisture (%)	7.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m ³)	1.96	Moisture Content (%)	7.2
Density Ratio (%)	94.5	Moisture Ratio (%)	103.0

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.96	Dry Density Ratio (%)	94.5
Moisture Content (%)	10.6	Moisture Ratio (%)	151.0

Specimen Conditions After Test

Top 30mm Moisture (%)	9.9	Remaining Depth (%)	10.4
-----------------------	-----	---------------------	------

Correction applied to Penetration: 0.2mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 60%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 29/November/2021



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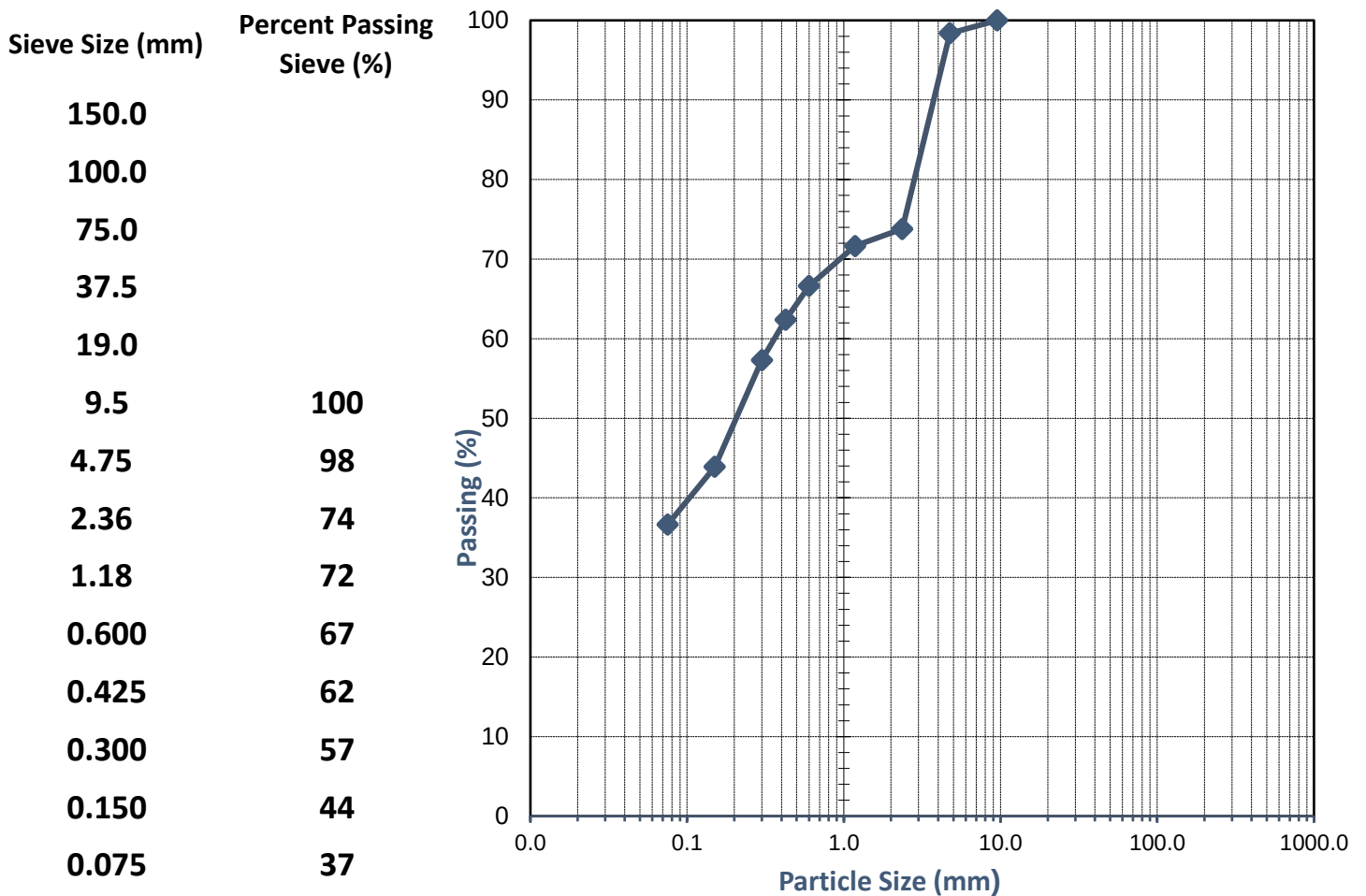
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15176_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15176
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH24 - 2.2-2.6m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 24-November-2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15176_1_PI
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15176
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not specified
Sample Identification:	BH24 - S0 - 2.2-2.6m	Date Tested:	24-11-2021

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:

Sampled by Client, Tested as Received

History of Sample:

Oven Dried <50°C

Method of Preparation:

Dry Sieved

AS 1289.3.1.1	Liquid Limit (%)	38
AS 1289.3.2.1	Plastic Limit (%)	13
AS 1289.3.3.1	Plasticity Index (%)	25
AS 1289.3.4.1	Linear Shrinkage (%)	10.0
AS 1289.3.4.1	Length of Mould (mm)	250
AS 1289.3.4.1	Condition of Dry Specimen:	-

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 25-November-2021



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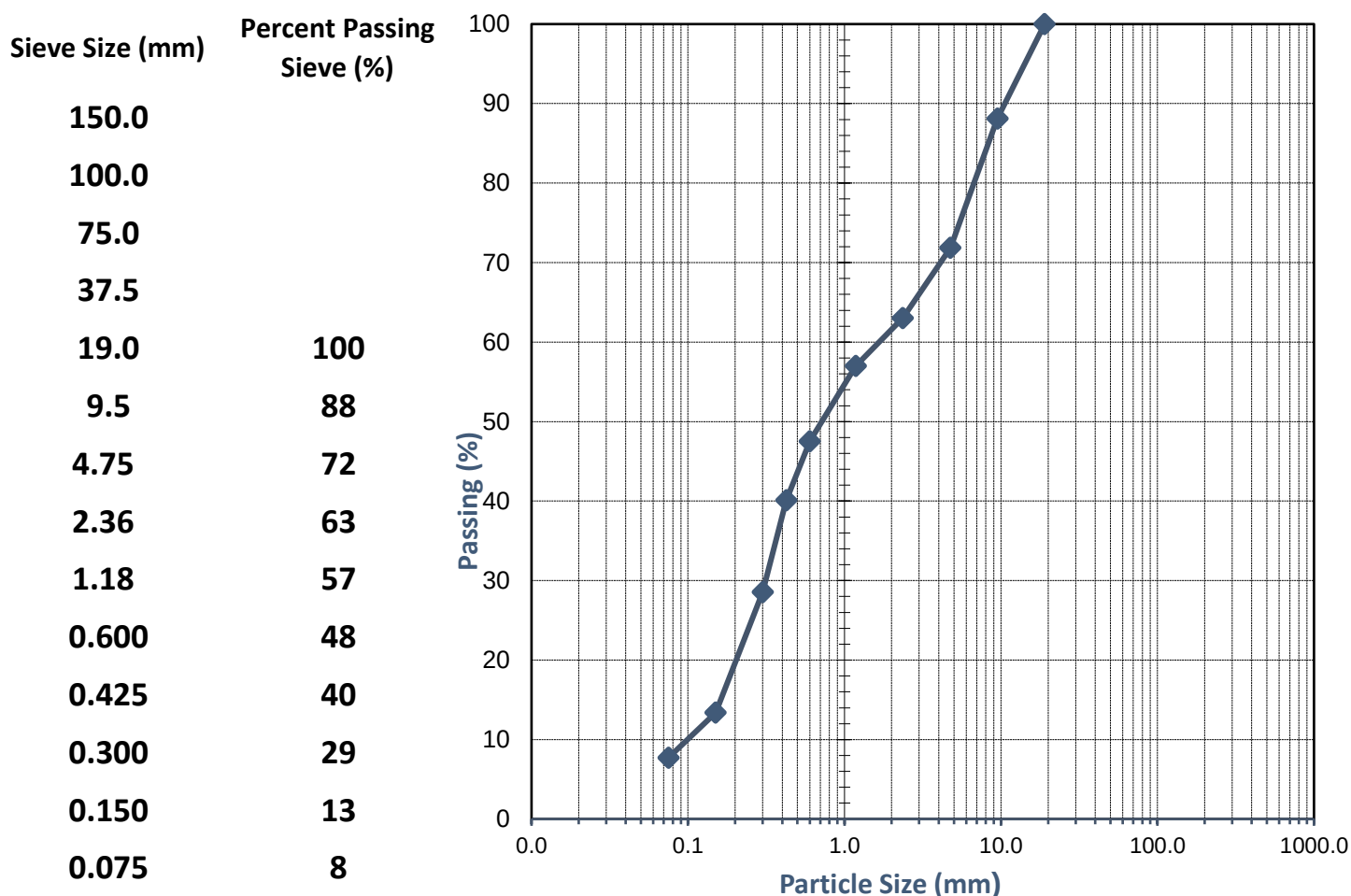
TEST REPORT - AS 1289.3.6.1* AS 1289.1.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15177_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15177
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	P01 - 0.1-0.5m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments: AS 1289.1.1- Deviation from standard: Insufficient sample according to test method requirements. NATA accreditation does not cover the performance of this service.

Approved Signatory:

Name: Brooke Elliott

Date: 24-November-2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15177_1_ECN
Project:	Proposed Wattle grove Retirement Village	Sample No.	WG21/15177
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	P01 - S01 - 0.1-0.5m	Date Tested:	23/11/2021

TEST RESULTS - Emerson Class Number

Sampling Method:

Sampled by Client, Tested as Received

Source of Material:

Not Specified

Soil Description:

Gravelly Sand

Water Used:

Distilled

**EMERSON CLASS
NUMBER**

5

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 23/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15178_1_ECN
Project:	Proposed Wattle grove Retirement Village	Sample No.	WG21/15178
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	P02 - S01 - 0.35-0.5m	Date Tested:	23/11/2021

TEST RESULTS - Emerson Class Number

Sampling Method:

Sampled by Client, Tested as Received

Source of Material:

Not Specified

Soil Description:

Gravelly Sand

Water Used:

Distilled

**EMERSON CLASS
NUMBER**

5

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 23/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15179_1_ECN
Project:	Proposed Wattle grove Retirement Village	Sample No.	WG21/15179
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH21 - S01 - 0.2-0.7m	Date Tested:	23/11/2021

TEST RESULTS - Emerson Class Number

Sampling Method:

Sampled by Client, Tested as Received

Source of Material:

Not Specified

Soil Description:

Gravelly Sand

Water Used:

Distilled

**EMERSON CLASS
NUMBER**

5

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 23/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

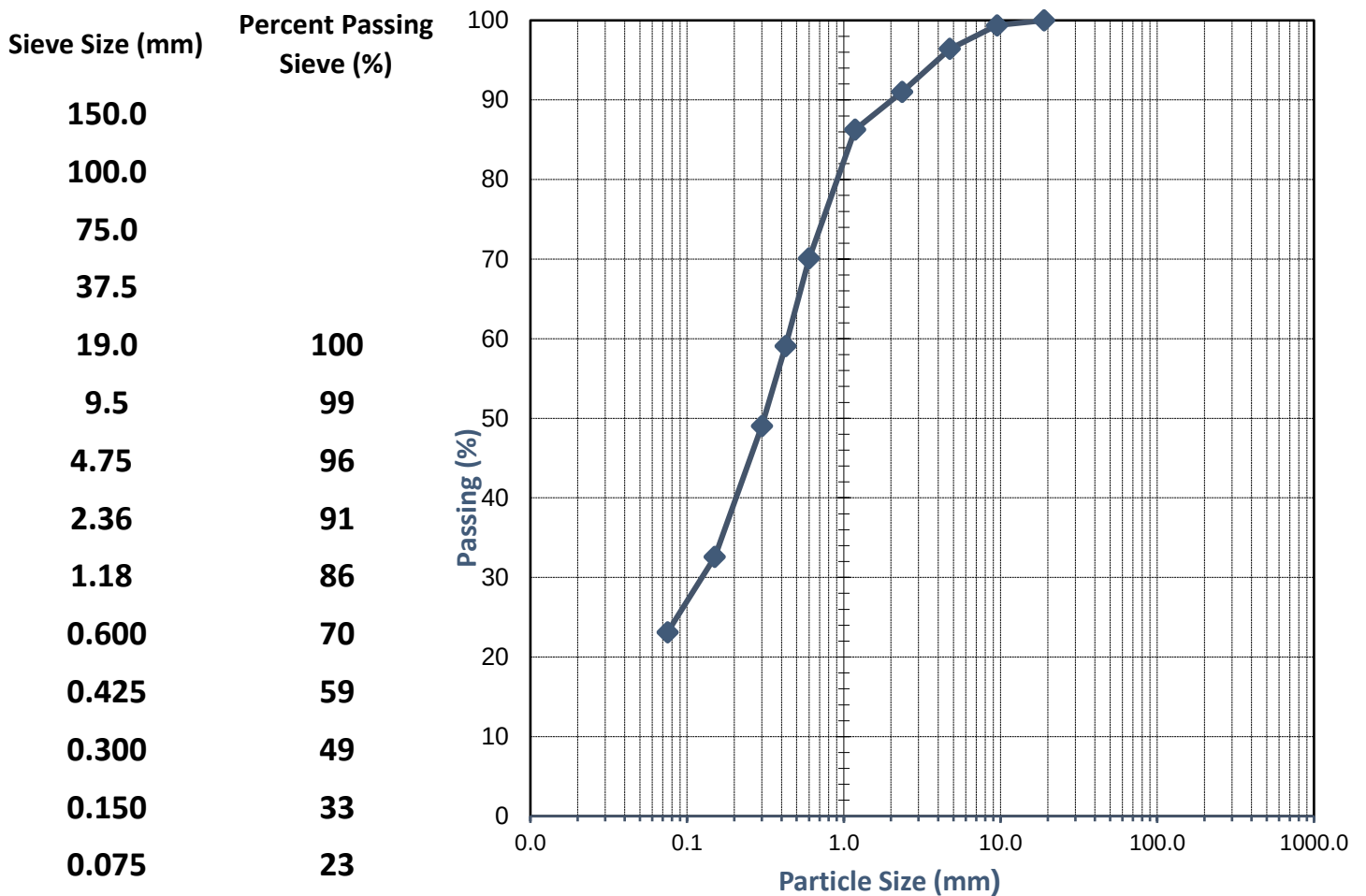
TEST REPORT - AS 1289.3.6.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21.15179_1_PSD
Project:	Proposed Wattle Grove Retirement Village	Sample No.	WG21.15179
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH21 - 0.2-0.7m	Date Tested:	23/11 - 24/11/2021

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 24-November-2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15180_1_ECN
Project:	Proposed Wattle grove Retirement Village	Sample No.	WG21/15180
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH24 - S01 - 0.2-0.7m	Date Tested:	23/11/2021

TEST RESULTS - Emerson Class Number

Sampling Method:

Sampled by Client, Tested as Received

Source of Material:

Not Specified

Soil Description:

Gravelly Sand

Water Used:

Distilled

**EMERSON CLASS
NUMBER**

5

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 23/November/2021



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Pritchard Francis	Ticket No.	S4797
Client Address:	-	Report No.	WG21/15181_1_ECN
Project:	Proposed Wattle grove Retirement Village	Sample No.	WG21/15181
Location:	Lot 500 Gavour Road, Wattle Grove	Date Sampled:	Not Specified
Sample Identification:	BH15 - S01 - 0.2-0.6m	Date Tested:	23/11/2021

TEST RESULTS - Emerson Class Number

Sampling Method:

Sampled by Client, Tested as Received

Source of Material:

Not Specified

Soil Description:

Gravelly Sand

Water Used:

Distilled

**EMERSON CLASS
NUMBER**

5

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 23/November/2021



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Appendix F: Understanding Your Report

UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev3

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- ✦ the project objectives as we understood them and as described in this report;
- ✦ the specific site mentioned in this report; and
- ✦ the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- ✦ the report was not written for you;
- ✦ the report was not written for the site specific to your development;
- ✦ the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- ✦ the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

4. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

5. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

6. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

7. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.

O:\Administration\Standard Forms and Documents\PMP11-Rev3 Understanding your Report.docx

Appendix 4 Historical Aerial Photographs

Our Ref: PLFWAT02

COTERRA
ENVIRONMENT

Level 1, 98 Colin Street
West Perth WA 6005

T (08) 9381 5513

www.coterra.com.au
info@coterra.com.au

Historical Aerial Imagery



Plate 1: 27 November 1953



Plate 2: 13 March 1961



Plate 3: 20 July 1970



Plate 4: 30 August 1981



Plate 5: 6 February 1995



Plate 6: 30 May 2010



Plate 7: 15 September 2024

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