

# **Proposed Residential Development 26-36 Park Road, 27-47 Berry Road and 48-52 River Road, St Leonards**

**Preliminary Site Investigation**

Berry Road Development Pty Ltd



**Reference: SYDGE304523**

13 June 2023

# PROPOSED RESIDENTIAL DEVELOPMENT, 26-36 PARK ROAD, 27-47 BERRY ROAD AND 48-52 RIVER ROAD, ST LEONARDS

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## Preliminary Site Investigation

**Report reference number: SYDGE304523**

13 June 2023

## PREPARED FOR

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### Restriction on Disclosure and Use of Data

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This report should be read in conjunction with the attached "Important information about your Tetra Tech Coffey Environmental Report" attached.



## EXECUTIVE SUMMARY<sup>1</sup>

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Tetra Tech Coffey Pty Ltd (Coffey) was engaged by Berry Road Development Pty Ltd (the client) to prepare this Preliminary Site Investigation (PSI) in connection with the proposed residential development at 26-36 Park Road 27-47 Berry Road and 48-52 River Road, St Leonards, NSW (the 'site').

Coffey previously prepared a PSI report for the southern part of the site<sup>2</sup> in 2018 (Coffey, 2018) which included a desktop review, site walkover and limited investigation of soil contamination. Relevant parts of the previous report were presented in this report.

It is understood this PSI was required to support a development application purposes.

Coffey understands that the client proposes to redevelop the site with a multi-storey residential development with associated basement carparking and amenities. The preliminary architectural plans (provided in Appendix B) indicate the basement will be excavated to approximately 54 m AHD relative to Australian Height Datum (AHD). This will result in a two level basement at the southern end of the site and a four level basement at the northern end of the site accounting for the rise in the ground level. This results in expected excavation depths ranging from 4 m in the south-west corner to 20 m depth in the north-eastern corner of the site.

The objectives of this report were to:

- Collate information to describe the current and historic uses of the site, its geological and hydrogeological setting, potential sources of contamination and potentially contaminated media that may affect human and / or environmental receptors;
- Identify data gaps / uncertainties associated with the potential for land contamination and outline recommendations for further investigations / assessments to address those data gaps; and
- Provide an opinion on whether the site is considered suitable for the proposed development from a contamination perspective.

Based on a review of the previous report (Coffey, 2018), publicly available information and the site walkover, the following conclusions and recommendations are made:

- A review of historical aerial photographs identified the majority of the site was occupied by low density residential housing, most of which appear to have been constructed prior to 1930. Aerial photographs suggest the structures within the site have remained largely unchanged since.
- The site walkover conducted for the previous investigation (Coffey, 2018) and the current investigation did not identify infrastructure consistent with USTs or ASTs and observed only small quantities of stored household chemicals and paints. While these household items were not stored in secondary containment, no visual evidence of contamination such as staining, or spills were observed indicating that it is unlikely for soil or groundwater at the site to have been impacted by these potential areas of environmental concern.
- The limited intrusive investigation completed as part of the previous investigation (Coffey, 2018) did not identify CoPC at concentrations that were likely to pose a potentially unacceptable health risks to workers, future residents or users of land adjoining the site. However, lead, zinc and BaP identified were detected at concentrations which exceeded the EIL adopted, which may pose potential risks to landscaping introduced as part of the proposed development if that soil was to be retained within the development.
- There remains some uncertainty regarding the quality of fill materials within the site.

In summary, this PSI has not identified a significant source of contamination that triggers the need for remediation. Based on the findings of this assessment, it is considered that the site can be made suitable for the proposed development, in accordance with SEPP55 – Remediation of Land.

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<sup>1</sup> This executive summary must be read in the context of the full report and the attached limitations.

<sup>2</sup> The previous assessment related to existing properties located at 38-50 Park Road, 41-47 Berry Road and 48-54 River Road, St Leonards.

It is recommended that further investigation be undertaken following demolition and removal of the existing structures to improve the level of confidence in the expected ground conditions. The aims of the investigation would be:

- Increase sampling density across the site, and complete investigations in areas of the site that were not previously accessible or have not yet been investigated (northern end );
- Groundwater sampling was not completed. Given the depth of excavation for the proposed development, it is considered likely the groundwater table will be intercepted. It is recommended that groundwater sampling and analysis be undertaken as part of further investigation.
- Assess the waste classification of surplus soil generated from the development.

It is also recommended that an Unexpected Finds Protocol be developed, either as part of the Construction Environment Management Plan or as a stand-alone document to manage unexpected finds of contamination that may arise during the development works.

This report should be read in conjunction with the attached “Important information about your Coffey Environmental Report” in Appendix A.

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# 1. INTRODUCTION

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Tetra Tech Coffey Pty Ltd (Coffey) was engaged by Berry Road Development Pty Ltd (the client) to prepare this Preliminary Site Investigation (PSI) in connection with the proposed residential development at 26-36 Park Road 27-47 Berry Road and 48-52 River Road, St Leonards, NSW (the 'site').

Coffey previously prepared a PSI report for the southern part of the site<sup>3</sup> in 2018 (Coffey, 2018) which included a desktop review, site walkover and limited investigation of soil contamination. Relevant parts of the previous report were presented in this report.

It is understood this PSI was required to support a development application purposes.

Coffey also prepared a geotechnical desktop study for the project under separate cover.

The site's location and boundary are shown in Figure 1.

## 1.1 PROPOSED DEVELOPMENT

Coffey understands that the client proposes to redevelop the site with a multi-storey residential development with associated basement carparking and amenities. The preliminary architectural plans (provided in Appendix B) indicate the basement will be excavated to approximately 54 m AHD relative to Australian Height Datum (AHD). This will result in a two level basement at the southern end of the site and a four level basement at the northern end of the site accounting for the rise in the ground level. This results in expected excavation depths ranging from 4 m in the south-west corner to 20 m depth in the north-eastern corner of the site.

## 1.2 OBJECTIVES

The objectives of this report were to:

- Collate information to describe the current and historic uses of the site, its geological and hydrogeological setting, potential sources of contamination and potentially contaminated media that may affect human and / or environmental receptors;
- Identify data gaps / uncertainties associated with the potential for land contamination and outline recommendations for further investigations / assessments to address those data gaps; and
- Provide an opinion on whether the site is considered suitable for the proposed development from a contamination perspective.

# 2. SCOPE OF WORK

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To meet the objectives (Section 1.2), Coffey completed a PSI for the site, in general accordance with relevant guidelines including the NSW EPA (2020) 'Guidelines for Consultants Reporting on Contaminated Land' and Schedule B2 of NEPC (2013) 'National Environment Protection (Assessment of Site Contamination) Measure 1999'. The PSI scope comprised:

- Review of:
  - The previous PSI completed for part of the site (Coffey, 2018);
  - Local geology, hydrogeology, topography, salinity and acid sulfate soil risk maps;
  - A selection of relevant historical aerial photographs covering the site and the surrounds;

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<sup>3</sup> The previous assessment related to existing properties located at 38-50 Park Road, 41-47 Berry Road and 48-54 River Road, St Leonards.

- Registered groundwater bore information in the public register held by NSW Office of Water; and
  - Contaminated land records and environmental protection licence information in the public registers held by the NSW Environment Protection Authority.
  - A site walkover was completed by an Environmental Scientist to observe the current site use and surrounding land uses and observe indications of potentially contaminating activities. The site walkover focused on accessible areas of the site. The interior of the existing buildings was not inspected;
  - A preliminary conceptual site model (CSM) was developed; and
  - This PSI report was prepared, including recommendations for further investigation and / or remediation.
- It is noted that no intrusive investigation was completed as part of this PSI.

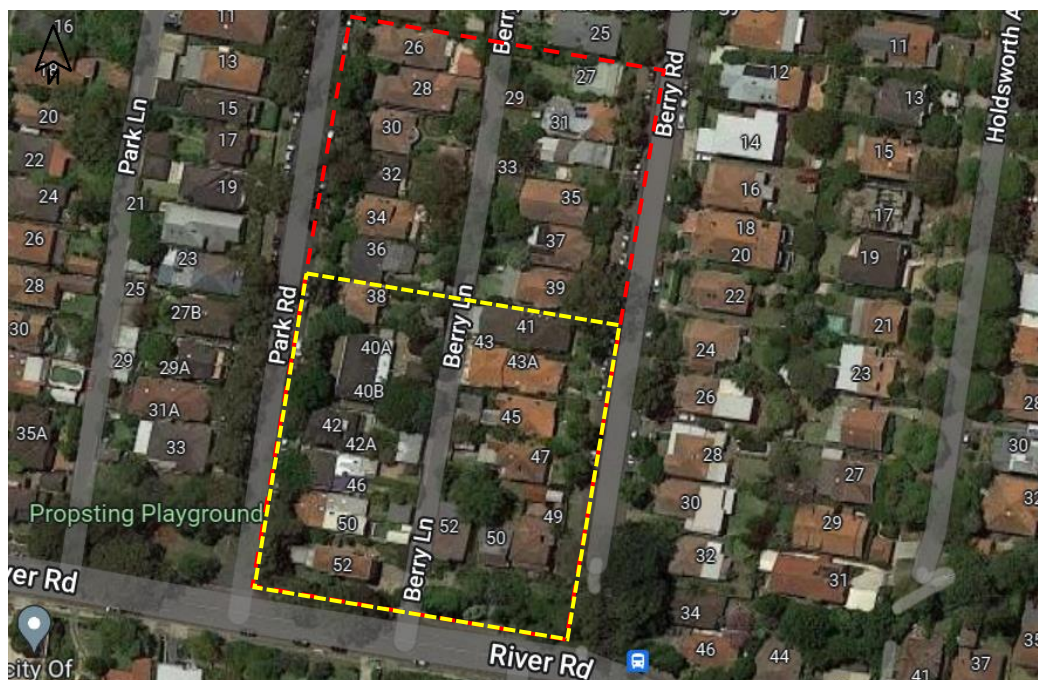
## 3. SITE INFORMATION AND DESCRIPTION

### 3.1 SITE LOCATION

Site identification details are summarised in Table 1. The location and boundary of the site is shown on Figure 1.

**Table 1: Site Location Details**

| Item                       | Description                                                                      |
|----------------------------|----------------------------------------------------------------------------------|
| Site Address               | 26 – 52 Park Road, 27 - 47 – Berry Road and 48 – 52 River Road, St Leonards, NSW |
| Site Area                  | Approximately 12,450 m <sup>2</sup> (1.245ha)                                    |
| Current land zoning        | R2 – Low density residential                                                     |
| Local Government Authority | Lane Cove Council                                                                |
| Current land use           | Low density residential                                                          |
| Proposed land use          | Multi-storey residential development with two to four level basement             |



**Figure 1: Approximate Site Boundary**

The approximate site boundary is shown in red. The yellow outline shows the site boundary at the time of the previous PSI (Coffey, 2018) (sourced from Google maps, accessed 20 June 2022).

## 3.2 SITE DESCRIPTION

A site walkover was carried out by a Coffey Environmental Scientist on 23<sup>rd</sup> June 2022. The key site features are summarised below, and a selection of photographs taken during the walkover are provided in Appendix C.

- The site comprised 26 individual lots, which were all occupied by residential housing in the form of single or double storey residential dwellings including some dual occupancy and townhouses. Some also contained swimming pools and sheds.
- The site was bounded by Berry Road to the west, River Road to the south, Park Road the east, residential properties to the north, with Berry Lane running north-south through the middle. The ground level falls from approximately 75 m AHD at the northern boundary to 57 m AHD towards River Road at grades of approximately 8 to 10 degrees, steepening into a small rock face with outcropping sandstone (approximately 5 m high) at the southern end of Berry Road.
- Given the likely age of many of the residences, it was suspected that asbestos-containing materials (ACM) were likely used as building materials in the construction of many buildings.
- Cut and fill activities appeared to have occurred across the site to provide level construction surfaces for individual plots. Fill would have likely been placed beneath the existing building footprints.
- Presence of topsoil / fill in the gardens and landscaped areas of the residential properties.
- No evidence of infrastructure associated with underground storage tanks (UST) or above ground storage tanks (AST) was observed at the properties within the site.
- Minor stored chemicals in the form of paints and household cleaning products were observed during the walkover completed for the previous investigation (Coffey, 2018) at several properties including stored paint in the garage of 52 River Road and in the outdoor shed of 46 Park Road. Visual evidence of spills or staining was not observed at the individual properties.
- Asbestos-containing debris or fragments were not visually identified on the soil / ground surface of the properties.
- No obvious vegetation stress or 'die-back' was observed.

### 3.3 SURROUNDING LAND USES

Based on observations made during the site walkover and recent aerial imagery, the surrounding land uses were largely low density residential with multi-storey residential and commercial further north, toward the Pacific Highway.

### 3.4 REGIONAL GEOLOGY AND SOIL LANDSCAPE

Review of the 1:100,000 Sydney Geological Sheet indicates the site is situated on the boundary of the following units:

- Hawkesbury Sandstone: Medium to coarse-grained quartz sandstone, very minor shale and laminite lenses. Typically bedded between 1 m and 3 m thickness; and
- Ashfield Shale: Dark-grey to black claystone-siltstone and fine sandstone-siltstone laminite of the Wianamatta Group.

The Sydney Soils Landscape Sheet indicates that the majority of site is within the Glenorie soil landscape with the southern boundary underlain by the GyMEA soil landscape, corresponding with the geological boundaries. Glenorie landscapes are characterised by undulating to rolling low hills on Wianamatta group shales. The soil horizons are typically hard-setting, dark brown loamy topsoil, underlain by grey to brown, plastic clays with shale rock fragments. Clays within the lower horizons are considered moderately reactive, have a high shrink-swell and potential for erodibility.

GyMEA soil landscapes are characterised by undulating to rolling rises and low hills on benching Hawkesbury sandstone. Encountered topsoil is typically described as loose, coarse sandy loam, overlying B and C horizons of yellowish brown clayey sand and loam, transitioning to clay with increased depth.

### 3.5 ACID SULFATE SOILS

Reference to local acid sulfate soil (ASS) risk maps, indicates that the site is located in an area of no known occurrence of ASS.

### 3.6 SITE TOPOGRAPHY AND DRAINAGE

The site elevation ranged from approximately 75 m AHD at the northern boundary to 57 m AHD towards River Road at grades of circa 8 to 10 degrees, steepening into a small rock face with outcropping sandstone (approximately 5 m high) at the southern end of Berry Road.

Individual properties were largely noted to be level, which is suspected to have been formed through minor cut and fill processes. It is expected that surface run-off would infiltrate through permeable ground surfaces (where present) with excess run-off collected via nearby stormwater drains along the road network surrounding / within the site.

Groundwater and excessive surface water that does not infiltrate the soil, is collected by the stormwater drainage system is expected to drain towards the Gore Cove situated approximately 850 m south of the site.

### 3.7 HYDROGEOLOGY

Groundwater at the site is likely to occur as discontinuous lenses at the soil and bedrock interface. This groundwater is likely recharged by local rainfall events and possibly by runoff from the land situated to the north (up topographical gradient) of the site.



### 3.8 LOCAL SENSITIVE RECEPTORS

There are no surface water features which pass through the site. The nearest surface water feature is Berry's Creek, located approximately 200 m south-east of the site.

## 4. SITE HISTORY REVIEW

### 4.1 AERIAL PHOTOGRAPHY

Selected aerial photography dated between 1930 and 2016 is provided within Appendix D. A summary of the aerial photography is provided in Table 2.

It is noted that the photographs were collated at the time of the previous assessment (Coffey, 2018) and the site boundary on the photographs is consistent with the previous site boundary.

Recent aerial imagery suggests the site and surrounding area have remained relatively unchanged since 2016.

**Table 2: Summary of Aerial Photography Review**

| Photo Date | Site                                                                                                                                                                                                  | Surrounding Area                                                                                                                                                                                                                                                                                                                                                                                              |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1930       | The site was occupied by what appeared to be low density residential housing. The properties generally appeared to have landscaped portions with some properties having small sheds situated on them. | The neighbouring properties to the north, west and east also comprised low density residential housing. River Road could be seen south of the site and Park Road; Berry Road and Berry Lane were also observed. South of the site, a large property could be seen which was comprised of large, grassy areas with some centrally located buildings. The Pacific Highway could also be seen north of the site. |
| 1943       | In the 1943 aerial photograph the site appeared relatively unchanged.                                                                                                                                 | The surrounding area to the north, east and west appeared relatively unchanged, however the large property to south of the site, appeared to have additional low density residential housing situated on it.                                                                                                                                                                                                  |
| 1951       | In the 1951 aerial photograph the site appeared relatively unchanged.                                                                                                                                 | The surrounding area to the north, east and west appeared relatively unchanged, however the large property to south of the site appeared to continue to undergo development with additional low density residential housing constructed.                                                                                                                                                                      |
| 1955       | In the 1955 aerial photograph the site appeared relatively unchanged.                                                                                                                                 | The surrounding area to the north, east and west appeared relatively unchanged, however the large property to south of the site appeared to continue to undergo development with additional low density residential housing constructed.                                                                                                                                                                      |
| 1961       | In the 1961 aerial photograph the site appeared relatively unchanged.                                                                                                                                 | The surrounding area to the north, east and west appeared relatively unchanged, however the large property to south of the site, appeared to continue to undergo development with additional low density residential housing constructed.                                                                                                                                                                     |
| 1965       | In the 1961 aerial photograph the site appeared relatively unchanged.                                                                                                                                 | The surrounding area appeared relatively unchanged.                                                                                                                                                                                                                                                                                                                                                           |
| 1970       | In the 1970 aerial photograph the site appeared relatively unchanged.                                                                                                                                 | The surrounding area appeared relatively unchanged.                                                                                                                                                                                                                                                                                                                                                           |
| 1982       | In the 1982 aerial photograph the site appeared relatively unchanged, however                                                                                                                         | The surrounding area appeared relatively unchanged.                                                                                                                                                                                                                                                                                                                                                           |

| Photo Date | Site                                                                                                                                                                                                                                                                                       | Surrounding Area                                                                                                                                                                                       |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | the properties currently denoted as 40A and 40B Park Road had undergone redevelopment, with the former residential structure appearing to have been demolished and replaced by a large rectangular main building, with a smaller building to the east which likely functioned as a garage. |                                                                                                                                                                                                        |
| 1991       | In the 1991 aerial photograph the site appeared relatively unchanged.                                                                                                                                                                                                                      | The surrounding area appeared relatively unchanged, with the exception of several newly constructed multi-storey commercial/industrial buildings situated on the southern side of the Pacific Highway. |
| 2002       | In the 2002 aerial photograph the site appeared relatively unchanged.                                                                                                                                                                                                                      | The surrounding area appeared relatively unchanged.                                                                                                                                                    |
| 2009       | In the 2009 aerial photograph the site appeared relatively unchanged.                                                                                                                                                                                                                      | The surrounding area appeared relatively unchanged.                                                                                                                                                    |
| 2015       | In the 2015 aerial photograph the site appeared relatively unchanged.                                                                                                                                                                                                                      | The surrounding area appeared relatively unchanged.                                                                                                                                                    |
| 2016       | In the 2016 aerial photograph the site appeared relatively unchanged.                                                                                                                                                                                                                      | The surrounding areas appeared relatively unchanged.                                                                                                                                                   |

## 4.2 PUBLIC REGISTER SEARCH

### 4.2.1 NSW EPA CONTAMINATED LAND REGISTERS

Coffey undertook a search of the NSW EPA online Contaminated Land: Record of Notices on the 20<sup>th</sup> June 2022 for the suburb of St Leonards, NSW. The search did not identify any notices that have been issued by the NSW EPA under the Contaminated Land Management Act (1997) for the site, or properties within a 500 m radius of the site.

Coffey also undertook a search of the NSW EPA online List of NSW Contaminated Sites Notified to EPA on the 20<sup>th</sup> of June 2022. The search did not identify any notices on the site, or properties located with the suburb of St Leonards.

### 4.2.2 PROTECTION OF THE ENVIRONMENT OPERATION ACT 1997 REGISTER

A search of the NSW EPA Protection of the Environment Operation Act public register was conducted by Coffey on the 20<sup>th</sup> June 2022. The POEO public register indicates that no licensed activities under the POEO Act 1997 are currently being carried out at the site or at properties within a 500 m radius of the site.

### 4.2.3 REGISTERED GROUNDWATER BORE SEARCH

At the time of the previous PSI (Coffey, 2018), a search of groundwater bore licenses was undertaken and the search did not identify any registered groundwater bores within a 500 m radius of the site.

### 4.2.4 NSW STATE HERIATEG SEARCH

A search of the NSW Office of Environment and Heritage register for aboriginal places and state heritage listed sites (<http://www.environment.nsw.gov.au/heritageapp/heritagesearch.aspx>) was undertaken on 20<sup>th</sup> June 2022. A review of the results did not identify any of the properties within the site.

## 4.2.5 FORMER GASWORKS

A search of NSW EPA List of Former Gasworks was undertaken on the 20<sup>th</sup> of June 2022. The search did not identify any former gasworks within the council area.

## 4.3 PREVIOUS REPORT (COFFEY, 2018)

At the time the previous report was prepared the proposed development was described as construction of a 13 storey residential building which would comprise 180 residential units with two levels for basement car parking. The site area comprised the southern portion of the current site, as shown in the yellow outline in Figure 1.

The scope of work completed comprised a desktop review, site walkover and limited intrusive investigation. Six bores were drilled to depths of between 10.00 m and 10.42 m below ground level (mBGL). Surface soil samples were also collected at six locations in the vicinity of the existing residential dwellings. Selected soil samples were analysed for the identified contaminants of potential concern, including:

- Asbestos;
- Polyaromatic hydrocarbons (PAH);
- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethylbenzene and xylenes (BTEX);
- Heavy metals; and
- Organochlorine pesticides (OCP).

The ground conditions encountered comprised sandy topsoil fill, then gravelly sand, clayey sand and gravelly and sandy clay to depths of between 0.25 m BGL and 3.2 m BGL overlying natural residual sandy clay and clay and sandstone bedrock.

Piezometers were installed at five locations (BH1, BH3, BH5, BH7 and BH9) and groundwater was encountered during drilling at depths of between 3.8 m BGL and 5.2 m BGL.

The report stated that there were no obvious signs of contamination (asbestos, stained or odours) noted during the drilling.

The CSM developed was generally consistent with that detailed in Section 5 of this report. The identified areas of environmental concern (AEC) identified were:

- Fill of unknown origin or quality;
- Fill material impacted by the weathering of hazardous building materials and / or poor demolition practices; and
- Soil materials impacted through the application of persistent pesticides.

Laboratory test results indicated that detections of lead, zinc and benzo(a)pyrene (BaP) were identified at concentrations which exceeded the adopted ecological investigation levels (EIL) for residential land use, which may pose potential risks to landscaping retained or introduced as part of the proposed development.

Laboratory test results did not indicate detections of the COPC above human health assessment criteria for residential land use.

The report concluded the following:

*In summary, the desk-based research and limited programme of investigation has not identified a significant source of contamination that triggers the need for remediation. Based on the findings of this assessment it is considered that the site can be made suitable for the proposed high-density residential land use redevelopment, in accordance with SEPP55 – Remediation of Land.*

*It is recommended that further investigation is undertaken as access constraints are removed from the site to improve confidence in ground conditions. The aims of the investigation would be:*

- Increase sampling density across the site, and complete investigations in areas of the site that were not previously accessible; namely, within the footprint of each residential property where a suspended floor slab exists where pesticides were likely applied over an extended period, and Berry Lane.*
- Groundwater sampling was not included in the scope of this limited assessment, however given the depth of excavation for the proposed development, it is considered possible that the groundwater table is intercepted – it is recommended that groundwater sampling be undertaken from the existing piezometers.*
- Assess the waste classification of surplus soil generated from the development.*

*It is recommended that an Unexpected Finds Protocol is developed, either as part of the Construction Environment Management Plan or as a stand-alone document to manage unexpected finds of contamination that may be encountered during site development.*

Figure 1, Results and Logs from the previous report are presented in Appendix E.

## 4.4 INTEGRITY OF ASSESSMENT OF INFORMATION REVIEWED

The following information sources were referred to for this assessment:

- Previous report prepared by Coffey (Coffey, 2018);
- Public registers, records and maps maintained and provided by various government departments; and
- Observations made in the field during the site walkover.

Coffey considers the data reviewed was considered to be generally adequate, reliable and suitable to provide an understanding of historic uses with regard to the investigation objectives.

## 5. PRELIMINARY CONCEPTUAL SITE MODEL

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A conceptual site model (CSM) is a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors.

Contamination, if not managed appropriately could pose a potential risk to human health and / or the environment during construction or future occupation of the site. For a risk from contamination to be present, there must be a plausible pollutant linkage between a contamination source and a receptor by means of an exposure route or transport mechanism (pathway). Table 3 discusses the plausible pollutant linkages identified between the AEC and these receptors.

Potential receptors were considered to comprise:

- Future construction workers.
- Future site workers.
- Future residents.
- Adjacent site users.
- Groundwater.
- Surface water.
- Flora and fauna.

**Table 3: Preliminary Conceptual Site Model**

| Potential Contaminating Activity/ Area of Environmental Concern                                                   | Contaminants of Potential Concern and Affected Media                 | Plausible Exposure Pathways & Transport Mechanisms                                                                                                          | Receptors                                                                                                                                                 | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AEC1: Fill material of unknown origin and quality                                                                 | TRH, BTEX, heavy metals, PAH, pesticides (OCP/OPP), PCB and asbestos | Inhalation of soil and fibres<br>Ingestion of soil<br>Dermal contact<br>Plant Uptake<br>Infiltration<br>Lateral Groundwater Migration<br>Surface Water Flow | Future construction workers<br>Future site workers and users<br>Neighbouring site users<br>Current / proposed landscaping<br>Groundwater<br>Surface Water | <p>The previous investigation (Coffey, 2018) did not identify concentrations of CoPC that exceeded the health assessment criteria for a generic high density residential land use, indicating the fill materials encountered during the previous investigation do not pose significant health risks.</p> <p>Concentrations of BaP were identified in seven samples in the previous investigation which exceeded the ecological screening level (ESL) for urban residential and public open space of 0.7 mg/kg. Concentrations of zinc were also identified in sample SS4 which exceeded the EIL (347 mg/kg). These fill materials may pose potential risks to landscaping introduced as part of the development via plant uptake mechanisms.</p> <p>There remains some uncertainty regarding the quality of fill within the site, particularly given the limited nature of the investigations completed previously.</p>                 |
| AEC2: Fill material impacted by the weathering of hazardous building materials and / or poor demolition practices | Asbestos and lead (lead-based paint)                                 | Inhalation of soil and fibres<br>Ingestion of soil<br>Plant uptake                                                                                          | Future construction workers<br>Future site workers and users<br>Neighbouring site users<br>Current / proposed landscaping                                 | <p>The previous investigation (Coffey, 2018) did not identify concentrations of CoPC that exceeded the adopted high density residential criteria for human health.</p> <p>Asbestos was not visually identified on or within the soil during the previous or current site walkover or in samples analysed as part of the previous investigation.</p> <p>Concentrations of lead were identified in surface sample SS4 (1,200 mg/kg) which exceeded the EIL of 1,100 mg/kg in the previous investigation. While not exceeding the adopted criteria, detections of lead were noted in other near surface samples.</p> <p>The previous investigation noted that review of the Pre-Demolition Hazardous Materials Assessment Reports identified both lead paint and lead dust present at a number of the properties that occupied the southern portion of the subject site. As such, the presence of lead in soil samples is likely to be</p> |



| Potential Contaminating Activity/ Area of Environmental Concern               | Contaminants of Potential Concern and Affected Media | Plausible Exposure Pathways & Transport Mechanisms                                   | Receptors                                                                                                                 | Comments                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                               |                                                      |                                                                                      |                                                                                                                           | attributed to the deterioration of lead-based paint applied historically to building surfaces.                                                                                                                                                                                                                                                                                                                |
| AEC3: Soil material impacted through the application of persistent pesticides | OPP/OCP                                              | Inhalation of soil and fibres<br>Ingestion of soil<br>Dermal contact<br>Plant Uptake | Future construction workers<br>Future site workers and users<br>Neighbouring site users<br>Current / proposed landscaping | While concentrations of OCP were less than the adopted health criteria detections of various OCP were identified in multiple samples collected at the site.<br><br>The previous investigation (Coffey, 2018) identified the historical application of pesticides to the site as an AEC. Investigation of the areas beneath the existing structures has not been possible and represents a potential data gap. |

**Notes:**

CoPC: Contaminants of Potential Concern

OCP: organochlorine pesticides

OPP: organophosphate pesticides

Heavy metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.

TRH: Total Recoverable Hydrocarbons.

BTEX: Benzene, Toluene, Ethylbenzene, Xylene.

PAH: Polycyclic Aromatic Hydrocarbons.

PCB: Polychlorinated Biphenyls.

## 6. CONCLUSIONS AND RECCOMENDATIONS

---

Based on a review of the previous report (Coffey, 2018), publicly available information and the site walkover, the following conclusions and recommendations are made:

- A review of historical aerial photographs identified the majority of the site was occupied by low density residential housing, most of which appear to have been constructed prior to 1930. Aerial photographs suggest the structures within the site have remained largely unchanged since.
- The site walkover conducted for the previous investigation (Coffey, 2018) and the current investigation did not identify infrastructure consistent with USTs or ASTs and observed only small quantities of stored household chemicals and paints. While these household items were not stored in secondary containment, no visual evidence of contamination such as staining, or spills were observed indicating that it is unlikely for soil or groundwater at the site to have been impacted by these potential areas of environmental concern.
- The limited intrusive investigation completed as part of the previous investigation (Coffey, 2018) did not identify CoPC at concentrations that were likely to pose a potentially unacceptable health risks to workers, future residents or users of land adjoining the site. However, lead, zinc and BaP identified were detected at concentrations which exceeded the EIL adopted, which may pose potential risks to landscaping introduced as part of the proposed development if that soil was to be retained within the development.
- There remains some uncertainty regarding the quality of fill materials within the site.

In summary, this PSI has not identified a significant source of contamination that triggers the need for remediation. Based on the findings of this assessment, it is considered that the site can be made suitable for the proposed development, in accordance with SEPP55 – Remediation of Land.

It is recommended that further investigation be undertaken following demolition and removal of the existing structures to improve the level of confidence in the expected ground conditions. The aims of the investigation would be:

- Increase sampling density across the site, and complete investigations in areas of the site that were not previously accessible or have not yet been investigated (northern end );
- Groundwater sampling was not completed. Given the depth of excavation for the proposed development, it is considered likely the groundwater table will be intercepted. It is recommended that groundwater sampling and analysis be undertaken as part of further investigation.
- Assess the waste classification of surplus soil generated from the development.

It is also recommended that an Unexpected Finds Protocol be developed, either as part of the Construction Environment Management Plan or as a stand-alone document to manage unexpected finds of contamination that may arise during the development works.

This report should be read in conjunction with the attached “Important information about your Coffey Environmental Report” in Appendix A.

## 7. REFERENCES

---

Coffey Environments a Tetra Tech Company (2018) Preliminary Site Investigation, Berry Lane, St Leonards, NSW, prepared for Country Garden Australia Pty Ltd dated 22 October 2018 (Coffey, 2018)

NEPC (2013); National Environment Protection (Assessment of Site Contamination) Measure 1999 (‘ASC NEPM)

NSW EPA (2020); Guidelines for Consultants Reporting on Contaminated Land

## APPENDIX A: LIMITATIONS

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## IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY ENVIRONMENTAL REPORT

---

### Introduction

This report has been prepared by Tetra Tech Coffey for you, as Tetra Tech Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Tetra Tech Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Tetra Tech Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

### Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

### Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Tetra Tech Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Tetra Tech Coffey should be kept apprised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statutes and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

## Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Tetra Tech Coffey would be pleased to assist with any investigation or advice in such circumstances.

## Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

## Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Tetra Tech Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Tetra Tech Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

## Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Tetra Tech Coffey prepared the report and has familiarity with the site, Tetra Tech Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Tetra Tech Coffey disowns any responsibility for such misinterpretation.

## Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

## Responsibility

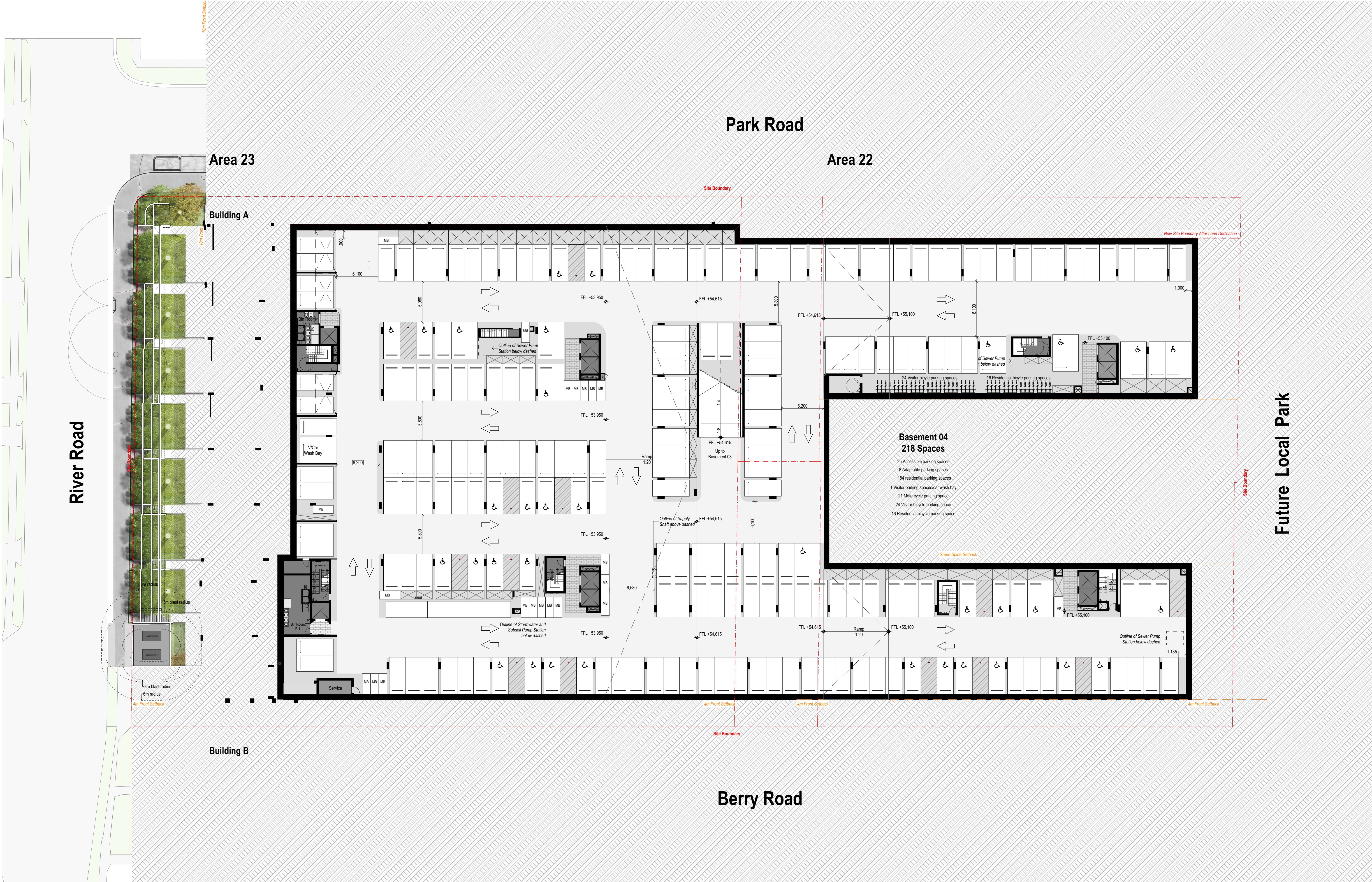
Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.



## APPENDIX B: PROPOSED DEVELOPMENT PLANS

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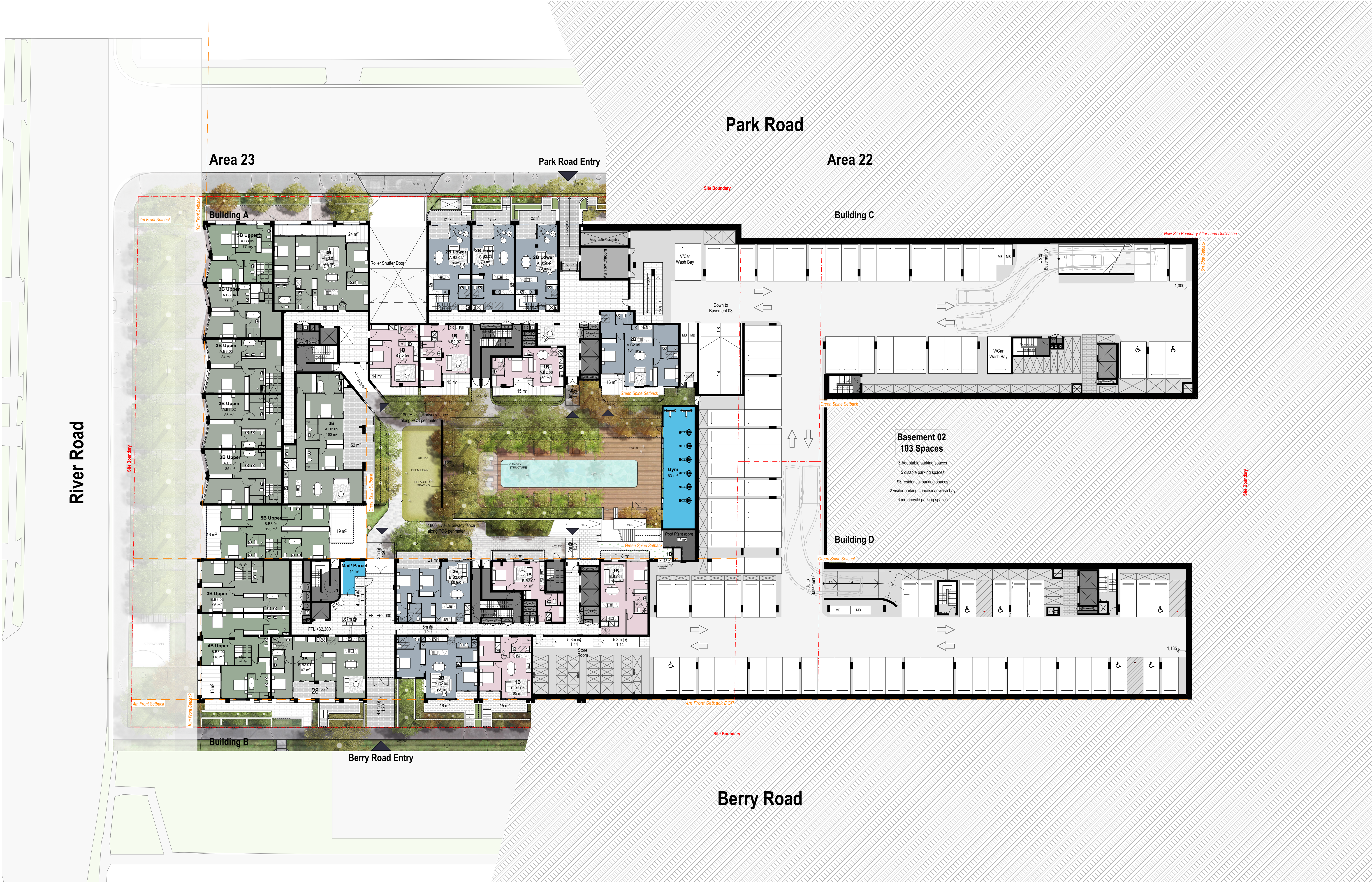










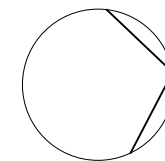


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Project Name  
Project Address

Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Project Number  
Drawing Name  
Scale  
Date

12883  
Basement 2  
1:250@A1  
June 2023

Client

Berry Road  
Development Pty Ltd.

Drawing Number  
Revision

DA202  
C



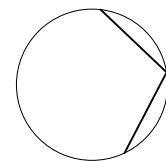


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Project Address

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26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Berry Road  
Development Pty Ltd.

Project Number

Drawing Name

Scale

Date

Drawing Number

Revision

12883

Basement 1  
1:250@A1  
June 2023

DA203  
C





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Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Client

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Development Pty Ltd.

Project Number  
Drawing Name  
Scale  
Date

Drawing Number  
Revision

12883  
Ground Floor Plan  
1:250@A1  
June 2023

**DA204**  
**C**



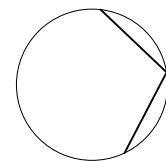


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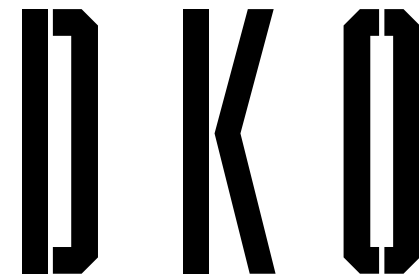
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NSW 2065

Client

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Development Pty Ltd.

Project Number  
Drawing Name  
Scale  
Date

Drawing Number  
Revision

12883  
Level 1  
1:250@A1  
June 2023

DA205  
C

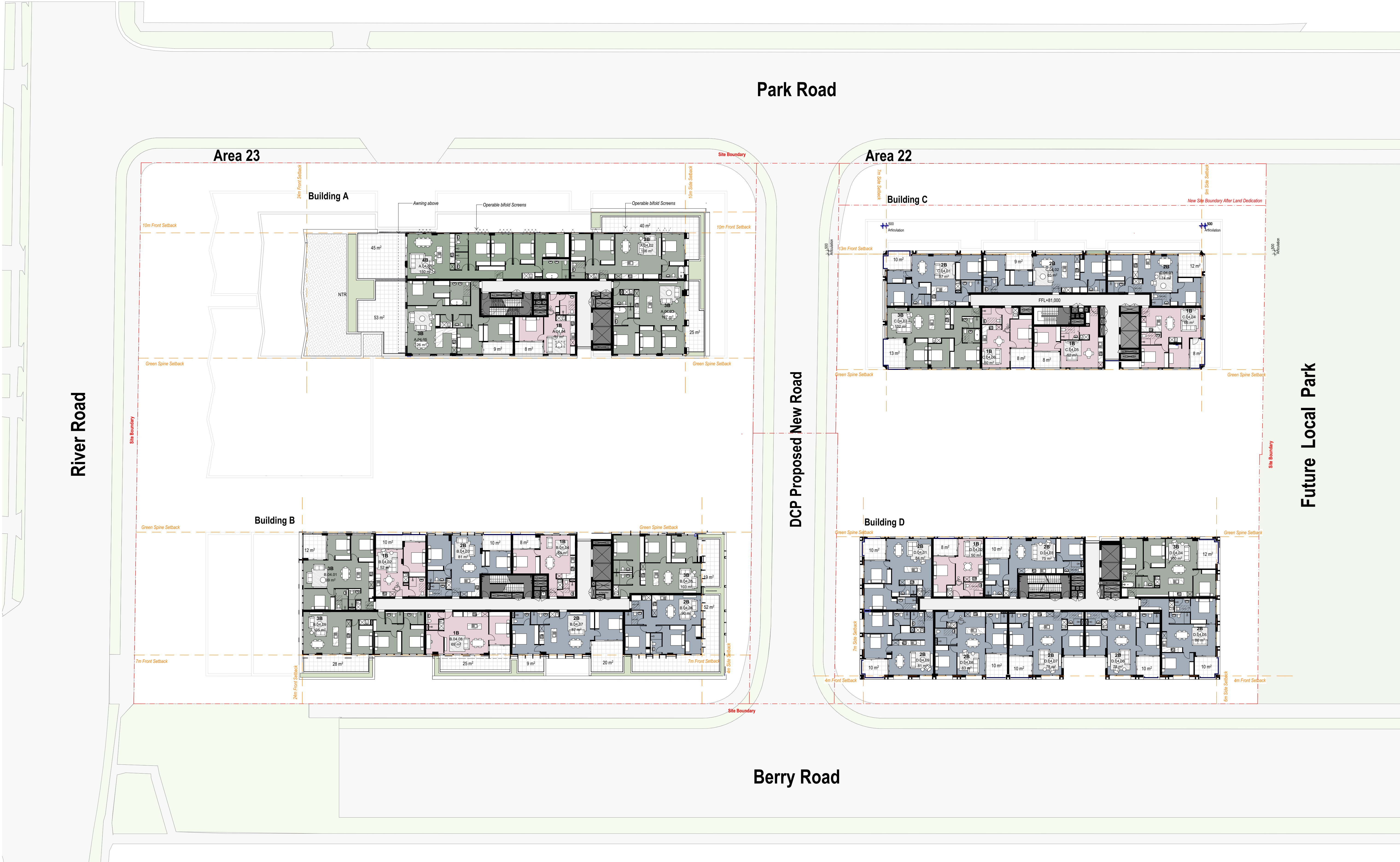










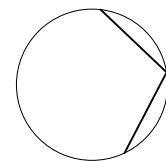


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Project Name

Project Address

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26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Berry Road  
Development Pty Ltd.

Project Number

Drawing Name

Scale

Date

Drawing Number  
Revision

12883

Level 4

1:250@A1

June 2023

**DA208**  
**C**



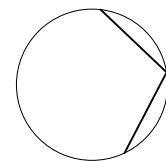


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| C   | 5/06/2023  | AC, IR     | XD     | DA Amendment  |



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Koos de Keijzer 5767  
David Randerson 8542



Project Name  
Project Address  
Client  
Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065  
Berry Road  
Development Pty Ltd.

Project Number  
Drawing Name  
Scale  
Date  
12883  
Level 5  
1:250@A1  
June 2023  
Drawing Number  
Revision

DA209  
C



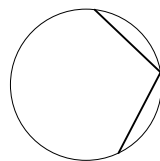


**Notes**  
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|-----|------------|------------|--------|---------------|
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Project Name  
Project Address

Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Client

Berry Road  
Development Pty Ltd.

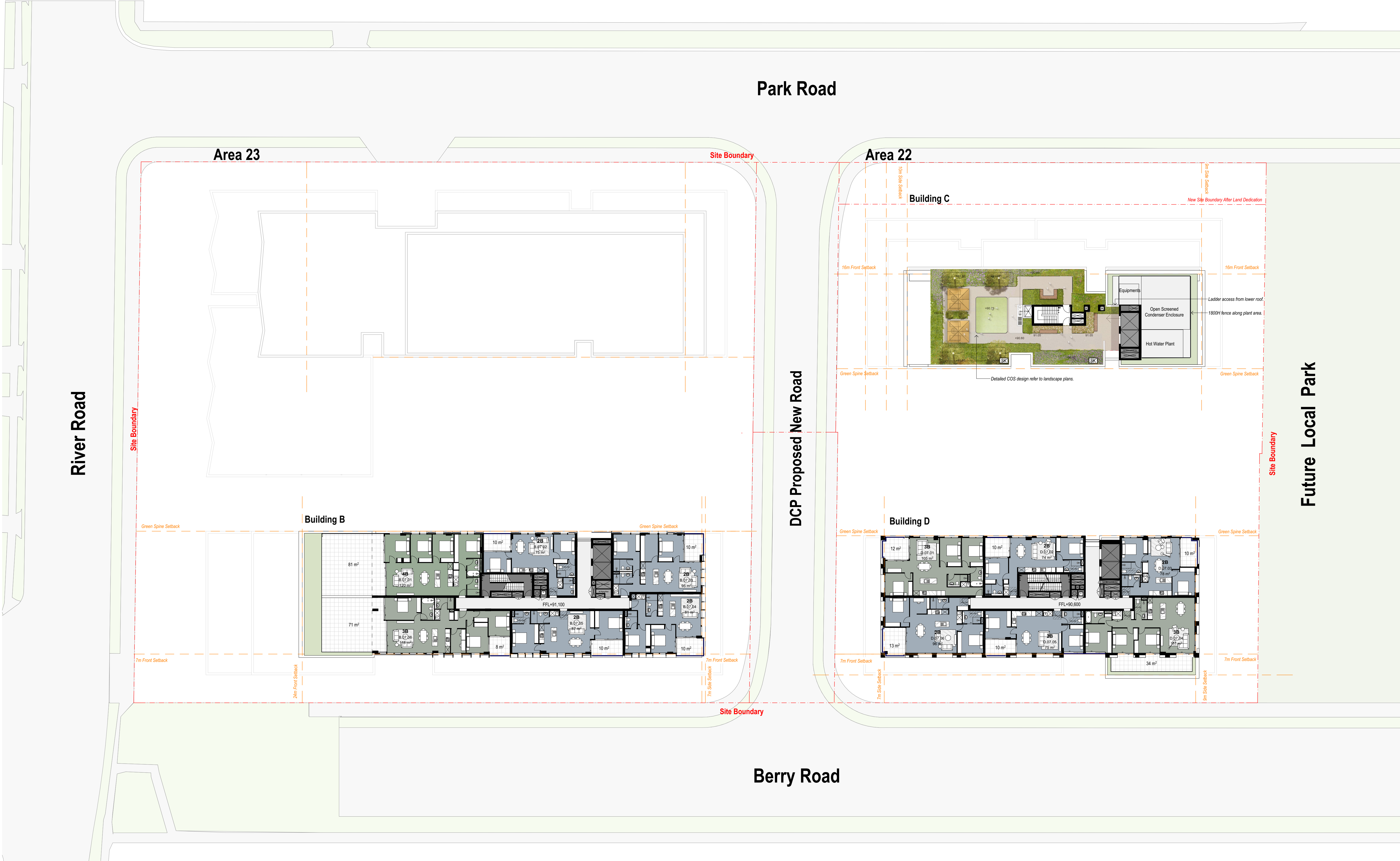
Project Number  
Drawing Name  
Scale  
Date

12883  
Level 6  
1:250@A1  
June 2023

Drawing Number  
Revision

DA210  
C



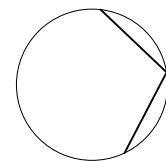


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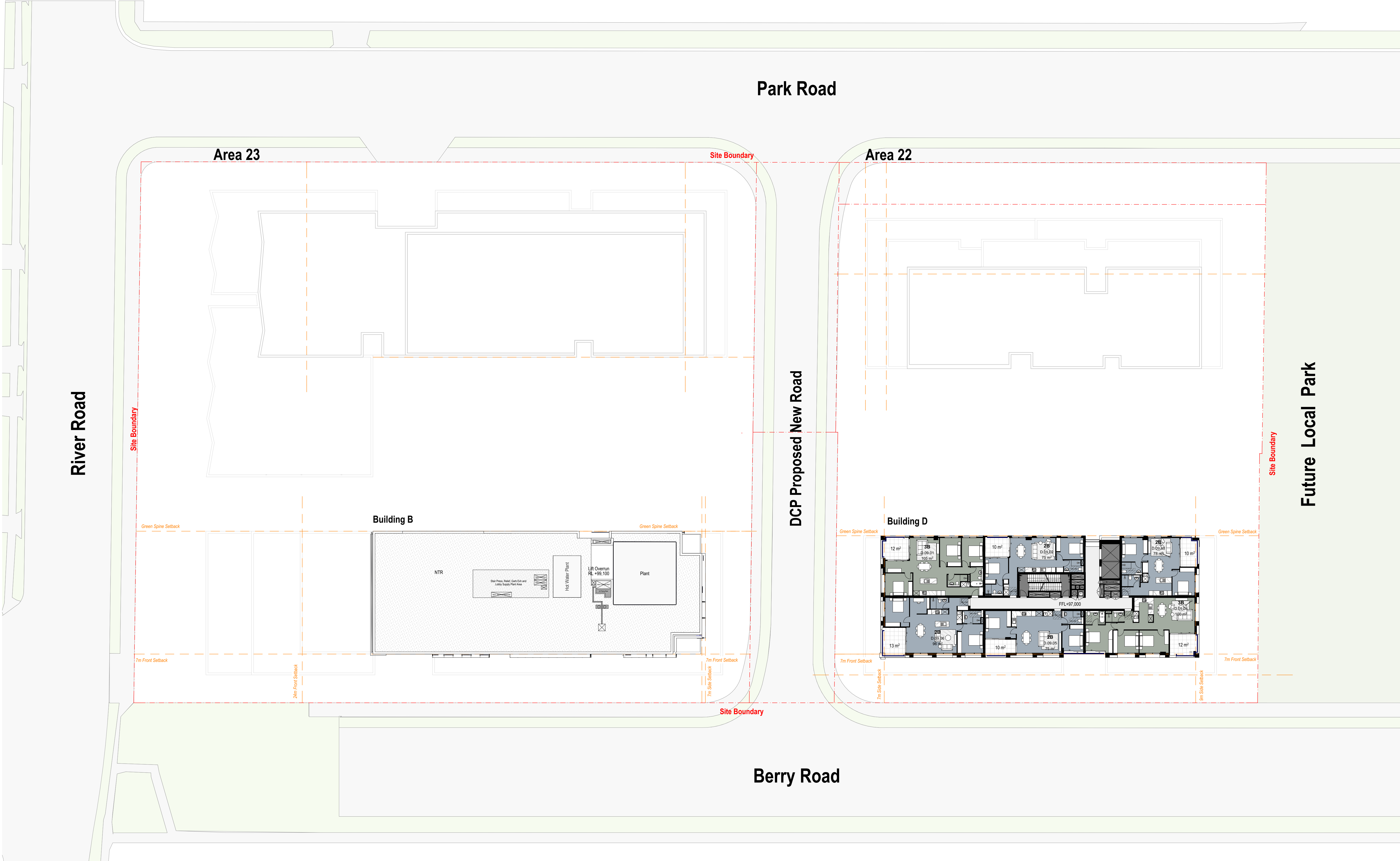
Project Name  
Project Address  
Client  
Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065  
Berry Road  
Development Pty Ltd.

Project Number  
Drawing Name  
Scale  
Date  
Drawing Number  
Revision  
12883  
Level 7  
1:250@A1  
June 2023  
DA211  
C

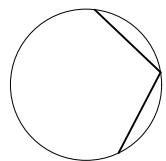








| Rev | Date       | By         | Chk    | Description   |
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| C   | 5/06/2023  | AC, IR     | XD     | DA Amendment  |



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David Randerson 8542



Project Name

Project Address

Client

Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Berry Road  
Development Pty Ltd.

Project Number

Drawing Name

Scale

Date

Drawing Number

Revision

12883

Level 9

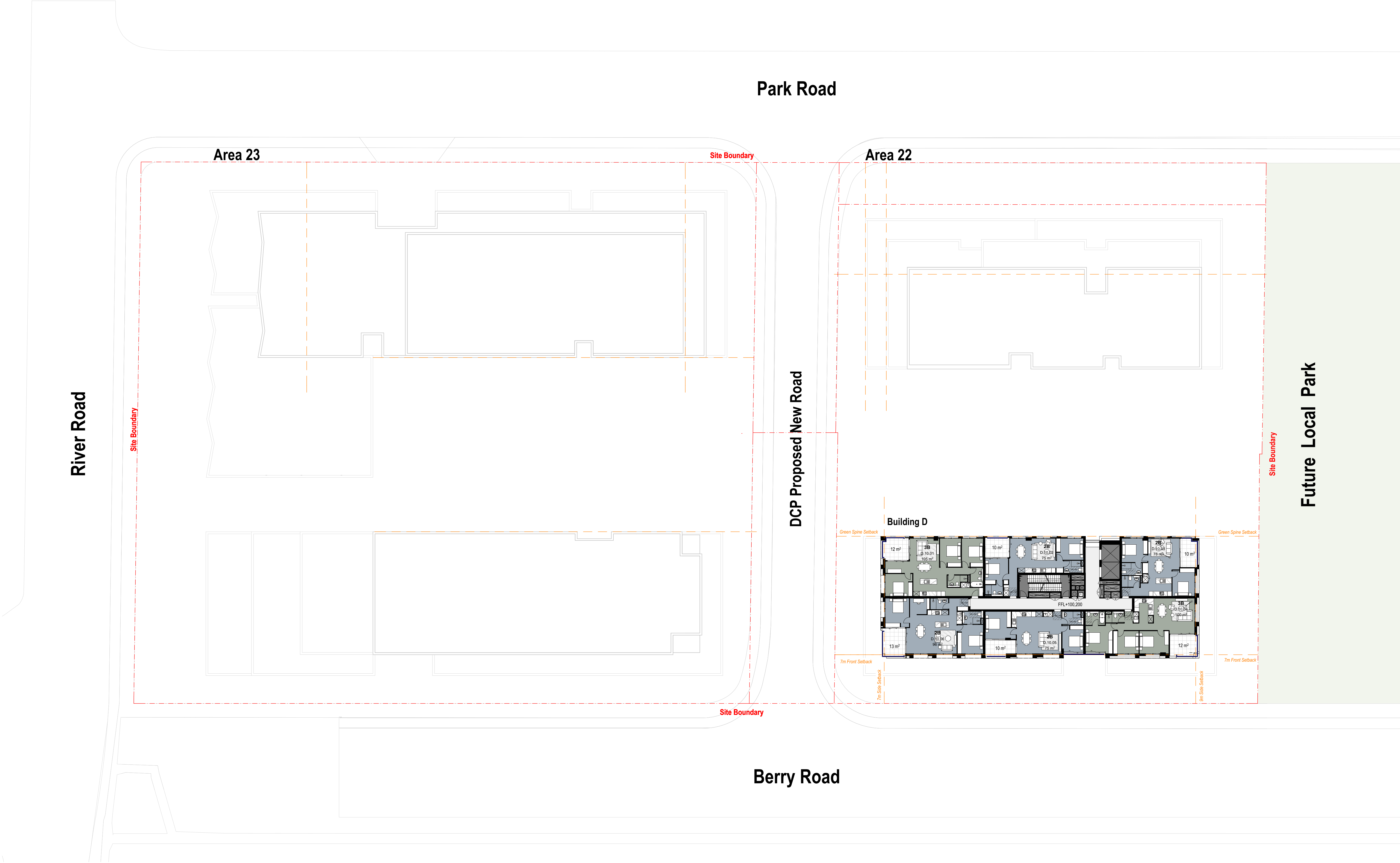
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June 2023

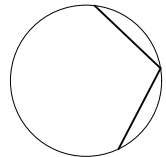
DA213

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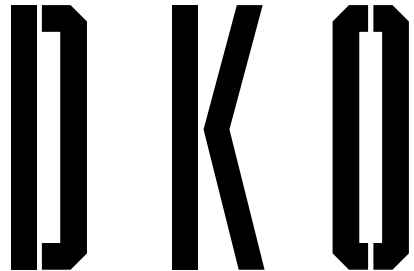




| Rev | Date       | By         | Chk    | Description   |
|-----|------------|------------|--------|---------------|
| A   | 24/11/2022 | AC, MJ, XD | XD, MR | Issued for DA |
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Project Name

Project Address

Client

Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Berry Road  
Development Pty Ltd.

Project Number

Drawing Name

Scale

Date

Drawing Number

Revision

12883

Level 10

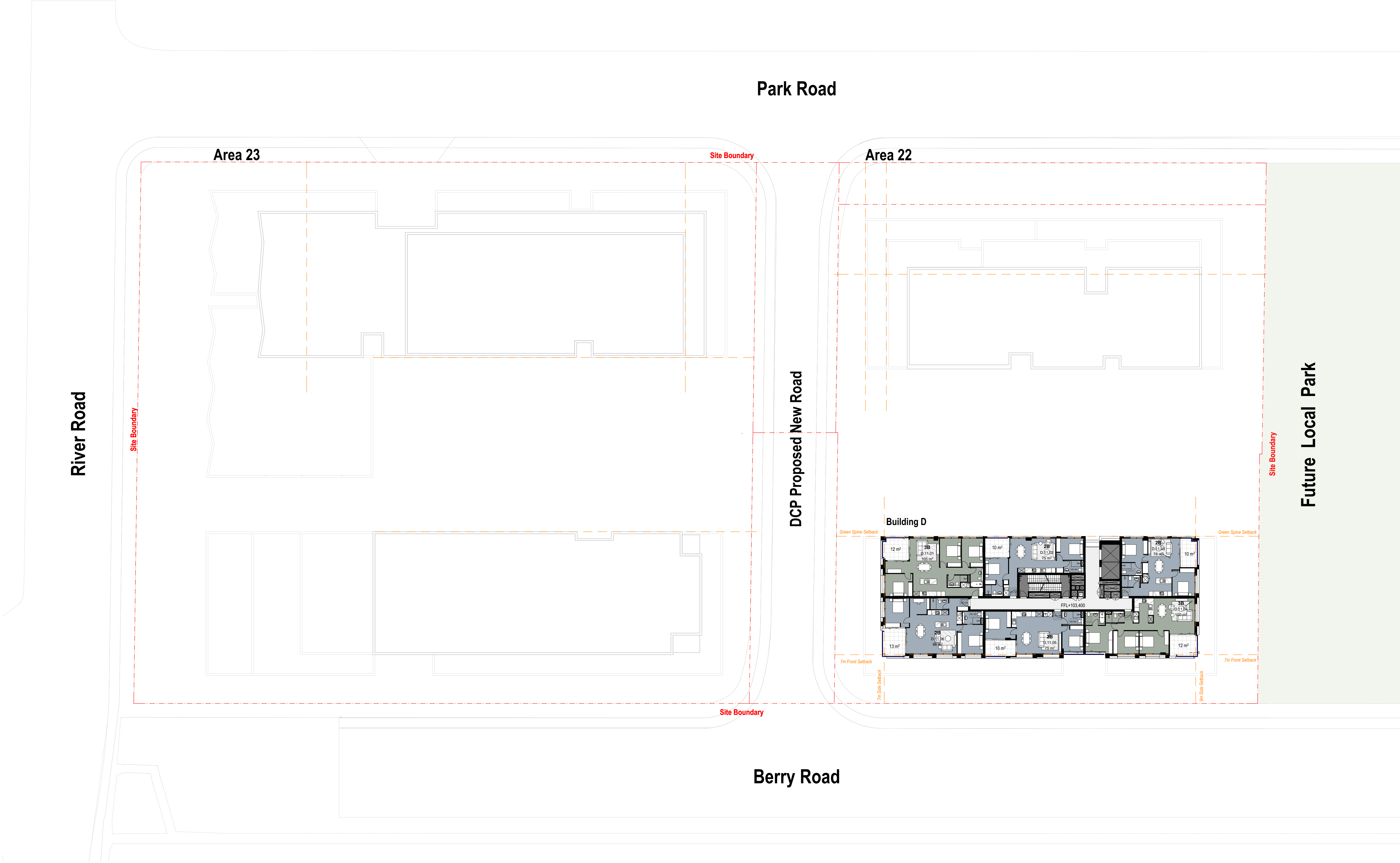
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June 2023

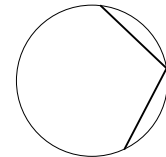
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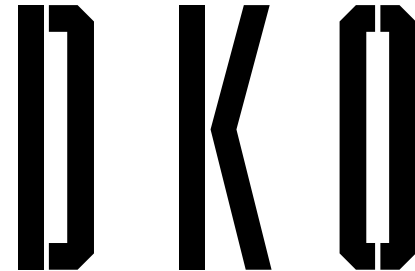




| Rev | Date       | By         | Chk    | Description   |
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Project Address

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NSW 2065

Client

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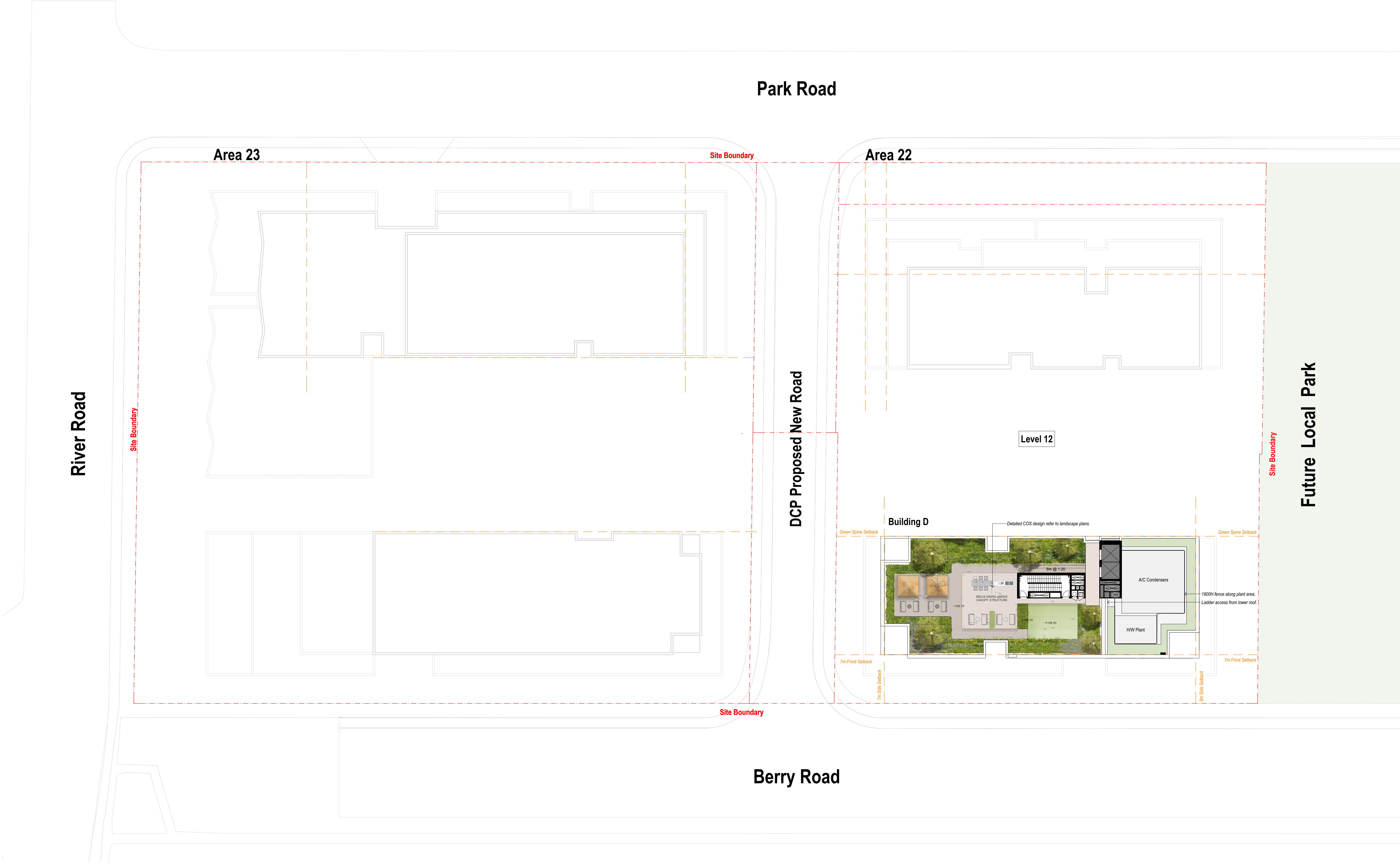
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12883  
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June 2023

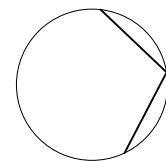
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DA215  
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| Rev | Date       | By         | Chk    | Description   |
|-----|------------|------------|--------|---------------|
| A   | 24/11/2022 | AC, MJ, XD | XD, MR | Issued for DA |
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Project Name

Project Address

Client

Park Road  
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Rd., (Area 22 & 23),  
NSW 2065

Berry Road  
Development Pty Ltd.

Project Number

Drawing Name

Scale

Date

Drawing Number  
Revision

12883

Level 12

Scale

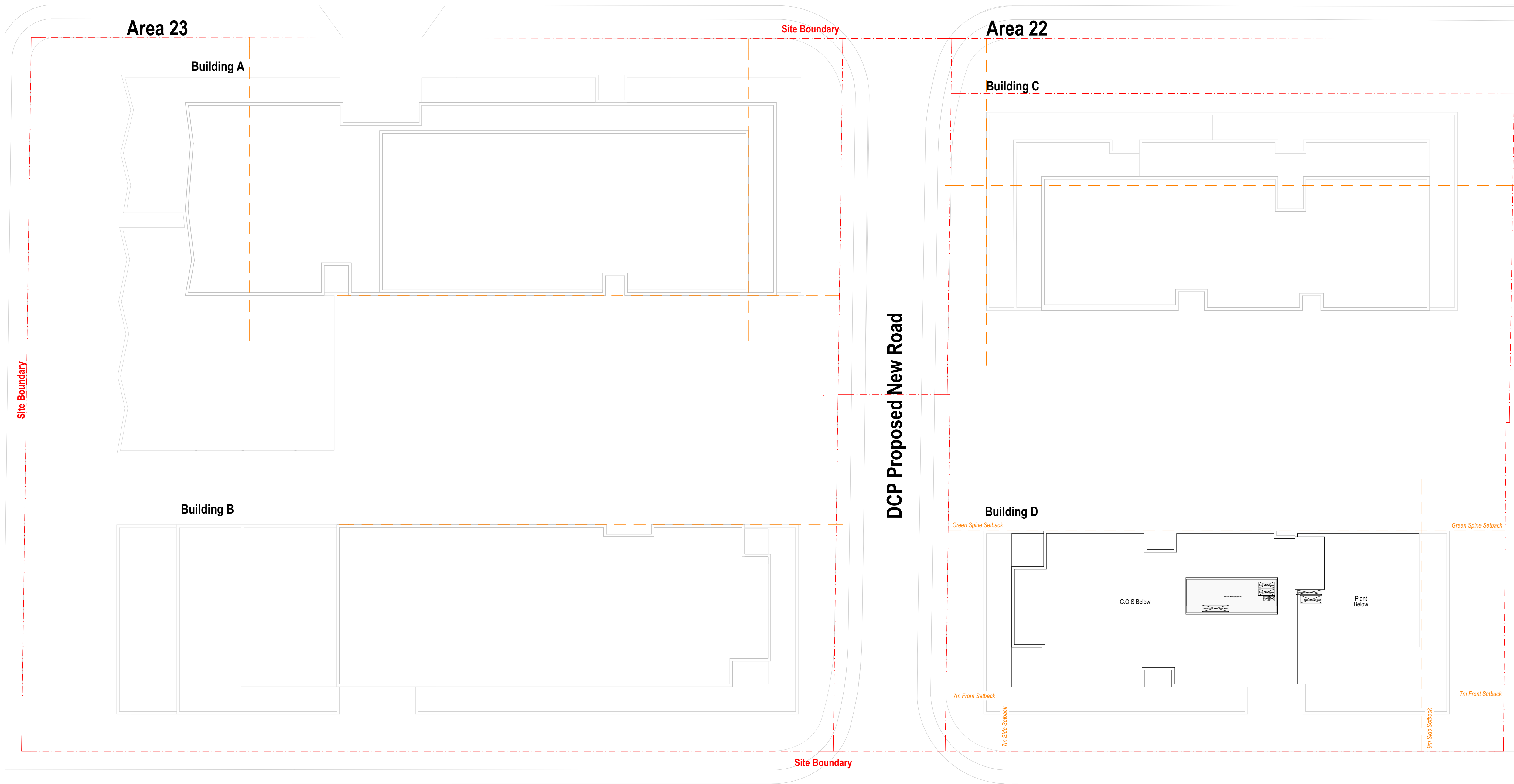
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June 2023

DA216  
C



Park Road



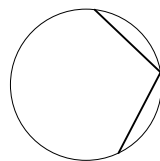
Berry Road

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Project Name  
Project Address  
Park Road  
26-50 Park Rd, 27-47  
Berry Rd, 48-54 River  
Rd., (Area 22 & 23),  
NSW 2065

Client  
Berry Road  
Development Pty Ltd.

Project Number  
Drawing Name  
Scale  
Date  
12883  
Roof Plan  
1:250@A1  
June 2023

Drawing Number  
Revision  
DA217  
C



## APPENDIX C: SITE PHOTOGRAPHS

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**Photograph 1 - Looking north up Berry Road, 23 June 2022**



**Photograph 2 - Looking north-west toward Park Road, 23 June 2022**





**Photograph 3 – Looking north along River Road, showing Berry Lane, 23 June 2022.**



**Photograph 4 – Looking south-south-west down Berry Lane, 23 June 2022.**

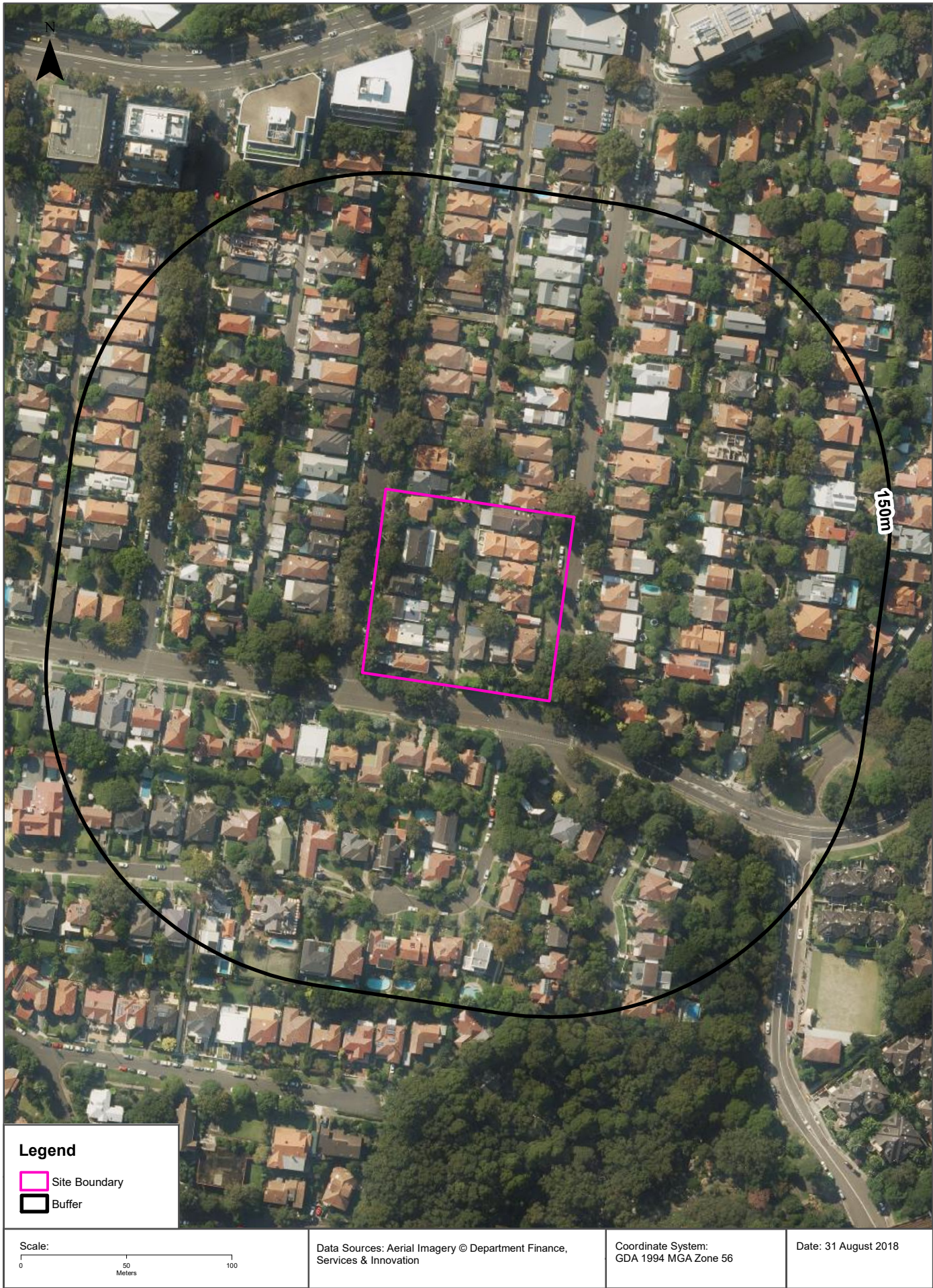




## APPENDIX D: AERIAL PHOTOGRAPHS

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Aerial Imagery 2015

Berry Lane, St Leonards, NSW 2065





# Aerial Imagery 2009

Berry Lane, St Leonards, NSW 2065

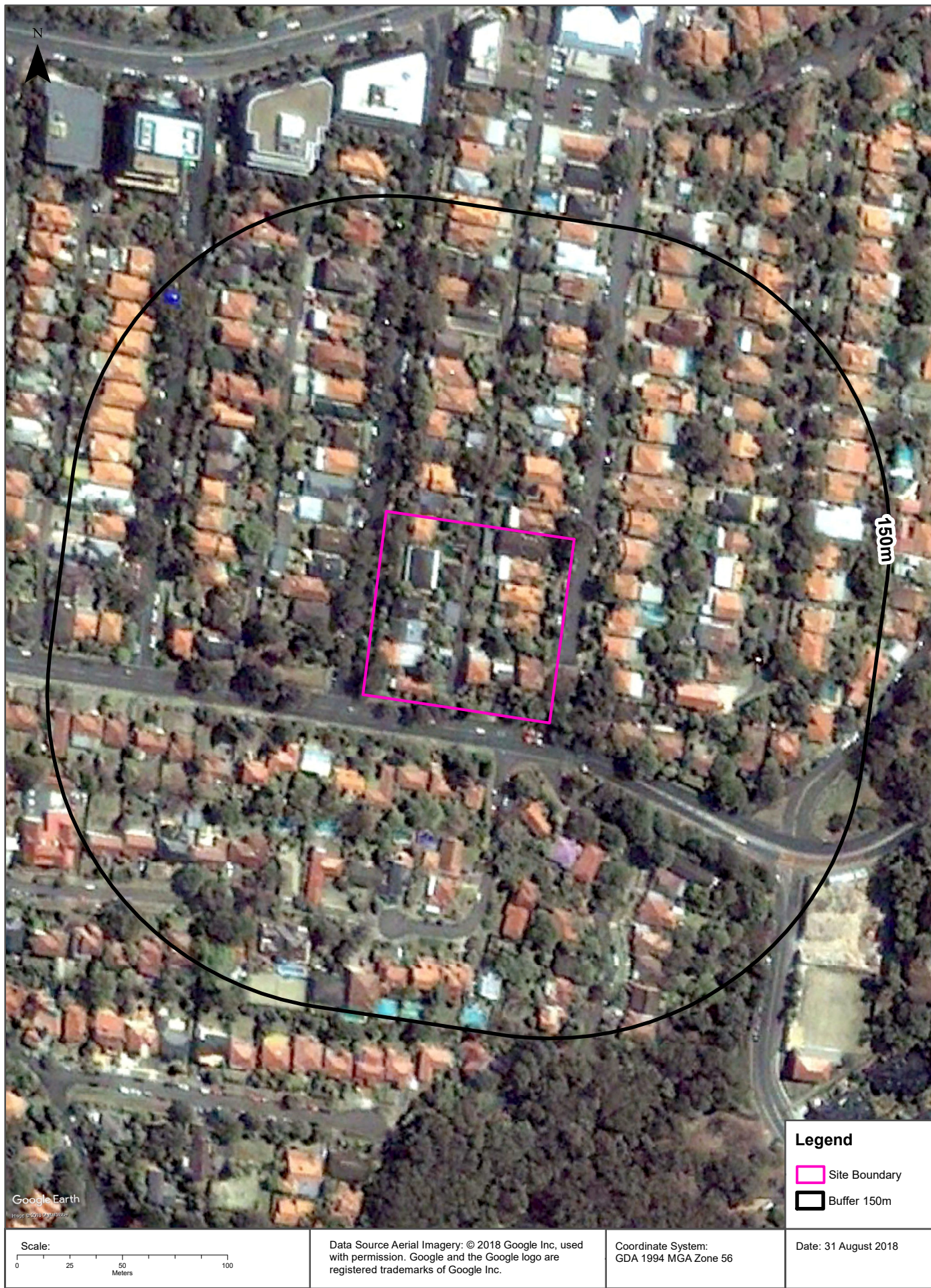


|                                                |                                                                                                                                                 |                                                       |                             |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------|
| <p>Scale:</p> <p>0 25 50 100</p> <p>Meters</p> | <p>Data Source Aerial Imagery: © 2018 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.</p> | <p>Coordinate System:</p> <p>GDA 1994 MGA Zone 56</p> | <p>Date: 31 August 2018</p> |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------|



Aerial Imagery 2002

Berry Lane, St Leonards, NSW 2065







|                                 |                                                                             |                                            |                      |
|---------------------------------|-----------------------------------------------------------------------------|--------------------------------------------|----------------------|
| Scale:<br>0 25 50 100<br>Meters | Data Sources: Aerial Imagery © Department Finance,<br>Services & Innovation | Coordinate System:<br>GDA 1994 MGA Zone 56 | Date: 31 August 2018 |
|---------------------------------|-----------------------------------------------------------------------------|--------------------------------------------|----------------------|











# Aerial Imagery 1965

Berry Lane, St Leonards, NSW 2065





# Aerial Imagery 1961

Berry Lane, St Leonards, NSW 2065





Aerial Imagery 1955

Berry Lane, St Leonards, NSW 2065





# Aerial Imagery 1951

Berry Lane, St Leonards, NSW 2065









Aerial Imagery 1930

Berry Lane, St Leonards, NSW 2065

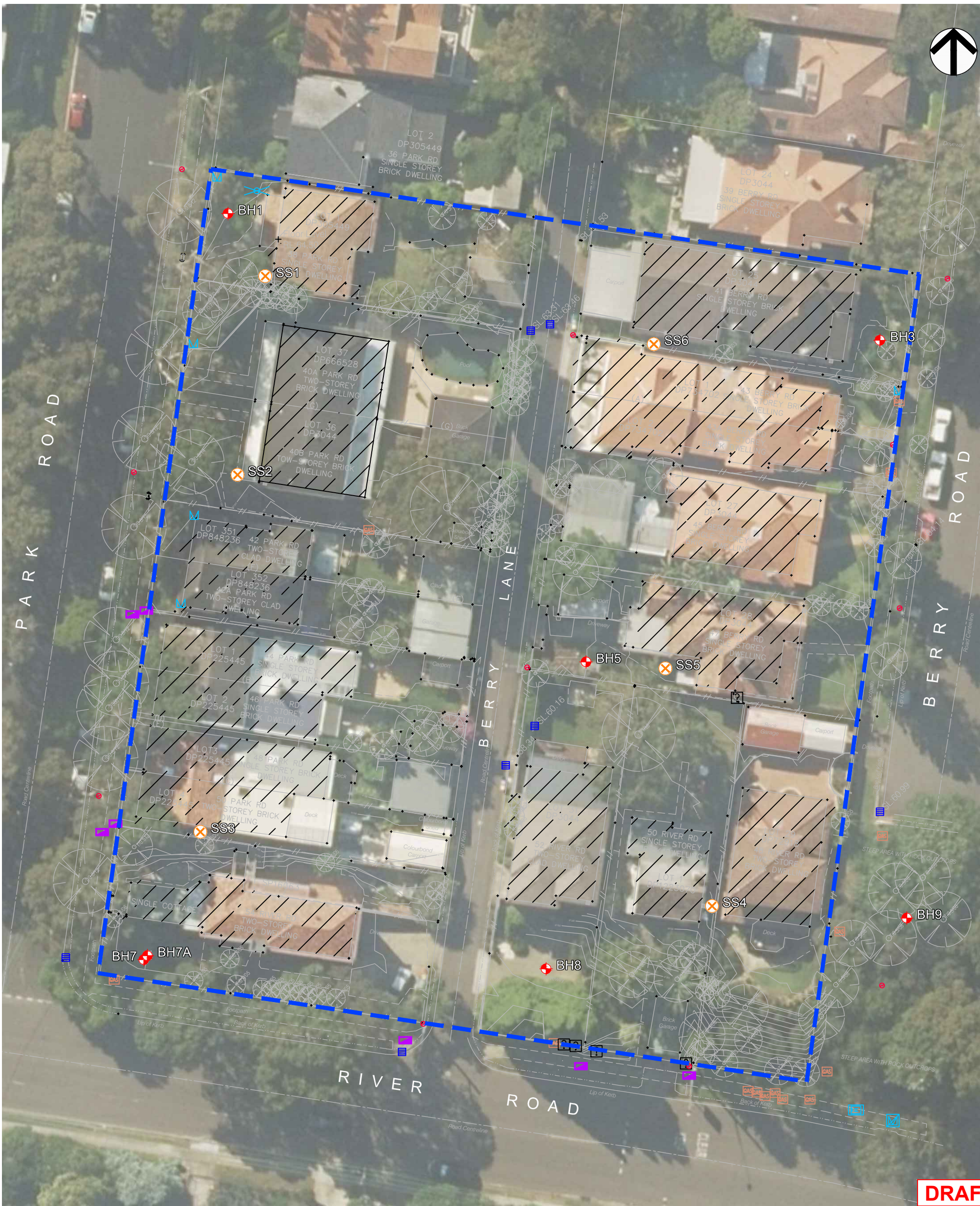




## APPENDIX E: FIGURE, RESULTS AND LOGS FROM PREVIOUS REPORT

---





DRAFT

|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |
|----------|-----|----------------|--|-------|----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| revision | no. | description    |  | drawn | approved | date | <div>LEGEND</div> <div><div><div></div></div>SITE BOUNDARY</div> <div><div></div>APPROXIMATE BOREHOLE LOCATION</div> <div><div></div>APPROXIMATE SOIL SAMPLE LOCATION</div> |  |  |  |
|          | A   | ORIGINAL ISSUE |  |       |          |      |                                                                                                                                                                             |  |  |  |
|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |
|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |
|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |
|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |
|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |
|          |     |                |  |       |          |      |                                                                                                                                                                             |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |              |  |                                                                        |                                                                         |  |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|--|------------------------------------------------------------------------|-------------------------------------------------------------------------|--|--------|
| <div><div><div>5</div><div>0</div><div>5</div><div>10</div><div>15</div><div>20</div></div><div>Scale (metres) 1:400</div></div> <div>AERIAL IMAGERY COPYRIGHT: ©Land and Property Information (1/06/2016)<br/>SOURCED FROM WEBSITE: <a href="http://www.lpi.nsw.gov.au/mapping_and_imagery/lpi_web_services">http://www.lpi.nsw.gov.au/mapping_and_imagery/lpi_web_services</a><br/>LICENSED UNDER CC BY 3.0 AU (<a href="https://creativecommons.org/licenses/by/3.0/au/legalcode">https://creativecommons.org/licenses/by/3.0/au/legalcode</a>)</div> | drawn         | SH / AW      |  | <div><div><div>coffey</div><div>A TETRA TECH COMPANY</div></div></div> | client: COUNTRY GARDEN AUSTRALIA                                        |  |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | approved      | -            |  |                                                                        | project: PRELIMINARY SITE INVESTIGATION<br>BERRY LANE, ST LEONARDS, NSW |  |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | date          | 18 / 09 / 18 |  |                                                                        | title: EXPLORATORY HOLE LOCATION PLAN                                   |  |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | scale         | AS SHOWN     |  |                                                                        | project no: 754-SYDGE219558-R01                                         |  |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | original size | A3           |  |                                                                        | figure no: FIGURE 1                                                     |  | rev: A |



[illegible]

| Ald_ID          | LocCode         | Sampled_Date-Time | Lab_Report_Number | Matrix_Description |     |      |      |      |      |     |     |      |     |     |      |      |     |     |       |       |       |       |       |      |       |       |       |       |       |       |       |       |       |  |
|-----------------|-----------------|-------------------|-------------------|--------------------|-----|------|------|------|------|-----|-----|------|-----|-----|------|------|-----|-----|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| BH1/0.1         | BH1/0.1         | 29-Aug-18         | 615206            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 14  | 2.9 | <0.4 | 6.6 | <5  | 6.6  | <0.1 | <5  | 5.4 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1  |  |
| BH3/0.1         | BH3/0.1         | 27-Aug-18         | 615206            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 13  | <2  | <0.4 | <5  | 7.9 | 31   | <0.1 | <5  | 30  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1  |  |
| BH5/0.1         | BH5/0.1         | 21-Aug-18         | 613945            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 20  | 7.3 | 0.4  | 15  | 35  | 220  | 0.1  | 5.5 | 200 | 0.18  | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | 0.11  | 0.29  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| BH7/0.5         | BH7/0.5         | 22-Aug-18         | 613945            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 14  | 13  | <0.4 | 33  | 26  | 130  | 0.2  | <5  | 96  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| BH8/0.3         | BH8/0.3         | 21-Aug-18         | 613945            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 12  | 3.4 | <0.4 | 15  | 18  | 89   | <0.1 | 5.3 | 150 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| BH9/0.0-0.2     | BH9/0.0-0.2     | 20-Aug-18         | 613945            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 2.8 | <2  | <0.4 | 5.3 | 5.3 | 18   | <0.1 | <5  | 26  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_QC1 | SYDGE219558_SS1 | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 7.3 | 4.7 | <0.4 | 8.4 | 21  | 650  | <0.1 | <5  | 160 | <0.2  | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_SS1 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 5.5 | 5.4 | <0.4 | 8.4 | 19  | 510  | <0.1 | <5  | 160 | 0.13  | <0.05 | <0.05 | 0.06  | <0.05 | 2.5  | <0.05 | <0.05 | <0.05 | 0.13  | 0.06  | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_SS2 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 13  | 3.4 | <0.4 | 5.7 | 29  | 21   | <0.1 | <5  | 44  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_SS3 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 7.4 | 6.6 | <0.4 | 10  | 21  | 170  | 0.1  | <5  | 190 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.5 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_SS4 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 8.2 | 44  | 0.8  | 13  | 46  | 1200 | 0.2  | 6.1 | 520 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 0.7  | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_SS5 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 2.9 | 3.6 | <0.4 | 7.3 | 180 | 48   | <0.1 | 7.5 | 210 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |
| SYDGE219558_SS6 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | NAD | <0.1 | <0.1 | <0.1 | <0.3 | 15  | 3.7 | <0.4 | 9.5 | 19  | 570  | <0.1 | <5  | 150 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |  |

[illegible]



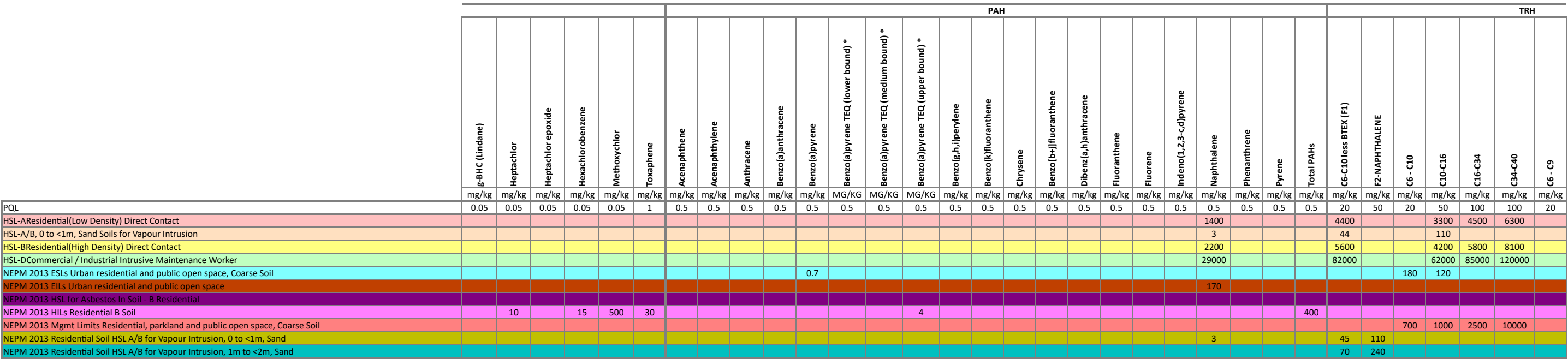
[illegible][illegible]





Table T1: Soil Analytical Results

|                                                                                | C10 - C14 | C15 - C28 | C29 - C36 | C10 - C36 (Sum of total) | C10 - C40 (Sum of total) |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|--------------------------|--------------------------|
|                                                                                | mg/kg     | mg/kg     | mg/kg     | mg/kg                    | mg/kg                    |
| PQL                                                                            | 20        | 50        | 50        | 50                       | 100                      |
| HSL-AResidential(Low Density) Direct Contact                                   |           |           |           |                          |                          |
| HSL-A/B, 0 to <1m, Sand Soils for Vapour Intrusion                             |           |           |           |                          |                          |
| HSL-BResidential(High Density) Direct Contact                                  |           |           |           |                          |                          |
| HSL-DCommercial / Industrial Intrusive Maintenance Worker                      |           |           |           |                          |                          |
| NEPM 2013 ESLs Urban residential and public open space, Coarse Soil            |           |           |           |                          |                          |
| NEPM 2013 EILs Urban residential and public open space                         |           |           |           |                          |                          |
| NEPM 2013 HSL for Asbestos In Soil - B Residential                             |           |           |           |                          |                          |
| NEPM 2013 HILs Residential B Soil                                              |           |           |           |                          |                          |
| NEPM 2013 Mgmt Limits Residential, parkland and public open space, Coarse Soil |           |           |           |                          |                          |
| NEPM 2013 Residential Soil HSL A/B for Vapour Intrusion, 0 to <1m, Sand        |           |           |           |                          |                          |
| NEPM 2013 Residential Soil HSL A/B for Vapour Intrusion, 1m to <2m, Sand       |           |           |           |                          |                          |

| Field_ID        | LocCode         | Sampled_Date-Time | Lab_Report_Number | Matrix_Description |     |     |     |     |      |
|-----------------|-----------------|-------------------|-------------------|--------------------|-----|-----|-----|-----|------|
| BH1/0.1         | BH1/0.1         | 29-Aug-18         | 615206            | Fill               | <20 | <50 | <50 | <50 | <100 |
| BH3/0.1         | BH3/0.1         | 27-Aug-18         | 615206            | Fill               | 26  | 160 | 220 | 406 | 480  |
| BH5/0.1         | BH5/0.1         | 21-Aug-18         | 613945            | Fill               | <20 | 77  | 130 | 207 | 160  |
| BH7/0.5         | BH7/0.5         | 22-Aug-18         | 613945            | Fill               | <20 | 68  | 62  | 130 | 110  |
| BH8/0.3         | BH8/0.3         | 21-Aug-18         | 613945            | Fill               | <20 | <50 | <50 | <50 | <100 |
| BH9/0.0-0.2     | BH9/0.0-0.2     | 20-Aug-18         | 613945            | Fill               | <20 | <50 | <50 | <50 | <100 |
| SYDGE219558_QC1 | SYDGE219558_SS1 | 23-Aug-18         | 613713            | Fill               | <20 | 130 | 98  | 228 | 180  |
| SYDGE219558_SS1 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | <20 | 150 | 100 | 250 | 190  |
| SYDGE219558_SS2 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | <20 | <50 | <50 | <50 | <100 |
| SYDGE219558_SS3 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | <20 | 120 | 90  | 210 | 170  |
| SYDGE219558_SS4 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | <20 | 86  | 58  | 144 | 130  |
| SYDGE219558_SS5 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | <20 | <50 | <50 | <50 | <100 |
| SYDGE219558_SS6 | SYDGE219558     | 23-Aug-18         | 613713            | Fill               | <20 | 250 | 170 | 420 | 460  |

| Statistical Summary                           |     |     |     |     |
|-----------------------------------------------|-----|-----|-----|-----|
| Number of Results                             | 13  | 13  | 13  | 13  |
| Number of Detects                             | 1   | 8   | 8   | 8   |
| Minimum Concentration                         | <20 | <50 | <50 | <50 |
| Minimum Detect                                | 26  | 68  | 58  | 130 |
| Maximum Concentration                         | 26  | 250 | 220 | 420 |
| Maximum Detect                                | 26  | 250 | 220 | 420 |
| Average Concentration                         | 11  | 90  | 81  | 163 |
| Median Concentration                          | 10  | 77  | 62  | 144 |
| Standard Deviation                            | 4.4 | 70  | 63  | 141 |
| Number of Guideline Exceedances               | 0   | 0   | 0   | 0   |
| Number of Guideline Exceedances(Detects Only) | 0   | 0   | 0   | 0   |



# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH1**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **28 Aug 2018**

date completed: **28 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,593.14; N: 6,255,592.88 (MGA94 )

surface elevation: 66.20 m (AHD)

angle from horizontal: 90°

drill model: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information |             |       |                                                                                      |        | material substance |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|----------------------|-------------|-------|--------------------------------------------------------------------------------------|--------|--------------------|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|--------------------------|---------------------------------------|
| method & support     | penetration | water | samples & field tests                                                                | RL (m) | depth (m)          | graphic log | soil group symbol | material description<br><br>SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | moisture condition | consistency / relative density | hand penetrometer (kPa)  | structure and additional observations |
| AD/T                 | 1           |       | E                                                                                    | -66    | 1.0                |             | CL                | TOPSOIL: SILTY SAND: dark brown.                                                                                     | D                  | VSt                            | 100<br>200<br>300<br>400 | TOPSOIL                               |
|                      | 2           |       | FILL: Gravelly SAND: fine grained, dark brown, trace silt.                           |        |                    |             |                   | FILL                                                                                                                 |                    |                                |                          |                                       |
|                      | 3           |       | Sandy CLAY: fine to medium grained, low plasticity, orange-brown, with fine gravels. | <Wp    |                    |             |                   | PID: 0.3 ppm<br>PID: 0.3 ppm<br>RESIDUAL SOIL                                                                        |                    |                                |                          |                                       |
|                      |             |       | E<br>SPT<br>4, 9, 12<br>N*=21                                                        | -65    |                    |             |                   |                                                                                                                      |                    |                                |                          | PID: 0.4 ppm                          |
| N                    |             |       |                                                                                      | -64    | 2.0                |             |                   | Borehole BH1 continued as cored hole                                                                                 |                    |                                |                          |                                       |
|                      |             |       |                                                                                      | -63    | 3.0                |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      | -62    | 4.0                |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      | -61    | 5.0                |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      | -60    | 6.0                |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      | -59    | 7.0                |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                |                          |                                       |
|                      |             |       |                                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                |                          |                                       |

|                                                                                                           |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                               |                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>HA hand auger<br>W washbore<br>HA hand auger | <b>support</b><br>M mud<br>C casing<br><br><b>penetration</b><br><br><b>water</b><br><br>* bit shown by suffix<br>e.g. AD/T<br>B blank bit<br>T TC bit<br>V V hit | <b>samples &amp; field tests</b><br>B bulk disturbed sample<br>D disturbed sample<br>E environmental sample<br>SS split spoon sample<br>U## undisturbed sample ##mm diameter<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shear; peak/remoulded (kPa)<br>R refusal<br>HB hammer bouncing | <b>soil group symbol &amp; soil description</b><br>based on AS 1726:2017<br><br><b>moisture condition</b><br>D dry<br>M moist<br>W wet<br>Wp plastic limit<br>Wl liquid limit | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

\* bit shown by suffix  
e.g. AD/T  
B blank bit  
T TC bit  
V V bit

support  
M mud  
C casing  
N nil

penetration  
no resistance ranging to refusal

water  
10-Oct-12 water level on date shown  
water inflow  
water outflow

samples & field tests  
B bulk disturbed sample  
D disturbed sample  
E environmental sample  
SS split spoon sample  
U## undisturbed sample ##mm diameter  
HP hand penetrometer (kPa)  
N standard penetration test (SPT)  
N\* SPT - sample recovered  
Nc SPT with solid cone  
VS vane shear; peak/remoulded (kPa)  
R refusal  
HB hammer bouncing

soil group symbol & soil description  
based on AS 1726:2017

moisture condition  
D dry  
M moist  
W wet  
Wp plastic limit  
WL liquid limit

consistency / relative density  
VS very soft  
S soft  
F firm  
St stiff  
VSt very stiff  
H hard  
Fb friable  
VL very loose  
L loose  
MD medium dense  
D dense  
VD very dense



client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH1**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **28 Aug 2018**

date completed: **28 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,593.14; N: 6,255,592.88 (MGA94 )

surface elevation: 66.20 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                              |       |        |           | material substance |                                                                                                   |                         |                             | rock mass defects |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| method & support                                                                  | water | RL (m) | depth (m) | graphic log        | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration | estimated strength & Is(50) |                   |   |   | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm) | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        |           |                    |                                                                                                   |                         | VL                          | L                 | M | H |                                     |                |                     | EH                                                                                                                   | a = axial;<br>d = diametral | particular | general |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| method & support<br>AS<br>AD<br>CB<br>W<br>RR<br>NMLC<br>NQ<br>HQ<br>PQ<br><br>HA | water | RL (m) | -66       | graphic log        |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        | -65       |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        | -64       |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        | -63       |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        | -62       |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        | -61       |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        | -60       |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|                                                                                   |       |        |           |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        |           |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                   |       |        |           |                    |                                                                                                   |                         |                             |                   |   |   |                                     |                |                     |                                                                                                                      |                             |            |         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH1**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **28 Aug 2018**

date completed: **28 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,593.14; N: 6,255,592.88 (MGA94 ) surface elevation: 66.20 m (AHD) angle from horizontal: 90°  
drill model: Hinowa HP9503, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        | material substance |             |                                                                                                  | rock mass defects       |                                                                                         |                                                                   |
|----------------------|-------|--------|--------------------|-------------|--------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| method & support     | water | RL (m) | depth (m)          | graphic log | material description<br>ROCK TYPE: grain characteristics, colour, structure, minor components    | weathering & alteration | estimated strength & Is(50)<br>X = axial<br>O = diametral<br>a = axial<br>d = diametral | samples, field tests & Is(50) (MPa)<br>a = axial<br>d = diametral |
| NMLC                 |       | -58    |                    |             | <b>SANDSTONE:</b> fine to coarse grained, orange-brown to pale grey, (Class III).<br>(continued) | MW to SW                |                                                                                         |                                                                   |
|                      |       | -57    | 9.0                |             |                                                                                                  | HW                      |                                                                                         |                                                                   |
|                      |       | -56    |                    |             |                                                                                                  | MW to SW                |                                                                                         |                                                                   |
|                      |       | -55    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -54    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -53    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -52    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -51    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -50    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -49    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -48    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -47    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -46    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -45    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -44    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -43    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -42    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -41    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -40    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -39    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -38    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -37    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -36    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -35    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -34    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -33    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -32    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -31    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -30    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -29    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -28    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -27    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -26    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -25    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -24    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -23    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -22    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -21    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -20    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -19    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -18    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -17    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -16    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -15    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -14    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -13    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -12    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -11    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -10    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -9     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -8     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -7     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -6     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -5     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -4     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -3     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -2     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | -1     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 0      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 1      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 2      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 3      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 4      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 5      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 6      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 7      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 8      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 9      |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 10     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 11     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 12     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 13     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 14     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 15     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 16     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 17     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 18     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 19     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 20     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 21     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 22     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 23     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 24     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 25     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 26     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 27     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 28     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 29     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 30     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 31     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 32     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 33     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 34     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 35     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 36     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 37     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 38     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 39     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 40     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 41     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 42     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 43     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 44     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 45     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 46     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 47     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 48     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 49     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 50     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 51     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 52     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 53     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 54     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 55     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 56     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 57     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 58     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 59     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 60     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 61     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 62     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 63     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 64     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 65     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 66     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 67     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 68     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 69     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 70     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 71     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 72     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 73     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 74     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 75     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 76     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 77     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 78     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 79     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 80     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 81     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 82     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 83     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 84     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 85     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 86     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 87     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 88     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 89     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 90     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 91     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 92     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 93     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 94     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 95     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 96     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 97     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 98     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 99     |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |
|                      |       | 100    |                    |             |                                                                                                  |                         |                                                                                         |                                                                   |

|                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                |                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided | <b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|



# Piezometer Installation Log

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Hole ID. **BH1**

sheet: 1 of 1

project no. **754-SYDGE219558**

date started: **28 Aug 2018**

date completed: **28 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,593.14; N: 6,255,592.88 (MGA94)

surface elevation: 66.20 m (AHD)

angle from horizontal: 90°

equipment type: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter: 125 mm

| drilling information |       |        | material substance | piezometer construction details |  |
|----------------------|-------|--------|--------------------|---------------------------------|--|
| method & support     | water | RL (m) | depth (m)          | material name                   |  |
|                      |       | -66    | 0                  | TOPSOIL                         |  |
|                      |       |        |                    | FILL                            |  |
|                      |       |        |                    | RESIDUAL SOIL                   |  |
|                      |       |        | 1                  |                                 |  |
|                      |       |        | 2                  | HAWKESBURY SANDSTONE            |  |
|                      |       | -64    |                    |                                 |  |
|                      |       |        | 3                  |                                 |  |
|                      |       |        | 4                  |                                 |  |
|                      |       | -62    |                    |                                 |  |
|                      |       |        | 5                  |                                 |  |
|                      |       |        | 6                  |                                 |  |
|                      |       | -60    |                    |                                 |  |
|                      |       |        | 7                  |                                 |  |
|                      |       |        | 8                  |                                 |  |
|                      |       | -58    |                    |                                 |  |
|                      |       |        | 9                  |                                 |  |
|                      |       |        | 10                 |                                 |  |
|                      |       | -56    |                    |                                 |  |
|                      |       |        | 11                 |                                 |  |

| method & support                                    | graphic log / core recovery | ID  | type      | installation date | stickup (m) | tip depth (m) | water level (m) | Relative Levels (AHD) |     |             |
|-----------------------------------------------------|-----------------------------|-----|-----------|-------------------|-------------|---------------|-----------------|-----------------------|-----|-------------|
| see engineering log for details<br><b>water</b><br> |                             | BH1 | standpipe |                   |             | 10.02 m       |                 | stickup               | tip | water level |
|                                                     |                             |     |           |                   |             |               |                 | 56.18                 |     |             |



# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH2**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **27 Jan 1900**

date completed: **27 Jan 1900**

logged by: **AM**

checked by: **AB**

position: E: 332,633.74; N: 6,255,580.28 (MGA94 )

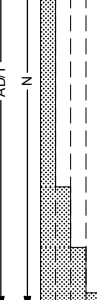
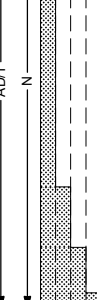
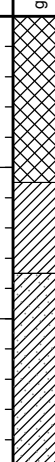
surface elevation: 64.47 m (AHD)

angle from horizontal: 90°

drill model: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                               |                                                                                    |                                                                                    |                                                                                     |        | material substance |                                                                                    |                   |                                                                                                                                                         |                                                                 |                                                                                      |                                                                                      |                                                            |                      |  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------|--------------------|------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------|--|
| method & support                                                                   | penetration                                                                        | water                                                                              | samples & field tests                                                               | RL (m) | depth (m)          | graphic log                                                                        | soil group symbol | material description                                                                                                                                    | moisture condition                                              | consistency / relative density                                                       | hand penetrometer (kPa)                                                              | structure and additional observations                      |                      |  |
|  |  |  |  | 64     |                    |  |                   | <b>FILL: SILTY SAND:</b> fine to medium grained, dark brown.                                                                                            | D                                                               |  |  | <b>FILL</b>                                                |                      |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     |        |                    |                                                                                    |                   |                                                                                                                                                         | <b>FILL: CLAYEY SAND:</b> fine to medium grained, orange-brown. |                                                                                      |                                                                                      |                                                            |                      |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 63     | 1.0                |                                                                                    | CI                | <b>FILL: Sandy CLAY:</b> fine to medium grained, low plasticity, dark grey.<br><b>CLAY:</b> medium plasticity, orange-brown, trace medium grained sand. | >Wp                                                             |                                                                                      |                                                                                      | St                                                         | <b>ALLUVIUM?</b>     |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 62     | 2.0                |                                                                                    | CL                | <b>Sandy CLAY:</b> medium to coarse grained, low plasticity, orange-brown mottled dark grey.                                                            |                                                                 |                                                                                      |                                                                                      | VSt                                                        | <b>RESIDUAL SOIL</b> |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 61     | 3.0                |                                                                                    |                   | Borehole BH2 continued as cored hole                                                                                                                    |                                                                 |                                                                                      |                                                                                      | Discontinued for fear of equipment becoming unrecoverable. |                      |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 60     | 4.0                |                                                                                    |                   |                                                                                                                                                         |                                                                 |                                                                                      |                                                                                      |                                                            |                      |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 59     | 5.0                |                                                                                    |                   |                                                                                                                                                         |                                                                 |                                                                                      |                                                                                      |                                                            |                      |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 58     | 6.0                |                                                                                    |                   |                                                                                                                                                         |                                                                 |                                                                                      |                                                                                      |                                                            |                      |  |
|                                                                                    |                                                                                    |                                                                                    |                                                                                     | 57     | 7.0                |                                                                                    |                   |                                                                                                                                                         |                                                                 |                                                                                      |                                                                                      |                                                            |                      |  |

|                                                                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                          |                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>HA hand auger<br>W washbore<br>HA hand auger | <b>support</b><br>M mud<br>C casing<br>N nil | <b>samples &amp; field tests</b><br>B bulk disturbed sample<br>D disturbed sample<br>E environmental sample<br>SS split spoon sample<br>U## undisturbed sample ##mm diameter<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shear; peak/remoulded (kPa)<br>R refusal<br>HB hammer bouncing | <b>soil group symbol &amp; soil description</b><br>based on AS 1726:2017 | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
| <b>penetration</b><br>                                                                                    | <b>water</b><br>                             | <b>moisture condition</b><br>D dry<br>M moist<br>W wet<br>Wp plastic limit<br>WI liquid limit                                                                                                                                                                                                                                                                                    |                                                                          |                                                                                                                                                                                                            |

\* bit shown by suffix  
e.g.  
AD/T  
B blank bit  
T TC bit  
V V bit



## Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH2**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **27 Jan 1900**

date completed: **27 Jan 1900**

logged by: **AM**

checked by: **AB**

position: E: 332,633.74; N: 6,255,580.28 (MGA94 )

surface elevation: 64.47 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                          |       |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | material substance |                                                                                                   |                         |                               | rock mass defects                   |                |                                  |                                                                                                                      |
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| method & support                                              | water | RL (m) | depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | graphic log        | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration | estimated strength & Is(50)   | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm)              | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |
|                                                               |       |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                                                                                                   |                         | VL<br>J<br>N<br>H<br>VH<br>EH |                                     |                | 30<br>100<br>300<br>1000<br>3000 |                                                                                                                      |
| AS<br>AD<br>CB<br>W<br>RR<br>NMLC<br>NQ<br>HQ<br>PQ<br><br>HA |       |        | -64<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><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|                    |                                                                                                   |                         |                               |                                     |                |                                  |                                                                                                                      |



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH2**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **27 Jan 1900**

date completed: **27 Jan 1900**

logged by: **AM**

checked by: **AB**

position: E: 332,633.74; N: 6,255,580.28 (MGA94 ) surface elevation: 64.47 m (AHD) angle from horizontal: 90°  
drill model: Hinowa HP9503, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                             |                         |                                                                                         | rock mass defects                   |                |                     |                                                                                                                      |
|----------------------|-------|--------|-----------|--------------------|-------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------|-------------------------------------|----------------|---------------------|----------------------------------------------------------------------------------------------------------------------|
| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br>ROCK TYPE: grain characteristics, colour, structure, minor components               | weathering & alteration | estimated strength & Is(50)<br>X = axial<br>O = diametral<br>a = axial<br>d = diametral | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm) | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |
|                      |       |        |           |                    | <b>SANDSTONE:</b> fine to coarse grained, pale grey, distinctly bedded at 0°-25° (Class II).<br>(continued) | FR                      |                                                                                         | a=1.40<br>d=0.89                    | 100%           |                     | PT, 22°, CU, RO, CN                                                                                                  |
|                      |       |        |           |                    |                                                                                                             |                         |                                                                                         | a=1.51<br>d=1.03                    | 100%           |                     |                                                                                                                      |
|                      |       |        |           |                    | Borehole BH2 terminated at 10.11 m<br>Target depth                                                          |                         |                                                                                         | a=1.58<br>d=1.06                    |                |                     |                                                                                                                      |

|                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                |                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLCNMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided | <b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|



# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH3**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **27 Aug 2018**

date completed: **27 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,663.83; N: 6,255,579.14 (MGA94 ) surface elevation: 66.20 m (AHD) angle from horizontal: 90°  
drill model: Hinowa HP9503, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information                    |             |   |   |       | material substance      |        |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|-----------------------------------------|-------------|---|---|-------|-------------------------|--------|-----------|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------|---------------------------------------|
| method & support                        | penetration |   |   | water | samples & field tests   | RL (m) | depth (m) | graphic log | soil group symbol | material description<br><br>SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | moisture condition | consistency / relative density | hand penetrometer (kPa) | structure and additional observations |
| <div><div>HA</div><div>AD/T</div></div> | 1           | 2 | 3 |       |                         |        |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       | E                       | -66    |           |             |                   | FILL: SILTY SAND: dark brown.                                                                                        | D                  |                                |                         | FILL                                  |
|                                         |             |   |   |       | E                       |        |           |             |                   | CLAY: medium plasticity, orange brown.                                                                               | <Wp                | F                              |                         | RESIDUAL SOIL                         |
|                                         |             |   |   |       | SPT<br>39<br>13<br>N=19 | -65    | 1.0       |             |                   | 1.0 m: trace sandstone gravels                                                                                       |                    | VSt                            | >>X                     |                                       |
|                                         |             |   |   |       |                         |        | 2.0       |             |                   | Borehole BH3 continued as cored hole                                                                                 | >Wp                |                                |                         |                                       |
|                                         |             |   |   |       |                         | -64    |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         |        | 3.0       |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         | -63    |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         |        | 4.0       |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         | -62    |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         |        | 5.0       |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         | -61    |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         |        | 6.0       |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         | -60    |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         |        | 7.0       |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                                         |             |   |   |       |                         | -59    |           |             |                   |                                                                                                                      |                    |                                |                         |                                       |

|                                                                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                          |                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>HA hand auger<br>W washbore<br>HA hand auger | <b>support</b><br>M mud<br>C casing<br>N nil | <b>samples &amp; field tests</b><br>B bulk disturbed sample<br>D disturbed sample<br>E environmental sample<br>SS split spoon sample<br>U## undisturbed sample ##mm diameter<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shear; peak/remoulded (kPa)<br>R refusal<br>HB hammer bouncing | <b>soil group symbol &amp; soil description</b><br>based on AS 1726:2017 | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
| <b>penetration</b><br>                                                                                    | <b>water</b><br>                             | <b>moisture condition</b><br>D dry<br>M moist<br>W wet<br>Wp plastic limit<br>WL liquid limit                                                                                                                                                                                                                                                                                    |                                                                          |                                                                                                                                                                                                            |

\* bit shown by suffix  
e.g.  
AD/T  
B blank bit  
T TC bit  
V V bit



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH3**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **27 Aug 2018**

date completed: **27 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,663.83; N: 6,255,579.14 (MGA94 )

surface elevation: 66.20 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                                                                                                                                                                                      |          |        |                                                        | material substance                                                                                                                                                                                                            |                                                                                                   |                                                                                                                                                                 |                             |   |                  | rock mass defects |                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                                                                                                        |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---|------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------|
| method & support                                                                                                                                                                                                                          | water    | RL (m) | depth (m)                                              | graphic log                                                                                                                                                                                                                   | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration                                                                                                                                         | estimated strength & Is(50) |   |                  |                   |                                                                                                                                                                                                                                                                       | samples, field tests & Is(50) (MPa) | core run & RQD                                                                                                                                                                                                         | defect spacing (mm)                                                                                                                                                                                   | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        |                                                        |                                                                                                                                                                                                                               |                                                                                                   |                                                                                                                                                                 | VL                          | L | M                | H                 | VH                                                                                                                                                                                                                                                                    |                                     |                                                                                                                                                                                                                        |                                                                                                                                                                                                       | a = axial;<br>d = diametral                                                                                          | particular                                                                                                                                | general |
|                                                                                                                                                                                                                                           |          |        | -66                                                    |                                                                                                                                                                                                                               |                                                                                                   |                                                                                                                                                                 |                             |   |                  |                   |                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                                                                                                        |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | -65                                                    |                                                                                                                                                                                                                               |                                                                                                   |                                                                                                                                                                 |                             |   |                  |                   |                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                                                                                                        |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | -64                                                    |                                                                                                                                                                                                                               | started coring at 1.90m                                                                           |                                                                                                                                                                 |                             |   |                  |                   |                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                                                                                                        |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
| ↑                                                                                                                                                                                                                                         | 04/09/18 | NMLC   | 2.0                                                    |                                                                                                                                                                                                                               | SANDSTONE: medium grained, red-brown to pale grey, (Class V).                                     | HW                                                                                                                                                              |                             |   |                  |                   | a=0.16<br>d=0.12                                                                                                                                                                                                                                                      | 85%                                 |                                                                                                                                                                                                                        |                                                                                                                                                                                                       | HAWKESBURY SANDSTONE<br>SM, Clay, 62 mm<br>JT, 66°, CU, RO, CN<br>JT, 64°, CU, RO, CN<br>JT, 70°, CU, RO, CN         |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | 3.0                                                    |                                                                                                                                                                                                                               |                                                                                                   |                                                                                                                                                                 |                             |   | a=0.27<br>d=0.24 | 82%               |                                                                                                                                                                                                                                                                       |                                     | PT, 5°, PL, RO, CN<br>SM, Clay, 200 mm<br>SM, Clay, 8 mm                                                                                                                                                               |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | 4.0                                                    |                                                                                                                                                                                                                               |                                                                                                   |                                                                                                                                                                 |                             |   | a=0.32<br>d=0.32 | 77%               |                                                                                                                                                                                                                                                                       |                                     | PT, 15°, PL, RO, CN<br>JT, 60°, PL, CN, Tight<br>SM, Clay, 10 mm                                                                                                                                                       |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | 5.0                                                    |                                                                                                                                                                                                                               | 5.26 to 5.43 m: distinctly laminated shale lens                                                   |                                                                                                                                                                 |                             |   | a=0.75<br>d=0.22 |                   |                                                                                                                                                                                                                                                                       |                                     | JT, 59°, CU, RO, CN<br>JT, 18°, PL, RO, CN<br>SM, Clay, 16 mm<br>SM, Sandy clay, 30 mm<br>PT, 7°, UN, RO, Fe SN<br>SM, Clay, 17 mm<br>JT, 25°, CU, RO, CN<br>JT, 16°, CU, RO, CN<br>SM, Clay, 33 mm<br>SM, Clay, 17 mm |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | 6.0                                                    |                                                                                                                                                                                                                               | SANDSTONE: fine to medium grained, pale grey, distinctly cross bedded at 5-15° (Class II to III). | FR                                                                                                                                                              |                             |   | 100%             |                   |                                                                                                                                                                                                                                                                       |                                     | PT, 11°, PL, RO, CN                                                                                                                                                                                                    |                                                                                                                                                                                                       |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | 6.61 to 6.91 m: fine sandstone interbedding, dark grey |                                                                                                                                                                                                                               | MW<br>FR<br>HW                                                                                    |                                                                                                                                                                 |                             |   |                  | a=0.48<br>d=0.06  | 82%                                                                                                                                                                                                                                                                   |                                     |                                                                                                                                                                                                                        | PT, 7°, PL, SO, CN                                                                                                                                                                                    |                                                                                                                      |                                                                                                                                           |         |
|                                                                                                                                                                                                                                           |          |        | -59                                                    |                                                                                                                                                                                                                               |                                                                                                   |                                                                                                                                                                 |                             |   |                  |                   | a=1.32<br>d=0.38                                                                                                                                                                                                                                                      | 100%                                |                                                                                                                                                                                                                        |                                                                                                                                                                                                       | PT, 18°, CU, RO, VN<br>SM, Clay, 4 mm                                                                                |                                                                                                                                           |         |
| method & support                                                                                                                                                                                                                          |          |        |                                                        | support                                                                                                                                                                                                                       |                                                                                                   | graphic log / core recovery                                                                                                                                     |                             |   |                  |                   | weathering & alteration*                                                                                                                                                                                                                                              |                                     |                                                                                                                                                                                                                        | defect type                                                                                                                                                                                           |                                                                                                                      | planarity                                                                                                                                 |         |
| AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6 mm)<br>HQ wireline core (63.5 mm)<br>PQ wireline core (85.0 mm)<br><br>HA hand auger |          |        |                                                        | C casing M mud N none<br><br>water<br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br><br>water pressure test result (lugeons) for depth interval shown |                                                                                                   | core recovered (graphic symbols indicate material)<br><br>no core recovered<br><br>core run & RQD<br>barrel withdrawn<br><br>RQD = Rock Quality Designation (%) |                             |   |                  |                   | RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br>strength<br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high |                                     |                                                                                                                                                                                                                        | PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><br>roughness<br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided |                                                                                                                      | PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR Irregular<br><br>coating<br>CN clean<br>SN stained<br>VN veneer<br>CO coating |         |



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH3**

sheet: 3 of 3

project no. **754-SYDGE219558**

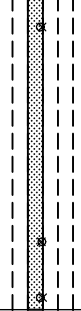
date started: **27 Aug 2018**

date completed: **27 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,663.83; N: 6,255,579.14 (MGA94 ) surface elevation: 66.20 m (AHD) angle from horizontal: 90°  
drill model: Hinowa HP9503, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                              |                         |                                                                                                   | rock mass defects                                                      |                |                                                                                     |                                                                                                                                                                                                                                                      |
|----------------------|-------|--------|-----------|--------------------|--------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components            | weathering & alteration | estimated strength & Is(50)<br><br>X = axial;<br>O = diametral<br><br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)<br><br>a = axial;<br>d = diametral | core run & RQD | defect spacing (mm)                                                                 | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)                                                                                                                              |
| NMLC                 |       | -58    | 9.0       |                    | SANDSTONE: fine to coarse grained, pale grey to orange-brown, distinctly bedded at 20-30° (Class II to III). | MV                      |                  | a=0.90<br>d=0.78                                                       | 86%            |  | SM, Fe, 4 mm<br>HAWKESBURY SANDSTONE<br>SM, Gravelly Clay, 14 mm<br>JT, 11°, CU, RO, Fe VN<br>JT, 38°, CU, Fe CO, Very Narrow<br>JT, 40°, PL, Fe CO<br>PT, 23°, PL, RO, CN<br>PT, 23°, PL, RO, CN<br>PT, 23°, PL, RO, Clay CO<br>PT, 25°, PL, RO, CN |
|                      |       | -57    |           |                    | SANDSTONE: fine to coarse grained, pale grey, indistinctly cross bedded at 10-20° (Class II).                | FR                      |                                                                                                   | a=0.84<br>d=0.88                                                       |                |                                                                                     |                                                                                                                                                                                                                                                      |
|                      |       | -56    | 10.0      |                    | Borehole BH3 terminated at 10.08 m<br>Target depth                                                           |                         |                  | a=0.93<br>d=0.78                                                       |                |                                                                                     | JT, 15°, PL, RO, SN                                                                                                                                                                                                                                  |
|                      |       | -56    |           |                    |                                                                                                              |                         |                                                                                                   |                                                                        |                |                                                                                     |                                                                                                                                                                                                                                                      |
|                      |       | -55    | 11.0      |                    |                                                                                                              |                         |                                                                                                   |                                                                        |                |                                                                                     |                                                                                                                                                                                                                                                      |
|                      |       | -54    | 12.0      |                    |                                                                                                              |                         |                                                                                                   |                                                                        |                |                                                                                     |                                                                                                                                                                                                                                                      |
|                      |       | -53    | 13.0      |                    |                                                                                                              |                         |                                                                                                   |                                                                        |                |                                                                                     |                                                                                                                                                                                                                                                      |
|                      |       | -52    | 14.0      |                    |                                                                                                              |                         |                                                                                                   |                                                                        |                |                                                                                     |                                                                                                                                                                                                                                                      |
|                      |       | -51    | 15.0      |                    |                                                                                                              |                         |                                                                                                   |                                                                        |                |                                                                                     |                                                                                                                                                                                                                                                      |

|                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                |                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided | <b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|



# Piezometer Installation Log

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Hole ID. **BH3**

sheet: 1 of 1

project no. **754-SYDGE219558**

date started: **27 Aug 2018**

date completed: **27 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,663.83; N: 6,255,579.14 (MGA94 )

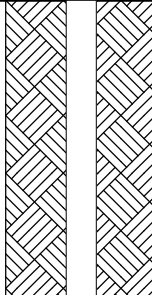
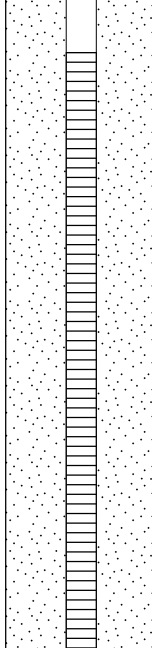
surface elevation: 66.20 m (AHD)

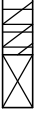
angle from horizontal: 90°

equipment type: Hinowa HP9503, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                          |       |        |           | material substance                                                                |                      | piezometer construction details                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|-----------------------------------------------|-------|--------|-----------|-----------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| method & support                              | water | RL (m) | depth (m) | graphic log                                                                       | material name        | bore construction license:<br>drilling company:<br>driller:<br>driller's permit no.:                                                                                                                                                                                                                                                                              |  |  |  |  |  |  |
| <div>HA</div> <div>AD/T</div> <div>NMLC</div> |       | -66    |           |  | FILL                 |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       |        | 1         |  | RESIDUAL SOIL        |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       | -64    | 2         |  | HAWKESBURY SANDSTONE | <div>BH3</div> <div></div> <div>Grout</div> <div></div> <div>Bentonite</div> <div></div> <div>Sand</div> |  |  |  |  |  |  |
|                                               |       |        | 3         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       |        | 4         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       | -62    | 5         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       |        | 6         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       | -60    | 7         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       |        | 8         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       | -58    | 9         |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               |       |        | 10        |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                               | -56   |        |           |                                                                                   |                      | 10.08 m                                                                                                                                                                                                                                                                                                                                                           |  |  |  |  |  |  |
|                                               |       |        | 11        |                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                 |     |           |                   |             |               |                 |                       |     |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------|-------------------|-------------|---------------|-----------------|-----------------------|-----|-------------|
| <b>method &amp; support</b><br>see engineering log for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>graphic log / core recovery</b>                                                                                                                                                                                                              | ID  | type      | installation date | stickup (m) | tip depth (m) | water level (m) | Relative Levels (AHD) |     |             |
| <b>water</b><br> 10-Oct-12, water level on date shown<br> water inflow<br> complete drilling fluid loss<br> partial drilling fluid loss<br><br> water pressure test result (lugeons) for depth interval shown |  core recovered (graphic symbols indicate material)<br> no core recovered | BH3 | standpipe |                   |             | 10.08 m       |                 | stickup               | tip | water level |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                 |     |           |                   |             |               |                 | 56.12                 |     |             |

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|                 |                        |
|-----------------|------------------------|
| Borehole ID.    | <b>BH4</b>             |
| sheet:          | 1 of 3                 |
| project no.     | <b>754-SYDGE219558</b> |
| date started:   | <b>23 Aug 2018</b>     |
| date completed: | <b>23 Aug 2018</b>     |
| logged by:      | <b>AM</b>              |
| checked by:     | <b>AB</b>              |

principal:

date started: **23 Aug 2018**

date completed: **23 Aug 2018**

location: **St Leonards, NSW**

logged by: **AM**

checked by: **AB**

position: E: 332,612.49; N: 6,255,561.93 (MGA94 )

surface elevation: 63.02 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt. Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                 |                                                                                               |       |                                                                      |        | material substance |             |                   |                                                                                                                      |                    |                                |                                                                                                                        |                                       |     |                                       |               |
|--------------------------------------|-----------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------|--------|--------------------|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----|---------------------------------------|---------------|
| method & support                     | penetration                                                                                   | water | samples & field tests                                                | RL (m) | depth (m)          | graphic log | soil group symbol | material description<br><br>SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | moisture condition | consistency / relative density | hand penetrometer (kPa)<br>100<br>200<br>300<br>400                                                                    | structure and additional observations |     |                                       |               |
| method<br>AD<br>AS<br>HA<br>WA<br>HA | 1<br>2<br>3<br>penetration<br>AD/T<br>N<br>SPT 2, F, 1<br>N=2<br>SPT 12, 9,<br>30/65mm<br>N=R |       | E<br><br>E<br>SPT 2, F, 1<br>N=2<br><br>SPT 12, 9,<br>30/65mm<br>N=R | 63     |                    |             |                   | FILL: SILTY SAND: dark brown, with coarse gravels.                                                                   | D                  |                                |                                                                                                                        | FILL<br>PID: 0.5 ppm                  |     |                                       |               |
|                                      |                                                                                               |       |                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                | FILL: CLAY: high plasticity, some ash with gravels.                                                                    | >Wp                                   |     | Reworked Natural?<br><br>PID: 0.5 ppm |               |
|                                      |                                                                                               |       |                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                | CLAY: low plasticity, pale grey.                                                                                       | <Wp                                   | VSt | >X                                    | RESIDUAL SOIL |
|                                      |                                                                                               |       |                                                                      |        |                    |             |                   |                                                                                                                      |                    |                                | SANDSTONE: orange-brown to pale grey, recovered as low strength gravelly sand.<br>Borehole BH4 continued as cored hole | D                                     |     |                                       |               |
|                                      |                                                                                               |       |                                                                      | 60     | 3.0                |             |                   |                                                                                                                      |                    |                                |                                                                                                                        |                                       |     |                                       |               |
|                                      |                                                                                               |       |                                                                      |        | 59                 | 4.0         |                   |                                                                                                                      |                    |                                |                                                                                                                        |                                       |     |                                       |               |
|                                      |                                                                                               |       |                                                                      |        | 58                 | 5.0         |                   |                                                                                                                      |                    |                                |                                                                                                                        |                                       |     |                                       |               |
|                                      |                                                                                               |       |                                                                      |        | 57                 | 6.0         |                   |                                                                                                                      |                    |                                |                                                                                                                        |                                       |     |                                       |               |
|                                      |                                                                                               |       |                                                                      |        | 56                 | 7.0         |                   |                                                                                                                      |                    |                                |                                                                                                                        |                                       |     |                                       |               |

method  
AD  
AS  
HA  
WA  
HA

\*  
e.g.  
B  
T  
V

bit shown by suffix  
AD/T  
blank bit  
TC bit  
V bit

support  
M  
C

penetration

water

10-Oct-12 water level on date shown  
water inflow  
water outflow

samples & field tests  
B  
D  
E  
SS  
U##  
HP  
N  
N\*  
Nc  
VS  
R  
HB

bulk disturbed sample  
disturbed sample  
environmental sample  
split spoon sample  
undisturbed sample ##mm diameter  
hand penetrometer (kPa)  
standard penetration test (SPT)  
SPT - sample recovered  
SPT with solid cone  
vane shear; peak/remoulded (kPa)  
refusal  
hammer bouncing

soil group symbol & soil description  
based on AS 1726:2017

moisture condition  
D  
M  
W  
Wp  
WL

dry  
moist  
wet  
plastic limit  
liquid limit

consistency / relative density  
VS  
S  
F  
St  
VSt  
H  
Fb  
VL  
L  
MD  
D  
VD

very soft  
soft  
firm  
stiff  
very stiff  
hard  
friable  
very loose  
loose  
medium dense  
dense  
very dense



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH4**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **23 Aug 2018**

date completed: **23 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,612.49; N: 6,255,561.93 (MGA94 ) surface elevation: 63.02 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter: 125 mm

| drilling information |       |        |           | material substance |                                                                                               |                         |                                                                                           | rock mass defects                   |                |                     |                                                                                                                         |
|----------------------|-------|--------|-----------|--------------------|-----------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------|-------------------------------------|----------------|---------------------|-------------------------------------------------------------------------------------------------------------------------|
| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration | estimated strength & Is(50)<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm) | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other) |
|                      |       |        |           |                    |                                                                                               |                         |                                                                                           |                                     |                |                     |                                                                                                                         |
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| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
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# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH4**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **23 Aug 2018**

date completed: **23 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,612.49; N: 6,255,561.93 (MGA94 ) surface elevation: 63.02 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                                    |                         |                                                                                       | rock mass defects                   |                |                     |                                                                                                                      |
|----------------------|-------|--------|-----------|--------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------|-------------------------------------|----------------|---------------------|----------------------------------------------------------------------------------------------------------------------|
| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br>ROCK TYPE: grain characteristics, colour, structure, minor components                      | weathering & alteration | estimated strength & Is50<br>X = axial<br>O = diametral<br>a = axial<br>d = diametral | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm) | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |
|                      |       | 53     |           |                    | <b>SANDSTONE:</b> medium to coarse grained, pale grey, distinctly cross bedded at 5-25° (Class II).<br>(continued) | FR                      |                                                                                       | a=0.32<br>d=0.87                    | 97%            |                     | SM, Clay, 10 mm<br><br>PT, 11°, PL, RO, CO<br><br>PT, 10°, PL, RO, Clay CO<br>SM, Clay, 8 mm                         |
|                      |       | 54     | 9.0       |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |
|                      |       | 53     | 10.0      |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |
|                      |       |        |           |                    | Borehole BH4 terminated at 10.42 m<br>Target depth                                                                 |                         |                                                                                       | a=2.07<br>d=1.15                    |                |                     |                                                                                                                      |
|                      |       | 52     | 11.0      |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |
|                      |       | 51     | 12.0      |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |
|                      |       | 50     | 13.0      |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |
|                      |       | 49     | 14.0      |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |
|                      |       | 48     | 15.0      |                    |                                                                                                                    |                         |                                                                                       |                                     |                |                     |                                                                                                                      |

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| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLCNMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
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# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH5**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,631.96; N: 6,255,544.25 (MGA94 ) surface elevation: 60.15 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |             |       |                       |        |           | material substance |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|----------------------|-------------|-------|-----------------------|--------|-----------|--------------------|-------------------|------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------|-----|-----|---------------|---------------------------------------|
| method & support     | penetration | water | samples & field tests | RL (m) | depth (m) | graphic log        | soil group symbol | material description                                                                     | moisture condition | consistency / relative density | hand penetrometer (kPa) |     |     |               | structure and additional observations |
|                      |             |       |                       |        |           |                    |                   | SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components |                    |                                | 100                     | 200 | 300 | 400           |                                       |
| AD<br>HA<br>Casing   | 1           |       | E                     | -60    |           |                    |                   | FILL: SILTY SAND: dark brown, with coarse gravels.                                       | D                  |                                |                         |     |     | FILL          |                                       |
|                      | 2           |       | E                     |        |           |                    | CL                | Sandy CLAY: low plasticity, pale orange-brown, with fine to coarse grained sand.         | >Wp                | F                              |                         |     |     | RESIDUAL SOIL |                                       |
|                      | 3           |       |                       |        |           |                    |                   | Borehole BH5 continued as cored hole                                                     |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 1.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 2.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 3.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 4.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 5.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 6.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |
|                      |             |       |                       |        | 7.0       |                    |                   |                                                                                          |                    |                                |                         |     |     |               |                                       |

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|-----------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>HA hand auger<br>W washbore<br>HA hand auger | <b>support</b><br>M mud<br>C casing<br>N nil | <b>samples &amp; field tests</b><br>B bulk disturbed sample<br>D disturbed sample<br>E environmental sample<br>SS split spoon sample<br>U## undisturbed sample ##mm diameter<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shear; peak/remoulded (kPa)<br>R refusal<br>HB hammer bouncing | <b>soil group symbol &amp; soil description</b><br>based on AS 1726:2017 | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
| <b>penetration</b><br>                                                                                    | <b>water</b><br>                             | <b>moisture condition</b><br>D dry<br>M moist<br>W wet<br>Wp plastic limit<br>WI liquid limit                                                                                                                                                                                                                                                                                    |                                                                          |                                                                                                                                                                                                            |

\* bit shown by suffix  
e.g.  
AD/T  
B blank bit  
T TC bit  
V V bit



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH5**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,631.96; N: 6,255,544.25 (MGA94 ) surface elevation: 60.15 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information                                                                                                                                                                                                                                       |       |        |           | material substance                                                                                                                                                                                                                       |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           | rock mass defects                                                                                                                                                                                                                                                                                 |                |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| method & support                                                                                                                                                                                                                                           | water | RL (m) | depth (m) | graphic log                                                                                                                                                                                                                              | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components                                                         | weathering & alteration                                                                                                                                                                            | estimated strength & Is(50)<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)<br>a = axial;<br>d = diametral                                                                                                                                                                                                                                | core run & RQD | defect spacing (mm)<br>30<br>50<br>100<br>200<br>500<br>1000<br>3000                                                                                                                                                                                                                                                                                                               | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)                                                                                                                          |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    | VL<br>L<br>M<br>H<br>VH<br>EH                                                             |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    | particular<br><br>general                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                            |       |        | 60        |                                                                                                                                                                                                                                          | started coring at 0.57m                                                                                                                                   |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          | SANDSTONE: fine to coarse grained, red-brown to pale grey.                                                                                                | HW                                                                                                                                                                                                 |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    | HAWKESBURY SANDSTONE                                                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          | NO CORE: 0.17 m                                                                                                                                           | XW                                                                                                                                                                                                 |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    | SM, Sandy clay, 410 mm                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                            |       |        | 59        |                                                                                                                                                                                                                                          | SANDSTONE: fine to coarse grained, red-brown to pale grey, (Class IV).                                                                                    |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   | 0%             |                                                                                                                                                                                                                                                                                                                                                                                    | FZ, 320 mm                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           | HW                                                                                                                                                                                                 |                                                                                           | a=0.11<br>d=0.14                                                                                                                                                                                                                                                                                  |                |                                                                                                                                                                                                                                                                                                                                                                                    | PT, 5°, PL, RO, CN<br>PT, 5°, PL, RO, CN<br>PT, 5°, PL, RO, CN<br>SM, Sandy clay, 35 mm<br>SM, Sandy clay, 11 mm<br>JT, 0°, PL, RO, CN<br>Root jacking 65°<br>Root jacking 65°<br>SM, Sandy clay, 35 mm<br>JT, 2°, PL, RO, CN<br>Root jacking 0° |
|                                                                                                                                                                                                                                                            |       |        | 58        |                                                                                                                                                                                                                                          | SANDSTONE: medium to coarse grained, dark red-brown to pale orange brown, indistinctly bedded at 10-25° (Class IV).                                       | MW                                                                                                                                                                                                 |                                                                                           | a=1.23<br>d=1.06                                                                                                                                                                                                                                                                                  | 65%            |                                                                                                                                                                                                                                                                                                                                                                                    | JT, 5°, CU, RO, CN                                                                                                                                                                                                                               |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                            |       |        | 57        |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                            |       |        | 56        |                                                                                                                                                                                                                                          | SANDSTONE: fine to coarse grained, pale grey, distinctly bedded at 0-20° with carbonaceous laminae (Class II).                                            | FR                                                                                                                                                                                                 |                                                                                           | a=0.94<br>d=0.81                                                                                                                                                                                                                                                                                  | 94%            |                                                                                                                                                                                                                                                                                                                                                                                    | JT, 5°, PL, RO, CN                                                                                                                                                                                                                               |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    | SM, Clayey sand, 8 mm                                                                                                                                                                                                                            |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           | a=1.06<br>d=0.98<br>a=0.96<br>d=0.84<br>a=1.01<br>d=0.74                                                                                                                                                                                                                                          |                |                                                                                                                                                                                                                                                                                                                                                                                    | JT, 5°, PL, RO, CN<br>JT, 5°, PL, RO, CN                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                            |       |        | 55        |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   | 97%            |                                                                                                                                                                                                                                                                                                                                                                                    | PT, 5°, UN, RO, CN<br>JT, 10°, CU, RO, CN<br>JT, 5°, UN, RO, CN<br>JT, 86°, UN, RO, CN                                                                                                                                                           |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           | a=1.36<br>d=1.14<br>a=1.10<br>d=1.27                                                                                                                                                                                                                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                    | PT, 15°, CU, RO, VN                                                                                                                                                                                                                              |
|                                                                                                                                                                                                                                                            |       |        | 54        |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                    | JT, 10°, PL, RO, CN<br>PT, 5°, PL, RO, Fe VN<br>PT, 5°, PL, RO, Fe VN                                                                                                                                                                            |
|                                                                                                                                                                                                                                                            |       |        |           |                                                                                                                                                                                                                                          |                                                                                                                                                           |                                                                                                                                                                                                    |                                                                                           | a=1.12<br>d=1.22                                                                                                                                                                                                                                                                                  | 94%            |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                            |       |        | 53        |                                                                                                                                                                                                                                          | SANDSTONE: medium to coarse grained, pale grey, massive (Class II).<br>7.30 to 7.41 m: Minor shale breccia<br>7.52 to 7.74 m: dark grey, laminated at 12° |                                                                                                                                                                                                    |                                                                                           | a=0.65<br>d=0.31                                                                                                                                                                                                                                                                                  |                |                                                                                                                                                                                                                                                                                                                                                                                    | FZ<br>PT, 20°, PL, RO, CN                                                                                                                                                                                                                        |
| method & support<br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br><br>HA hand auger |       |        |           | support<br>C casing M mud N none<br><br>water<br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br><br>water pressure test result (lugeons) for depth interval shown |                                                                                                                                                           | graphic log / core recovery<br><br>core recovered (graphic symbols indicate material)<br><br>no core recovered<br><br>core run & RQD<br>barrel withdrawn<br><br>RQD = Rock Quality Designation (%) |                                                                                           | weathering & alteration*<br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br>strength<br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high |                | defect type<br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><br>roughness<br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><br>planarity<br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><br>coating<br>CN clean<br>SN stained<br>VN veneer<br>CO coating |                                                                                                                                                                                                                                                  |



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH5**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,631.96; N: 6,255,544.25 (MGA94 )

surface elevation: 60.15 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                                                                                                                                                                                                                    |       |        |           | material substance                                                                                                                                                                                                                                             |                                                                                               |                                                                                                                                                                                                                             |                                                                                           | rock mass defects                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--|
| method & support                                                                                                                                                                                                                                                        | water | RL (m) | depth (m) | graphic log                                                                                                                                                                                                                                                    | material description<br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration                                                                                                                                                                                                     | estimated strength & Is(50)<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)<br>a = axial;<br>d = diametral                                                                                                                                                                                                                                                  | core run & RQD | defect spacing (mm)<br>30<br>100<br>300<br>1000<br>3000                                                                                                                                                                                                                                                                                                                                                        | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)<br>particular<br>general |  |
| NMILC                                                                                                                                                                                                                                                                   |       | -52    |           |                                                                                                                                                                                                                                                                | SANDSTONE: medium to coarse grained, pale grey, massive (Class II). (continued)               | FR                                                                                                                                                                                                                          |                                                                                           | a=0.97<br>d=1.08                                                                                                                                                                                                                                                                                                    | 94%            |                                                                                                                                                                                                                                                                                                                                                                                                                | HAWKESBURY SANDSTONE                                                                                                                             |  |
|                                                                                                                                                                                                                                                                         |       | -51    | 9.0       |                                                                                                                                                                                                                                                                | 9.06 m: becoming indistinctly bedded at 5-10°                                                 |                                                                                                                                                                                                                             |                                                                                           | a=1.37<br>d=1.06<br>a=1.16<br>d=0.88<br>a=1.08<br>d=0.96                                                                                                                                                                                                                                                            | 93%            |                                                                                                                                                                                                                                                                                                                                                                                                                | SM, Sandy clay, 8 mm<br>PT, 5°, PL, RO, CN<br>PT, 10°, PL, RO, CN                                                                                |  |
|                                                                                                                                                                                                                                                                         |       | -50    | 10.0      |                                                                                                                                                                                                                                                                | Borehole BH5 terminated at 10.00 m Target depth                                               |                                                                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                         |       | -49    | 11.0      |                                                                                                                                                                                                                                                                |                                                                                               |                                                                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                         |       | -48    | 12.0      |                                                                                                                                                                                                                                                                |                                                                                               |                                                                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                         |       | -47    | 13.0      |                                                                                                                                                                                                                                                                |                                                                                               |                                                                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                         |       | -46    | 14.0      |                                                                                                                                                                                                                                                                |                                                                                               |                                                                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                         |       | -45    | 15.0      |                                                                                                                                                                                                                                                                |                                                                                               |                                                                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                  |  |
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMILC NMILC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br><br>HA hand auger |       |        |           | <b>support</b><br>C casing M mud N none<br><br><b>water</b><br><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br><br><br>water pressure test result (lugeons) for depth interval shown |                                                                                               | <b>graphic log / core recovery</b><br><br>core recovered<br>(graphic symbols indicate material)<br><br>no core recovered<br><br><b>core run &amp; RQD</b><br><br>barrel withdrawn<br><br>RQD = Rock Quality Designation (%) |                                                                                           | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high |                | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR Irregular<br><br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |                                                                                                                                                  |  |



client: **Country Garden Australia Pty Ltd**

principal:

project: ***St Leonards Development***

location: **St Leonards, NSW**Hole ID. **BH5**

sheet: 1 of 1

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,631.96; N: 6,255,544.25 (MGA94 )

surface elevation: 60.15 m (AHD)

angle from horizontal:  $90^\circ$

equipment type: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                                                                                                                                              |                      |        |           | material substance                                                      |                      | piezometer construction details                                                      |           |                   |             |               |                 |                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------|-----------|-------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------|-----------|-------------------|-------------|---------------|-----------------|-----------------------|
| method & support                                                                                                                                                                                  | water                | RL (m) | depth (m) | graphic log                                                             | material name        | bore construction license:<br>drilling company:<br>driller:<br>driller's permit no.: |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        |           |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
| HA<br>CASING<br>NMLC                                                                                                                                                                              | 04/09/18<br>27/08/18 | -60    | 0         |                                                                         | FILL                 | 0.30 m                                                                               |           |                   | Grout       |               |                 | Bentonite             |
|                                                                                                                                                                                                   |                      |        |           |                                                                         | RESIDUAL SOIL        | 0.60 m                                                                               |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 1         |                                                                         | HAWKESBURY SANDSTONE | 1.00 m                                                                               |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 2         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 3         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 4         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 5         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 6         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 7         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 8         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 9         |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 10        |                                                                         |                      | 10.00 m                                                                              |           |                   |             |               |                 |                       |
|                                                                                                                                                                                                   |                      |        | 11        |                                                                         |                      |                                                                                      |           |                   |             |               |                 |                       |
| method & support<br>see engineering log for details                                                                                                                                               |                      |        |           | graphic log / core recovery                                             |                      | ID                                                                                   | type      | installation date | stickup (m) | tip depth (m) | water level (m) | Relative Levels (AHD) |
| water<br>10-Oct-12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br><br>water pressure test result (lugeons) for depth interval shown |                      |        |           | core recovered (graphic symbols indicate material)<br>no core recovered |                      | BH5                                                                                  | standpipe |                   |             | 10.00 m       |                 | 50.15                 |



# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH6**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,657.29; N: 6,255,533.79 (MGA94 )

surface elevation: 61.36 m (AHD)

angle from horizontal: 90°

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                 |                                                 |  |  |                                                 | material substance    |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|--------------------------------------|-------------------------------------------------|--|--|-------------------------------------------------|-----------------------|--------|----------------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------|---------------------------------------|--|--|--|--|--|--|--|
| method & support                     | penetration                                     |  |  | water                                           | samples & field tests | RL (m) | depth (m)                                    | graphic log | soil group symbol                                                                                                                                                    | material description<br><br>SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | moisture condition | consistency / relative density | hand penetrometer (kPa) | structure and additional observations |  |  |  |  |  |  |  |
| HA<br>AD/T                           | <div><div>1</div><div>2</div><div>3</div></div> |  |  | <div><div>E</div><div>E</div><div>E</div></div> | 61                    | 1.0    | <div><div></div><div></div><div></div></div> | CL          | BRICK PAVERS.<br>FILL: SAND: yellow brown.<br>FILL: SILTY SAND: pale brown, with gravels.<br>FILL: CLAYEY SAND: orange brown.<br>CLAY: low plasticity, orange brown. | D                                                                                                                    |                    |                                |                         | FILL                                  |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             | <Wp                                                                                                                                                                  | F                                                                                                                    |                    |                                | RESIDUAL SOIL           |                                       |  |  |  |  |  |  |  |
| Borehole BH6 continued as cored hole |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
|                                      |                                                 |  |  |                                                 |                       |        |                                              |             |                                                                                                                                                                      |                                                                                                                      |                    |                                |                         |                                       |  |  |  |  |  |  |  |
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# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH6**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,657.29; N: 6,255,533.79 (MGA94 ) surface elevation: 61.36 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                   |                         |                                                                                               | rock mass defects                                                      |                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration | estimated strength & Is(50)<br><br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)<br><br>a = axial;<br>d = diametral | core run & RQD | defect spacing (mm)        | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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|                      |       |        |           |                    |                                                                                                   |                         | VL<br>L<br>J<br>M<br>H<br>VH<br>EH                                                            |                                                                        |                | 30<br>300<br>3000<br>30000 | particular<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><b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|                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                |                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLCNMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided | <b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|



client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH6**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **21 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,657.29; N: 6,255,533.79 (MGA94 )

surface elevation: 61.36 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                                                                                                                                                                                                                 |       |        |                                                           | material substance                                                             |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   | rock mass defects                                                                                                                                                                                                                                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| method & support                                                                                                                                                                                                                                                     | water | RL (m) | depth (m)                                                 | graphic log                                                                    | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration                                                                                                                                                                                                         | estimated strength & Is(50)<br><br>X = axial;<br>O = diametral<br><br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)<br><br>a = axial;<br>d = diametral                                                                                                                                                                                                                                              | core run & RQD | defect spacing (mm)                                                                                                                                                                                                                                                                                                                                                                                            | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)                                     |         |
|                                                                                                                                                                                                                                                                      |       |        |                                                           |                                                                                |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                | particular                                                                                                                                                  | general |
| NMLC                                                                                                                                                                                                                                                                 |       | -53    |                                                           |                                                                                | SANDSTONE: fine to coarse grained, pale grey, distinct carbonaceous laminae at 3-10° (Class II).  | FR                                                                                                                                                                                                                              |                                                                                                   | a=0.38<br>d=0.37                                                                                                                                                                                                                                                                                                    | 91%            |                                                                                                                                                                                                                                                                                                                                                                                                                | JT, 28°, CU, RO, CN<br>SM, Clay, 24 mm, grey<br>PT, 10°, PL, RO, CN<br>PT, 6°, PL, RO, CN<br>PT, 6°, PL, RO, CN<br>PT, 6°, PL, RO, CN<br>PT, 6°, PL, RO, CN |         |
|                                                                                                                                                                                                                                                                      | -52   |        | SANDSTONE: fine to medium grained, pale grey, (Class II). |                                                                                | a=0.73<br>d=0.76                                                                                  |                                                                                                                                                                                                                                 |                                                                                                   | 100%                                                                                                                                                                                                                                                                                                                |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|                                                                                                                                                                                                                                                                      | 10.0  |        |                                                           |                                                                                | a=1.44<br>d=0.59                                                                                  |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                | JT, 5°, PL, RO, CN                                                                                                                                          |         |
|                                                                                                                                                                                                                                                                      |       | -51    |                                                           |                                                                                | Borehole BH6 terminated at 10.07 m Target depth                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|                                                                                                                                                                                                                                                                      |       | -50    |                                                           |                                                                                |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|                                                                                                                                                                                                                                                                      |       | -49    |                                                           |                                                                                |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|                                                                                                                                                                                                                                                                      |       | -48    |                                                           |                                                                                |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|                                                                                                                                                                                                                                                                      |       | -47    |                                                           |                                                                                |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
|                                                                                                                                                                                                                                                                      |       | -46    |                                                           |                                                                                |                                                                                                   |                                                                                                                                                                                                                                 |                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                             |         |
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLCNMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br><br>HA hand auger |       |        |                                                           | <b>support</b><br>C casing M mud N none<br><br><b>water</b><br><br><br><br>25m |                                                                                                   | <b>graphic log / core recovery</b><br><br>core recovered<br>(graphic symbols indicate material)<br><br><br>no core recovered<br><br><b>core run &amp; RQD</b><br><br>barrel withdrawn<br><br>RQD = Rock Quality Designation (%) |                                                                                                   | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high |                | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR Irregular<br><br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |                                                                                                                                                             |         |



# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH7**

sheet: 1 of 1

project no. **754-SYDGE219558**

date started: **22 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,584.02; N: 6,255,511.96 (MGA94)

surface elevation: 56.93 m (AHD)

angle from horizontal: 90°

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter: 125 mm

| drilling information |             |   |       |                       |        | material substance |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|----------------------|-------------|---|-------|-----------------------|--------|--------------------|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------|---------------------------------------|
| method & support     | penetration |   | water | samples & field tests | RL (m) | depth (m)          | graphic log | soil group symbol | material description<br><br>SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | moisture condition | consistency / relative density | hand penetrometer (kPa) | structure and additional observations |
|                      | 1           | 2 |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      | HA          |   |       |                       |        |                    |             |                   | FILL: CLAYEY SAND: dark brown, with coarse gravels.                                                                  | D                  |                                |                         | FILL                                  |
|                      |             |   |       | E                     |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       | E                     |        | 0.5                |             |                   |                                                                                                                      |                    |                                |                         | PID: 1.76 ppm                         |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       | E                     |        | 1.0                |             |                   | FILL: CLAY: low plasticity, dark orange brown.                                                                       | <Wp                |                                |                         | PID: 0.98 ppm                         |
|                      |             |   |       | SPT 1, 1, 18<br>N=19  |        | 1.5                |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   | Borehole BH7 terminated at 1.6 m<br>Services present                                                                 |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
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|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
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|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
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|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
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|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |
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|                      |             |   |       |                       |        |                    |             |                   |                                                                                                                      |                    |                                |                         |                                       |

# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH7A**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **22 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,584.41; N: 6,255,512.40 (MGA94 )

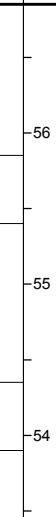
surface elevation: 56.85 m (AHD)

angle from horizontal: 90°

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information |                                                                                    |                                                                                    |                                                                                    |                                                                                    | material substance    |        |           |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|----------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------|--------|-----------|-------------------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------|---------------|
| method & support     | 1<br>penetration                                                                   | 2<br>penetration                                                                   | 3<br>penetration                                                                   | water                                                                              | samples & field tests | RL (m) | depth (m) | graphic log                                                                         | soil group symbol | material description                                                                                                                                               | moisture condition                                                           | consistency / relative density                                                       | hand penetrometer (kPa)                                                              | structure and additional observations |               |
| AD/T                 |  |  |  |  |                       |        |           |   |                   | FILL: CLAYEY SAND: dark brown, with coarse gravels.                                                                                                                | D                                                                            |  |  | FILL                                  |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       |        |           |                                                                                     |                   |                                                                                                                                                                    | FILL: Gravelly CLAY: low plasticity, dark orange brown, with coarse gravels. |                                                                                      |                                                                                      | <Wp                                   | PID: 2.43 ppm |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    | SPT<br>1, 1, 3<br>N=4 | -56    | 1.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      | PID: 2.12 ppm                         |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       | -55    | 2.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    | SPT<br>3, 2, 2<br>N=4 | -54    | 3.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       |        |           |  |                   | SANDSTONE: medium to coarse grained, pale yellow brown, recovered as sand with clay, very low to low strength (Class V)..<br>Borehole BH7A continued as cored hole |                                                                              |                                                                                      | HAWKESBURY SANDSTONE                                                                 |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       | -53    | 4.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       | -52    | 5.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       | -51    | 6.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       | -50    | 7.0       |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |
|                      |                                                                                    |                                                                                    |                                                                                    |                                                                                    |                       | -49    |           |                                                                                     |                   |                                                                                                                                                                    |                                                                              |                                                                                      |                                                                                      |                                       |               |

|                                                                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                               |                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>HA hand auger<br>W washbore<br>HA hand auger | <b>support</b><br>M mud<br>C casing<br>N nil | <b>samples &amp; field tests</b><br>B bulk disturbed sample<br>D disturbed sample<br>E environmental sample<br>SS split spoon sample<br>U## undisturbed sample ##mm diameter<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shear; peak/remoulded (kPa)<br>R refusal<br>HB hammer bouncing | <b>soil group symbol &amp; soil description</b><br>based on AS 1726:2017                      | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
| * bit shown by suffix<br>e.g.<br>AD/T<br>B blank bit<br>T TC bit<br>V V bit                               | <b>penetration</b><br><br><b>water</b><br>   |                                                                                                                                                                                                                                                                                                                                                                                  | <b>moisture condition</b><br>D dry<br>M moist<br>W wet<br>Wp plastic limit<br>WI liquid limit |                                                                                                                                                                                                            |



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH7A**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **22 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,584.41; N: 6,255,512.40 (MGA94 )

surface elevation: 56.85 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                                                                                                                                                                                                                  |       |        |                   | material substance                                                                                                                                                                                                                                     |                                                                                                                                                                                |                                                                                                                                                                                                                          |                             | rock mass defects |                                                                                                                                                                                                                                                                                                                     |                  |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      |                                                                                                                             |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------|
| method & support                                                                                                                                                                                                                                                      | water | RL (m) | depth (m)         | graphic log                                                                                                                                                                                                                                            | ROCK TYPE: grain characteristics, colour, structure, minor components                                                                                                          | weathering & alteration                                                                                                                                                                                                  | estimated strength & Is(50) |                   |                                                                                                                                                                                                                                                                                                                     |                  | samples, field tests & Is(50) (MPa) | core run & RQD                                                                                                                                                                                                                                                                                                                                                                                                 | defect spacing (mm) | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |                                                                                                                             |            |
|                                                                                                                                                                                                                                                                       |       |        |                   |                                                                                                                                                                                                                                                        |                                                                                                                                                                                |                                                                                                                                                                                                                          | VL                          | L                 | M                                                                                                                                                                                                                                                                                                                   | H                |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                     | VH                                                                                                                   | EH                                                                                                                          | particular |
|                                                                                                                                                                                                                                                                       |       |        | -56<br>-55<br>-54 |                                                                                                                                                                                                                                                        |                                                                                                                                                                                |                                                                                                                                                                                                                          |                             |                   |                                                                                                                                                                                                                                                                                                                     |                  |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      |                                                                                                                             |            |
|                                                                                                                                                                                                                                                                       |       |        | -53               |                                                                                                                                                                                                                                                        | started coring at 3.40m<br><b>SANDSTONE:</b> fine to medium grained, orange, (Class II to III).<br><b>NO CORE:</b> 0.31 m                                                      | MW                                                                                                                                                                                                                       |                             |                   |                                                                                                                                                                                                                                                                                                                     | a=0.51<br>d=0.51 |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      | SM, Sandy clay, 36 mm                                                                                                       |            |
|                                                                                                                                                                                                                                                                       |       |        | -52               |                                                                                                                                                                                                                                                        | <b>SANDSTONE:</b> fine to medium grained, orange, (Class II).<br><b>SANDSTONE:</b> fine to medium grained, pale grey, (Class II), distinctly to indistinctly bedded at 15-25°. | MW<br>SW                                                                                                                                                                                                                 |                             |                   |                                                                                                                                                                                                                                                                                                                     | a=0.64<br>d=0.50 | 62%                                 |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      | SM, Sandy clay, 34 mm<br>Root Joint, 5°, UN, RO, Roots<br>SM, Sandy clay, 10 mm<br>SM, CL Clay, 8 mm<br>PT, 18°, PL, RO, CN |            |
|                                                                                                                                                                                                                                                                       |       |        | -51               |                                                                                                                                                                                                                                                        |                                                                                                                                                                                | MW<br>SW                                                                                                                                                                                                                 |                             |                   |                                                                                                                                                                                                                                                                                                                     | a=0.22<br>d=0.24 |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      | SM, Clay, 18 mm                                                                                                             |            |
|                                                                                                                                                                                                                                                                       |       |        | -50               |                                                                                                                                                                                                                                                        |                                                                                                                                                                                |                                                                                                                                                                                                                          |                             |                   |                                                                                                                                                                                                                                                                                                                     | a=1.13<br>d=0.54 | 92%                                 |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      | JT, 12°, PL, RO, CN<br>PT, 17°, ST, RO, VN<br>PT, 15°, PL, RO, CN<br>PT, 15°, PL, RO, CN<br>PT, 17°, PL, RO, CN             |            |
|                                                                                                                                                                                                                                                                       |       |        | -49               |                                                                                                                                                                                                                                                        |                                                                                                                                                                                |                                                                                                                                                                                                                          |                             |                   |                                                                                                                                                                                                                                                                                                                     | a=0.98<br>d=0.39 | 79%                                 |                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                      | PT, 20°, PL, RO, VN<br>PT, 20°, PL, RO, VN<br>PT, 21°, PL, RO, CN<br>JT, 9°, PL, RO, CN                                     |            |
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br><br>HA hand auger |       |        |                   | <b>support</b><br>C casing M mud N none<br><br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br><br>water pressure test result (lugeons) for depth interval shown |                                                                                                                                                                                | <b>graphic log / core recovery</b><br><br>core recovered (graphic symbols indicate material)<br><br>no core recovered<br><br><b>core run &amp; RQD</b><br><br>barrel withdrawn<br><br>RQD = Rock Quality Designation (%) |                             |                   | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high |                  |                                     | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |                     |                                                                                                                      |                                                                                                                             |            |

|                 |                        |
|-----------------|------------------------|
| Borehole ID.    | <b>BH7A</b>            |
| sheet:          | 3 of 3                 |
| project no.     | <b>754-SYDGE219558</b> |
| date started:   | <b>22 Aug 2018</b>     |
| date completed: | <b>22 Aug 2018</b>     |
| logged by:      | <b>AM</b>              |
| checked by:     | <b>AB</b>              |

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

from horizontal:  $90^\circ$

surface elevation: 56.85 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt. Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                                    |                         |                                                                                         | rock mass defects                                                  |                |                     |                                                                                                                         |         |
|----------------------|-------|--------|-----------|--------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------|----------------|---------------------|-------------------------------------------------------------------------------------------------------------------------|---------|
| method & support     | water | RL (m) | depth (m) | graphic log        | ROCK TYPE: grain characteristics, colour, structure, minor components                                              | weathering & alteration | estimated strength & Is50<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)<br>a = axial;<br>d = diametral | core run & RQD | defect spacing (mm) | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other) |         |
|                      |       |        |           |                    |                                                                                                                    |                         |                                                                                         |                                                                    |                |                     | particular                                                                                                              | general |
| NMLC                 |       | -48    | 9.0       |                    | SANDSTONE: fine to medium grained, pale grey, (Class II), distinctly bedded at 20-35° with some disturbed bedding. | FR                      | X O                                                                                     | a=1.03<br>d=1.50                                                   | 79%            |                     | JT, 5°, CU, RO, CN<br>JT, 5°, PL, RO, CN                                                                                |         |
|                      |       | -47    | 10.0      |                    |                                                                                                                    |                         |                                                                                         | a=0.22<br>d=0.79                                                   |                |                     |                                                                                                                         |         |
|                      |       | -46    | 11.0      |                    | Borehole BH7A terminated at 10.26 m<br>Target depth                                                                |                         |                                                                                         |                                                                    |                |                     |                                                                                                                         |         |
|                      |       | -45    | 12.0      |                    |                                                                                                                    |                         |                                                                                         |                                                                    |                |                     |                                                                                                                         |         |
|                      |       | -44    | 13.0      |                    |                                                                                                                    |                         |                                                                                         |                                                                    |                |                     |                                                                                                                         |         |
|                      |       | -43    | 14.0      |                    |                                                                                                                    |                         |                                                                                         |                                                                    |                |                     |                                                                                                                         |         |
|                      |       | -42    | 15.0      |                    |                                                                                                                    |                         |                                                                                         |                                                                    |                |                     |                                                                                                                         |         |
|                      |       | -41    |           |                    |                                                                                                                    |                         |                                                                                         |                                                                    |                |                     |                                                                                                                         |         |

method & support

AS auger screwing  
AD auger drilling  
CB claw or blade bit  
W washbore  
RR rock roller  
NMLC NMLC core (51.9 mm)  
NQ wireline core (47.6mm)  
HQ wireline core (63.5mm)  
PQ wireline core (85.0mm)  
  
HA hand auger

support

C casing    M mud    N none

water

10/10/12, water level on date shown

water inflow

complete drilling fluid loss

partial drilling fluid loss

water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

core recovered (graphic symbols indicate material)

no core recovered

core run & RQD

barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration\*

RS residual soil  
XW extremely weathered  
HW highly weathered  
MW moderately weathered  
SW slightly weathered  
FR fresh  
\*W replaced with A for alteration

strength

VL very low  
L low  
M medium  
H high  
VH very high  
EH extremely high

defect type

PT parting  
JT joint  
SS shear surface  
SZ shear zone  
CO contact  
CS crushed seam  
SM seam

roughness

VR very rough  
RO rough  
SO smooth  
POL polished  
SL slickensided

planarity

PL planar  
CU curved  
UN undulating  
ST stepped  
IR Irregular

coating

CN clean  
SN stained  
VN veneer  
CO coating



client: **Country Garden Australia Pty Ltd**

principal:

project: ***St Leonards Development***

location: **St Leonards, NSW**Hole ID. **BH7A**

sheet: 1 of 1

project no. **754-SYDGE219558**

date started: **22 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,584.41; N: 6,255,512.40 (MGA94 )

surface elevation: 56.85 m (AHD)

angle from horizontal:  $90^\circ$

equipment type: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                    |                                                                                                                                             |                                                                                     |           | material substance                                                                  |                      | piezometer construction details                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--|---------|--|--|--|--|--|
| method & support                                                        | water                                                                                                                                       | RL (m)                                                                              | depth (m) | graphic log                                                                         | material name        | bore construction license:<br>drilling company:<br>driller:<br>driller's permit no.:                                                                                                                                       |        |  |         |  |  |  |  |  |
| <div>AD/T</div> <div>04/09/18</div> <div>27/08/18</div> <div>NMLC</div> | <div>water level on date shown</div> <div>water inflow</div> <div>complete drilling fluid loss</div> <div>partial drilling fluid loss</div> | <div>56</div> <div>54</div> <div>52</div> <div>50</div> <div>48</div> <div>46</div> | 1         |    | FILL                 | <div>BH7A</div> <div>Grout</div> <div>Bentonite</div> <div>Sand</div> <div>ID: BH7A PVC TYPE: uPVC<br/>ID/OD: 51/60.2 mm<br/>DESCRIPTION OF SLOTS: Slot Spacing = 4 mm,<br/>Slot width = 0.5 mm<br/>SAND PACK: K2 mm</div> |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 3         |   | HAWKESBURY SANDSTONE |                                                                                                                                                                                                                            | 3.22 m |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 4         |  |                      |                                                                                                                                                                                                                            | 3.76 m |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 5         |                                                                                     |                      |                                                                                                                                                                                                                            | 4.26 m |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 6         |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 7         |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 8         |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 9         |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 10        |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     | 11        |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     |           |                                                                                     |                      |                                                                                                                                                                                                                            |        |  | 10.26 m |  |  |  |  |  |
|                                                                         |                                                                                                                                             |                                                                                     |           |                                                                                     |                      |                                                                                                                                                                                                                            |        |  |         |  |  |  |  |  |

| method & support<br>see engineering log for details                                                                                                                                                                                                            | graphic log / core recovery                                                                                                                                                                                                                                        | ID   | type      | installation date | stickup (m) | tip depth (m) | water level (m) | Relative Levels (AHD) |     |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|-------------------|-------------|---------------|-----------------|-----------------------|-----|-------------|
|                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                    |      |           |                   |             |               |                 | stickup               | tip | water level |
| <div>water</div> <div>10-Oct-12, water level on date shown</div> <div>water inflow</div> <div>complete drilling fluid loss</div> <div>partial drilling fluid loss</div> <div>water pressure test result (lugeons) for depth interval shown</div> <div>25</div> | <div> core recovered (graphic symbols indicate material)</div> <div> no core recovered</div> | BH7A | standpipe |                   |             | 10.26 m       |                 | 46.59                 |     |             |

# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH8**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,627.64; N: 6,255,510.97 (MGA94)

surface elevation: 54.92 m (AHD)

angle from horizontal: 90°

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter: 125 mm

| drilling information |             |       |                       |        | material substance |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|----------------------|-------------|-------|-----------------------|--------|--------------------|-----------------------------------------------------------------------------------|-------------------|------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------|---------------------------------------|
| method & support     | penetration | water | samples & field tests | RL (m) | depth (m)          | graphic log                                                                       | soil group symbol | material description                                                                     | moisture condition | consistency / relative density | hand penetrometer (kPa) | structure and additional observations |
| AD<br>HA<br>W<br>HA  | 1<br>2<br>3 |       |                       |        | -54                |  |                   | SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | D                  |                                |                         | PAVEMENT FILL                         |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|                      |             |       |                       |        | 1.0                |                                                                                   |                   | FILL: SAND: pale brown.<br>FILL: SAND: dark brown, with coarse gravels.                  |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   | CLAY: low plasticity, orange-brown, with fine grained sand.                              | <Wp                | St                             |                         | RESIDUAL SOIL                         |
|                      |             |       |                       |        |                    |                                                                                   |                   | Borehole BH8 continued as cored hole                                                     |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
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|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
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|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
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|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |
|                      |             |       |                       |        |                    |                                                                                   |                   |                                                                                          |                    |                                |                         |                                       |

\* bit shown by suffix  
e.g. AD/T

B blank bit

T TC bit

V V bit

support N nil

C casing

penetration

no resistance ranging to refusal

water

10-Oct-12 water level on date shown

water inflow

water outflow

samples & field tests

B bulk disturbed sample

D disturbed sample

E environmental sample

SS split spoon sample

U## undisturbed sample ##mm diameter

HP hand penetrometer (kPa)

N standard penetration test (SPT)

N\* SPT - sample recovered

Nc SPT with solid cone

VS vane shear; peak/remoulded (kPa)

R refusal

HB hammer bouncing

soil group symbol & soil description

based on AS 1726:2017

moisture condition

D dry

M moist

W wet

Wp plastic limit

WI liquid limit

consistency / relative density

VS very soft

S soft

F firm

St stiff

VSt very stiff

H hard

Fb friable

VL very loose

L loose

MD medium dense

D dense

VD very dense



# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH8**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,627.64; N: 6,255,510.97 (MGA94 ) surface elevation: 54.92 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                                    |                         |                                                                                         | rock mass defects                    |                |                            |                                                                                                                                                          |         |
|----------------------|-------|--------|-----------|--------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------|--------------------------------------|----------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br><b>ROCK TYPE:</b> grain characteristics, colour, structure, minor components               | weathering & alteration | estimated strength & Is50<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa)  | core run & RQD | defect spacing (mm)        | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)                                  |         |
|                      |       |        |           |                    |                                                                                                                    |                         | VL<br>L<br>M<br>H<br>VH<br>EH                                                           |                                      |                | 30<br>300<br>3000<br>30000 | particular                                                                                                                                               | general |
|                      |       | -54    | 1.0       |                    | started coring at 1.33m                                                                                            |                         |                                                                                         |                                      |                |                            |                                                                                                                                                          |         |
|                      |       | -53    | 2.0       |                    | <b>SANDSTONE:</b> fine to coarse grained, orange-red-brown to pale grey, (Class IV), indistinctly bedded at 5-15°. | MW                      | X<br>O                                                                                  | a=0.78<br>d=0.54                     | 81%            |                            | PT, 26°, PL, RO, CN<br>JT, 5°, UN, RO, CN                                                                                                                |         |
|                      |       | -52    | 3.0       |                    |                                                                                                                    |                         | X<br>O                                                                                  | a=0.68<br>d=0.46<br>a=1.23<br>d=0.92 | 95%            |                            | JT, 6°, CU, RO, Clay CO<br>PT, 18°, PL, RO, CN<br>JT, 5°, UN, RO, CN<br>JT, 33°, IR, RO, Fe SN                                                           |         |
|                      |       | -51    | 4.0       |                    | <b>SANDSTONE:</b> fine to medium grained, pale grey, (Class II), indistinctly bedded at 5-20°.                     | SW - FR                 | O                                                                                       | a=1.17<br>d=0.43                     |                |                            | PT, 18°, PL, RO, CN<br>JT, 41°, PL, RO, CN<br>JT, 65°, PL, RO, CN                                                                                        |         |
|                      |       | -50    | 5.0       |                    |                                                                                                                    |                         | X                                                                                       | a=1.13<br>d=0.68                     | 81%            |                            |                                                                                                                                                          |         |
|                      |       | -49    | 6.0       |                    | <b>SANDSTONE:</b> fine to medium grained, orange-brown, (Class IV), indistinctly bedded at 10-25°.                 | MW - SW                 | O                                                                                       | a=1.45<br>d=0.48                     |                |                            | SM, Clay, 11 mm<br>SM, Sandy clay, 6 mm<br>SM, Sandy clay, 5 mm<br>JT, 3°, UN, RO, CN<br>JT, 71°, PL, RO, CN<br>JT, 3°, PL, RO, CN<br>JT, 5°, PL, RO, CN |         |
|                      |       | -48    | 7.0       |                    |                                                                                                                    |                         | X                                                                                       | a=0.86<br>d=0.46                     | 83%            |                            | PT, 25°, PL, RO, Fe SN                                                                                                                                   |         |
|                      |       | -47    |           |                    |                                                                                                                    |                         |                                                                                         |                                      |                |                            |                                                                                                                                                          |         |

NMLC

Defects are:  
PT, 5 - 20° PL, RO, CN,  
unless otherwise described

|                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                |                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLCNMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided | <b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH8**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **21 Aug 2018**

date completed: **22 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,627.64; N: 6,255,510.97 (MGA94 )

surface elevation: 54.92 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                   |                         |                                                                                           | rock mass defects                   |                |                     |                                                                                                                      |         |
|----------------------|-------|--------|-----------|--------------------|---------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------|-------------------------------------|----------------|---------------------|----------------------------------------------------------------------------------------------------------------------|---------|
| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components | weathering & alteration | estimated strength & Is(50)<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm) | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |         |
|                      |       |        |           |                    |                                                                                                   |                         |                                                                                           |                                     |                |                     | particular                                                                                                           | general |
| NMLC                 |       |        |           |                    |                                                                                                   | MW - SW                 |                                                                                           |                                     |                |                     |                                                                                                                      |         |
|                      |       |        |           |                    | SANDSTONE: fine to medium grained, pale grey, (Class III), indistinctly bedded at 10-30°.         | SW                      |                                                                                           | a=0.74<br>d=0.04                    | 83%            |                     | JT, 83°, UN, RO, CN<br>FZ, 110 mm                                                                                    |         |
|                      |       |        |           |                    | NO CORE: 0.35 m                                                                                   |                         |                                                                                           |                                     |                |                     |                                                                                                                      |         |
|                      |       |        |           |                    | SANDSTONE: fine to medium grained, pale grey, (Class II), indistinctly bedded at 10-30°.          | FR                      |                                                                                           | a=1.09<br>d=1.07                    | 74%            |                     | SM, CL Clay, 15 mm<br>JT, 8°, UN, RO, CN                                                                             |         |
|                      |       |        | 10.0      |                    | Borehole BH8 terminated at 10.00 m<br>Target depth                                                |                         |                                                                                           |                                     |                |                     |                                                                                                                      |         |
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# Engineering Log - Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH9**

sheet: 1 of 3

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **20 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,666.75; N: 6,255,516.48 (MGA94 )

surface elevation: 60.16 m (AHD)

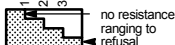
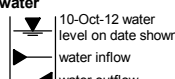
angle from horizontal: 90°

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information |                          |       |                                      |        | material substance                                              |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |
|----------------------|--------------------------|-------|--------------------------------------|--------|-----------------------------------------------------------------|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|----------------------------------------|-------------------------------------------------|
| method & support     | penetration              | water | samples & field tests                | RL (m) | depth (m)                                                       | graphic log | soil group symbol | material description<br><br>SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components | moisture condition | consistency / relative density | hand penetrometer (kPa)                | structure and additional observations           |
| HA<br>AD/T<br>HA     | <div>1<br/>2<br/>3</div> |       | E                                    | -60    |                                                                 |             |                   | TOPSOIL: SILTY SAND: pale yellow brown.                                                                              | D                  |                                | <div>100<br/>200<br/>300<br/>400</div> | TOPSOIL<br>PID: 3.5 ppm<br>HAWKESBURY SANDSTONE |
|                      |                          |       |                                      |        | SANDSTONE: orange brown, recovered as low strength clayey sand. |             | M                 |                                                                                                                      |                    |                                |                                        |                                                 |
|                      |                          |       | SPT<br>2, 8,<br>/100mm<br>HB<br>N*=R | -59    |                                                                 |             |                   | Borehole BH9 continued as cored hole                                                                                 |                    |                                |                                        |                                                 |
|                      |                          |       |                                      | -58    | 2.0                                                             |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |
|                      |                          |       |                                      | -57    | 3.0                                                             |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |
|                      |                          |       |                                      | -56    | 4.0                                                             |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |
|                      |                          |       |                                      | -55    | 5.0                                                             |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |
|                      |                          |       |                                      | -54    | 6.0                                                             |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |
|                      |                          |       |                                      | -53    | 7.0                                                             |             |                   |                                                                                                                      |                    |                                |                                        |                                                 |

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| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>HA hand auger<br>W washbore<br>HA hand auger | <b>support</b><br>M mud<br>C casing<br><br><b>penetration</b><br><br><b>water</b><br> | <b>samples &amp; field tests</b><br>B bulk disturbed sample<br>D disturbed sample<br>E environmental sample<br>SS split spoon sample<br>U## undisturbed sample ##mm diameter<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shear; peak/remoulded (kPa)<br>R refusal<br>HB hammer bouncing | <b>soil group symbol &amp; soil description</b><br>based on AS 1726:2017<br><br><b>moisture condition</b><br>D dry<br>M moist<br>W wet<br>Wp plastic limit<br>WI liquid limit | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
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# Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**

Borehole ID. **BH9**

sheet: 2 of 3

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **20 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,666.75; N: 6,255,516.48 (MGA94 ) surface elevation: 60.16 m (AHD) angle from horizontal: 90°  
drill model: Geoprobe 7822dt, Track mounted drilling fluid: Water hole diameter : 125 mm

| drilling information |       |        |           | material substance |                                                                                                      |                         |                                                                                           | rock mass defects                   |                |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| method & support     | water | RL (m) | depth (m) | graphic log        | material description<br><b>ROCK TYPE:</b> grain characteristics, colour, structure, minor components | weathering & alteration | estimated strength & Is(50)<br>X = axial;<br>O = diametral<br>a = axial;<br>d = diametral | samples, field tests & Is(50) (MPa) | core run & RQD | defect spacing (mm)                                                                    | additional observations and defect descriptions<br>(type, inclination, planarity, roughness, coating, thickness, other)                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                      |       |        |           |                    |                                                                                                      |                         | VL<br>L<br>M<br>H<br>VH<br>EH                                                             |                                     |                | 30<br>100<br>300<br>600<br>900<br>1200<br>1500<br>1800<br>2100<br>2400<br>2700<br>3000 | particular<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><b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|

Defects are:  
JT, 0-2°, PL, RO, CN,  
unless otherwise described

|                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br>HA hand auger | <b>support</b><br>C casing M mud N none<br><b>water</b><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br>water pressure test result (lugeons) for depth interval shown | <b>graphic log / core recovery</b><br>core recovered (graphic symbols indicate material)<br>no core recovered<br><b>core run &amp; RQD</b><br>barrel withdrawn<br>RQD = Rock Quality Designation (%) | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR irregular<br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## Engineering Log - Cored Borehole

client: **Country Garden Australia Pty Ltd**

principal:

project: **St Leonards Development**

location: **St Leonards, NSW**Borehole ID. **BH9**

sheet: 3 of 3

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **20 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,666.75; N: 6,255,516.48 (MGA94 )

surface elevation: 60.16 m (AHD)

angle from horizontal:  $90^\circ$

drill model: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information                                                                                                                                                                                                                                                  |       |        |                  | material substance                                                                                                                                                                                                                                             |                                                                                                                        |                                                                                                                                                                                                                         |                                           |               | rock mass defects                                                                                                                                                                                                                                                                                                       |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| method & support                                                                                                                                                                                                                                                      | water | RL (m) | depth (m)        | graphic log                                                                                                                                                                                                                                                    | material description<br><br>ROCK TYPE: grain characteristics, colour, structure, minor components                      | weathering & alteration                                                                                                                                                                                                 | estimated strength & Is(50)               |               | samples, field tests & Is(50) (MPa)                                                                                                                                                                                                                                                                                     | core run & RQD | defect spacing (mm) |                                                                                                                                                                                                                                                                                                                                                                                                                | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) |                                           |
|                                                                                                                                                                                                                                                                       |       |        |                  |                                                                                                                                                                                                                                                                |                                                                                                                        |                                                                                                                                                                                                                         | a = axial:<br>X = axial;<br>O = diametral | d = diametral |                                                                                                                                                                                                                                                                                                                         |                | 30                  | 100                                                                                                                                                                                                                                                                                                                                                                                                            | 300                                                                                                                  | 1000                                      |
| NMLC                                                                                                                                                                                                                                                                  |       | -52    |                  |                                                                                                                                                                                                                                                                | SANDSTONE: fine to medium grained, pale grey, distinctly bedded at 0-10° (Class II), carbonaceous laminae. (continued) | FR                                                                                                                                                                                                                      |                                           |               | a=0.57<br>d=0.75                                                                                                                                                                                                                                                                                                        | 98%            |                     |                                                                                                                                                                                                                                                                                                                                                                                                                | SM, Clay, 8 mm                                                                                                       | JT, 8°, ST, RO, CN<br>JT, 25°, ST, RO, CN |
|                                                                                                                                                                                                                                                                       | -51   | 9.0    | a=1.26<br>d=0.99 |                                                                                                                                                                                                                                                                | 98%                                                                                                                    |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       | -50   | 10.0   | a=0.93<br>d=0.91 |                                                                                                                                                                                                                                                                | 100%                                                                                                                   |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       |       |        |                  |                                                                                                                                                                                                                                                                | 10.41 m: dark grey laminations<br>Borehole BH9 terminated at 10.48 m<br>Target depth                                   |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       |       | -49    | 11.0             |                                                                                                                                                                                                                                                                |                                                                                                                        |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       |       | -48    | 12.0             |                                                                                                                                                                                                                                                                |                                                                                                                        |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       |       | -47    | 13.0             |                                                                                                                                                                                                                                                                |                                                                                                                        |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       |       | -46    | 14.0             |                                                                                                                                                                                                                                                                |                                                                                                                        |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
|                                                                                                                                                                                                                                                                       |       | -45    | 15.0             |                                                                                                                                                                                                                                                                |                                                                                                                        |                                                                                                                                                                                                                         |                                           |               |                                                                                                                                                                                                                                                                                                                         |                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |                                           |
| <b>method &amp; support</b><br>AS auger screwing<br>AD auger drilling<br>CB claw or blade bit<br>W washbore<br>RR rock roller<br>NMLC NMLC core (51.9 mm)<br>NQ wireline core (47.6mm)<br>HQ wireline core (63.5mm)<br>PQ wireline core (85.0mm)<br><br>HA hand auger |       |        |                  | <b>support</b><br>C casing M mud N none<br><br><b>water</b><br><br>10/10/12, water level on date shown<br>water inflow<br>complete drilling fluid loss<br>partial drilling fluid loss<br><br><br>water pressure test result (lugeons) for depth interval shown |                                                                                                                        | <b>graphic log / core recovery</b><br><br>core recovered<br>(graphic symbols indicate material)<br>no core recovered<br><br><b>core run &amp; RQD</b><br><br>barrel withdrawn<br><br>RQD = Rock Quality Designation (%) |                                           |               | <b>weathering &amp; alteration*</b><br>RS residual soil<br>XW extremely weathered<br>HW highly weathered<br>MW moderately weathered<br>SW slightly weathered<br>FR fresh<br>*W replaced with A for alteration<br><br><b>strength</b><br>VL very low<br>L low<br>M medium<br>H high<br>VH very high<br>EH extremely high |                |                     | <b>defect type</b><br>PT parting<br>JT joint<br>SS shear surface<br>SZ shear zone<br>CO contact<br>CS crushed seam<br>SM seam<br><br><b>roughness</b><br>VR very rough<br>RO rough<br>SO smooth<br>POL polished<br>SL slickensided<br><br><b>planarity</b><br>PL planar<br>CU curved<br>UN undulating<br>ST stepped<br>IR Irregular<br><br><b>coating</b><br>CN clean<br>SN stained<br>VN veneer<br>CO coating |                                                                                                                      |                                           |

client: **Country Garden Australia Pty Ltd**

principal:

project: ***St Leonards Development***

location: **St Leonards, NSW**Hole ID. **BH9**

sheet: 1 of 1

project no. **754-SYDGE219558**

date started: **20 Aug 2018**

date completed: **20 Aug 2018**

logged by: **AM**

checked by: **AB**

position: E: 332,666.75; N: 6,255,516.48 (MGA94 )

surface elevation: 60.16 m (AHD)

angle from horizontal:  $90^\circ$

equipment type: Geoprobe 7822dt, Track mounted

drilling fluid: Water

hole diameter : 125 mm

| drilling information |       |        |                                                       | material substance                                                                 |                                 | piezometer construction details                                                      |  |  |  |  |  |  |  |  |
|----------------------|-------|--------|-------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|
| method & support     | water | RL (m) | depth (m)                                             | graphic log                                                                        | material name                   | bore construction license:<br>drilling company:<br>driller:<br>driller's permit no.: |  |  |  |  |  |  |  |  |
| HA<br>ADT<br>CASING  |       |        | 60<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>10 |  | TOPSOIL<br>HAWKESBURY SANDSTONE |                                                                                      |  |  |  |  |  |  |  |  |
|                      |       |        | 58                                                    |                                                                                    |                                 |                                                                                      |  |  |  |  |  |  |  |  |
|                      |       |        | 56                                                    |                                                                                    |                                 |                                                                                      |  |  |  |  |  |  |  |  |
|                      |       |        | 54                                                    |                                                                                    |                                 |                                                                                      |  |  |  |  |  |  |  |  |
|                      |       |        | 52                                                    |                                                                                    |                                 |                                                                                      |  |  |  |  |  |  |  |  |
|                      |       |        | 50                                                    |                                                                                    |                                 |                                                                                      |  |  |  |  |  |  |  |  |
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