Douglas Partners
Geotechnics / Environment / Groundwater

Report on
Geotechnical Investigation

Proposed Mixed Use Development
136-148 New South Head Road, Edgecliff

Prepared for
Edgecliff Central Pty Ltd

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

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1. Introduction

This report presents the results of a geotechnical investigation undertaken by Douglas Partners Pty Ltd (DP) for a proposed mixed use development at 136-148 New South Head Road, Edgecliff. The investigation was commissioned by Dennis Meyer of Edgecliff Central Pty Ltd and was undertaken in accordance with DP's proposal SYD201438.P.002.Rev0 dated 20 December 2020.

It is understood that the proposed development includes the demolition of all existing structures and construction of a new 18 storey mixed use commercial and residential tower over three basement levels. The lowest basement floor level is proposed at a reduced level of RL 21.5 m, relative to Australian height datum (AHD) and requires approximately 10 m to 14 m depth of excavation, given the sloping nature of the site.

The investigation included the drilling of two rock cored boreholes to below the lowest basement floor level, as well as a footing exposure test pit below the sandstone block retaining wall on the northern side of Nos. 142 to 148. It is noted that due to limited access, the boreholes were drilled using a tight access drilling rig in accessible areas of the site, with hand tools used to excavate the footing exposure. At the time of the investigation, access to 148 New South Head Road was not available. Details of the field and laboratory testing are given in the report, together with comments on design and construction issues.

It is noted that EI Australia Pty Ltd (EI) previously drilled two cored boreholes within 136 New South Head Road, the results of which were presented in their report (Reference E24119.G03_Rev1, dated 20 November 2019). The data from these boreholes has been considered in the preparation of the geotechnical model included herein.

DP also completed a Detailed Site Investigation (DSI) for contamination for this site. Reference should be made to the DSI report in project planning (Ref: 200333.00.R.002.Rev0 dated 17 March 2021).

2. Site Description

The development site comprises four existing properties that extend from 136 to 148 New South Head Road (inclusive). The properties are located on the northern side of New South Head Road (a TfNSW road) and extend east from the intersection with Darling Point Road at Edgecliff. The combined site is trapezoidal and covers an area of approximately 2550 m^2. The site is bounded by residential unit buildings on all adjoining sites to the north and east, and by New South Head Road to the south and Darling Point Road to the west.

Existing developments on the site include:

- 136 New South Head Road – a two storey commercial building adjacent to New South Head Road and on-grade parking at the rear.
- 138-140 New South Head Road – a three storey residential unit building that occupies almost the entire site area.
- 142 to 148 New South Head Road – a one and two storey commercial building that appears to straddle the common lot boundary. Paved courtyards surround the building on all sides.

All existing buildings are of brick construction (some rendered). A heritage sandstone block wall of approximately 30 m in length is noted along the northern boundary of Nos. 142 to 148 and a similar sized brick retaining wall lies along the northern boundary of Nos. 136 to 140. All structures are likely to found at relatively shallow depths.

The land surrounding the site falls to the south, meaning both street frontages fall towards the intersection of New South Head and Darling Point Roads. Ground surface levels vary between reduced levels (relative to AHD) of RL 30.5 at the footpath intersection to RL 33 along New South Head Road and RL 32 along Darling Point Road. Internally, ground surface levels vary up to an estimated high point of RL 36 at the rear of 142 to 148 New South Head Road.

3. Regional Mapping

3.1 Geology

Reference to the NSW seamless geology map indicates that the site is underlain by Hawkesbury Sandstone, which typically comprises medium to coarse grained quartz sandstone with minor shale and laminite lenses. The site also lies close to areas affected by aeolian transgressive dunes, indicating that near-surface soils are likely to be relatively sandy. The topographic setting suggests that rock is likely to be encountered within a few metres of the ground surface however rock depths are variable in this area. The results of the investigation confirmed the regional mapping with sandy soil underlain by sandstone bedrock intersected at shallow depth.

Within the Sydney area the most common defects within the Hawkesbury Sandstone are widely spaced horizontal bedding plans, typically spaced at 1-3 m, and two orthogonal sets of steeply dipping joints. The joints typically have dips of 75 to 90 degrees from horizontal (i.e. close to vertical) and are typically orientated with strikes just east of north (about 010 degrees) and just south of east (about 110 degrees). Apart from these main defect sets, there are likely to be other less common joints or faults with moderate dips of 20-30 degrees and 40-60 degrees.

3.2 Hydrogeology

Based on the geology and topography, the regional groundwater table is likely to be well below the site’s surface and proposed excavation levels. Perched groundwater seepage flows should be expected, however, at the soil/rock interface, which is likely to be evident as an intermittent seepage flow.

3.3 Soil Landscape

Reference was made to the Soil Conservation Service NSW 'Sydney' 1:100,000 Soils Landscape Map to determine the type and extent of each soil landscape present within the site. The map indicates that the entire site is represented by soils of the 'Hawkesbury Soil Landscape', which is characterised by *"rugged, rolling to very steep hills on Hawkesbury Sandstone, with local relief of 40-200 m and slopes greater than 25%"*. This is a colluvial landscape and generally comprises shallow siliceous sands near shallow rock outcrops and earthy yellow sands elsewhere. These soils are typically of low fertility, are generally non to slightly reactive, are highly permeable and prone to erosion.

To the north of the site the soil landscape maps indicate the presence of the Gymea Soil Landscape (i.e. approximately 40 m to the north), which is characterised by *"undulating to rolling rises and low hills on Hawkesbury Sandstone, with local relief of 20 m to 80 m and slopes usually within 10% to 25%"*. This is an erosional landscape and generally comprises yellow podzolic earthy sands over shale lenses on crests and yellow-grey siliceous sands elsewhere. These soils are typically of low fertility, are of high permeability and highly erodible.

The latter soil landscape was not identified during the field investigation.

3.4 Acid Sulphate Soils

Acid Sulphate Soil Risk Mapping supplied by the NSW Office of Environment and Heritage does not identify the site to be within or close to an area of acid sulphate soils risk.

3.5 Salinity

The site is not located within an area known for soil salinity issues.

4. Previous Investigations on the Site

As part of the current site investigation, a copy of a geotechnical report prepared by EI Australia Pty Ltd (EI) was provided to DP for review (Ref: E24119.G03_Rev1, dated 20 November 2019). The investigation covered only 136 New South Head Road and was undertaken in November 2019 for a proposed five storey commercial office building with ground level parking. It is understood that the development proposal would retain the existing two storey heritage building currently on the site.

The investigation included the drilling of two boreholes, standard penetration tests (SPTs) and the installation of two groundwater monitoring wells. The reported investigation findings included shallow fill in the form of existing pavements (approximately 0.2 m thick) over residual clayey sand/sandy clay over very low to low strength sandstone bedrock at depths of 2 m and 3 m. The sandstone reportedly increased to medium strength approximately 2.5 m below the rock surface. Groundwater levels measured in the monitoring wells 11 days after well development identified groundwater at depths of 3.9 m and 4.4 m, although this is most likely trapped top of rock ephemeral seepage water perched within the deepened borehole void.

It is noted that the ground conditions reported by EI are partly inconsistent with those encountered by DP. This is discussed further in Section 8.

5. Field Work Methods

The field work for the investigation was conducted over five days, from 1 to 5 February 2021, and included:

- On-site electronic scanning for buried services at proposed borehole and test pit locations.
- Drilling of two boreholes (BH1 and BH2) using a tight access drilling rig fitted with solid flight augers and a tungsten carbide (TC) bit. The boreholes were initially drilled to the top of rock at depths of between 0.8 m and 2.4 m to identify the subsurface conditions. The boreholes were then extended using NMLC diamond coring methods to depths of between 15 m and 18.8 m.
- Geotechnical inspection of the heritage sandstone block wall, to record the condition and dimension of the wall.
- Hand excavation of a footing exposure test pit adjacent to the heritage sandstone block wall. The test pit was excavated within the courtyard of 142-146 New South Head Road, on the southern side (low side) of the wall. The test pit consisted of hand sawing the concrete slab and excavation to approximately 0.7 m depth to expose the base of the retaining wall footing.
- Dynamic penetrometer testing (DPT) within each of the borehole and test pit locations, after coring and removal of the surface concrete, to determine the in situ consistency and inferred density of the soil profile. DPT testing was undertaken to depths of 2.2 m, 0.6 m and 2.4 m in BH1, BH2 and TP1, respectively, before encountering refusal on bedrock.
- Sampling of soils to assist in logging and to provide specimens for laboratory testing of soil aggressivity.
- Measurement of groundwater levels within existing monitoring wells previously installed by EI.

All boreholes and test pits were backfilled with drilling/excavated spoil upon completion and were capped with concrete or asphalt. The test locations are shown in Drawing 1 in Appendix B. The boreholes locations were measured using a high precision GPS system accurate to 0.1 m in plan and elevation, with their details recorded on the borehole logs. It is noted that a further five shallow boreholes were drilled using a hand auger as part of DP's concurrent environmental assessment.

6. Field Work Results

The detailed borehole and test pit logs and rock core photographs are included in Appendix C, together with notes defining classification methods and terms used to describe the soils and rocks. For ease of reference, a copy of the EI borehole logs has been included in Appendix E.

6.1 Boreholes

Based on the results of DP's investigation, the sequence of subsurface materials encountered at the site, in increasing depth order, is summarised in Table 1. The depth ranges provided in the table are based on the boreholes by DP only. The borehole data reported by EI would slightly thicken Unit 2 with a corresponding reduction in thickness in Unit 3, which is discussed further in Section 8. Discussion on the selection of 'Units' is provided in Section 8.

Table 1: Summary of the Subsurface Profile

Unit	Material	Depth Range to Top of Unit (m)	RL Range to Top of Unit (m AHD)	Thickness (m)	General Description
1	Fill	0	35.2 to 31.8	0.5 to 0.6	Typically comprising concrete, asphalt or pavers over sand fill with gravels at all test locations.
2	Sand	0.5 to 0.6	34.6 to 31.2	0.0 to 1.8	Typically observed as pale brown medium sand of a medium dense to dense condition at all test locations.
3	VL-L Sandstone	0.6 to 2.4	32.8 to 31.2	0.2 to 3.1	Very low to low strength sandstone, moderately weathered, slightly fractured. This unit was encountered within BH1 and BH2.
4	M, M-H & H Sandstone	0.8 to 5.5	29.7 to 31.0	13.3 to 14.2	Medium, medium to high and high strength sandstone, slightly weathered to fresh, slightly fractured to unbroken.

Notes: VL = Very Low Strength, M = Medium Strength, H = High Strength

6.2 Heritage Retaining Wall

The footing exposure test pit excavated adjacent to the existing heritage sandstone block wall noted the following conditions. Reference should be made to the footing exposure drawing (Drawing 4) provided in Appendix B.

- The sandstone block wall is situated along the northern site boundary and is approximately 30 m long. It extends from the from the common boundary between the property of 138-140 and 142-146 New South Head Road, Edgecliff to the north east corner of the site. The wall comprises sandstone blocks with mortared joints. The wall is generally in a good condition, however vegetation was observed to be growing from the between the sandstone blocks where mortar has been eroded away.

- The wall is approximately 4.5 m to 5 m high, estimated at 1.6 m wide at the base and decreasing in width as the wall tapers up in height. The face of the wall is inclined at approximately 75 to 80 degrees from horizontal.
- From the test pit footing exposure, the wall is founded upon a strip footing at approximately 0.6 m depth, estimated to be 1.6 m in width and comprises further sandstone blocks on medium dense to dense sand, as determined by the DPT to a depth of 1.4 m below the underside of the footing.

6.3 Groundwater

Groundwater was not observed during the auger drilling of the boreholes. The essential use of water as a drilling fluid during rock core drilling, precluded any further groundwater observations. Groundwater measurements were made, however, within the monitoring wells previously installed by EI. Groundwater measurements by DP included purging the wells dry on 3 February 2021 followed by measuring of water levels on 5 February 2021. A summary of the measured groundwater levels is provided in Table 2.

Table 2: Summary of Groundwater Measurements in EI Monitoring Wells

Borehole	Surface RL* (m AHD)	Groundwater Depth (m)	Groundwater RL* (m AHD)	Date	Comments
EI_BH1M	32.7	4.2	28.5	5 Feb 2021	Measured approximately 40 hours after purging of the wells.
EI_BH6M	32.8	3.8	29.0	5 Feb 2021	

*Note: * = based upon details recorded within EI's investigation report.*

It should be noted that groundwater levels are transient and that fluctuations may occur in response to climatic and seasonal conditions. Refer to Sections 8 and 10.5 for further comments on groundwater.

7. Laboratory Testing

Laboratory testing was carried out on two soil samples to determine the aggressiveness for exposure classification of buried concrete and steel elements.

The results of the chemical laboratory testing are presented in Table 3. The detailed laboratory test results are given in Appendix D.

Table 3: Summary of Aggressivity Test Results

Borehole	Material	Depth (m)	Conductivity (µS/cm)	pH	Cl (ppm)	SO_4 (ppm)
BH1	Sand	2.0 – 2.1	51	8.5	10	<10
BH2	Sandy Fill	0.1 – 0.2	140	7.8	32	90

Notes: Cl = Chloride ion concentration *SO_4 = Sulphate ion concentration* *ppm = Parts Per Million*

The point load test results on rock cores were tested in-house, with results shown on the borehole logs in Appendix C.

8. Geotechnical Model

From the investigation, the site is underlain by a thin surficial layer of aeolian sand over shallow sandstone bedrock. Prior cutting and filling of the land surface is evident by the presence of existing retaining walls constructed along the various property boundaries (perimeter and internal) and the various terraced areas in between. The likely depth/height of prior cutting and filling is estimated to be less than 2 m.

Groundwater seepage was not observed during the field investigation, however ephemeral seepage flow across the top of the rock and along bedding planes within the rock should be anticipated. The permanent groundwater table is likely to be located well below the proposed excavation level, however it should be noted that groundwater levels are transient and may fluctuate over time, particularly, following periods of heavy rainfall. The groundwater levels measured within the EI monitoring wells are considered to represent trapped water within the borehole void emanating from near surface seepage.

For design purposes, the subsurface profile encountered during the investigation has been grouped into four geotechnical units. The interpreted geotechnical profile below the site is shown as interpretive cross sections on Drawings 2 and 3, in Appendix B.

The interpreted depth and RLs at the top of the various units at each test location is shown in Table 4. Reference should be made to the borehole logs for more detailed information and descriptions for the soil and rock profile.

The boreholes from DP’s environmental investigation (BH3 to BH7) were also considered in the preparation of the geotechnical model. These boreholes were drilled with a hand auger for the purposes of contamination sampling and were extended to a target depth of 0.5 m into natural soil or prior refusal on inferred rock. Refusal was encountered within all environmental boreholes, except for BH3, at a depth of less than 0.7 m, which equates well with the deeper geotechnical borehole results.

The results of EI’s geotechnical investigation are considered to be mostly consistent DP’s with the exception that EI reported a deeper soil profile and one comprising residual sandy clay. The residual soil profile is not common for this locality and it is apparent that their drilling method has over-extended the drilling of the augers into the top of the underlying weathered sandstone bedrock. The softer rock has therefore been ‘ground out’ with the auger cuttings resembling a sandy clay. DP’s boreholes have demonstrated that the rock surface is actually shallower than as reported by EI and is therefore initially weaker than implied by the EI’s log descriptions.

A summary of the geotechnical model is presented in Table 4.

Table 4: Summary of Geotechnical Model

Unit	Material	Depth [m] Reduced Level (m AHD) To Top of Each Unit									
		BH1	BH2	BH3	BH4	BH5	BH6	BH7	TP1	EI_BH1M	EI_BH6M
1	Fill	[0] (35.2)	[0] (31.8)	[0] (34.0)	[0] (34.5)	[0] (32.7)	[0] (32.7)	[0] (32.8)	[0] (35.2)	[0] (32.8)	[0] (32.8)
2	Sand	[0.6] (34.6)	NE	[1.3] (32.7)	[0.6] (33.9)	NO	NO	NO	[0.5] (34.7)	[0.1]^1 (32.7)	[0.3]^1 (32.5)
3	VL-L Sandstone	[2.4] (32.8)	[0.6] (31.2)	NE	[0.7] (33.8)	[0.45] (32.2)	[0.4] (32.3)	[0.6] (32.2)	NO	[2.0]^1 (30.8)	[3.0]^1 (29.8)
4	M, M-H & H Sandstone	[5.5] (29.7)	[0.8] (31.0)	NE	NE	NE	NE	NE	NO	[5.5] (27.3)	[4.1] (28.7)

Notes: VL = Very Low Strength, L = Low Strength, M = Medium Strength, H = High Strength
NE = Not Encountered
NO = Not Observed due to discontinuation of borehole/test pit
[1] Based on the recent DP boreholes (BH1 & BH2), and DP's general knowledge of the area, it is considered that the depth and potentially the strength of the rock in the upper part of the EI boreholes has been underestimated due to the drilling process used.

9. Proposed Development

Based on the supplied architectural drawings prepared by Group GSA, it is understood that the proposed development includes the demolition of all existing structures, excluding the heritage sandstone block wall, and construction of a new 18 storey mixed use commercial and residential tower over three basement levels. The initial concept architectural plans are presented in Appendix B.

Initial survey data for the site indicates the existing ground surface levels range between reduced levels of approximately RL 31 and RL 35, relative to AHD. The developments lowest basement finished floor level is proposed at RL 21.5 AHD, assuming a bulk excavation level of 0.5 m below (RL 21 AHD) it is anticipated that basement excavation is expected to extend to depths of approximately 10 m to 14 m. The basements are shown to extend to the site boundaries (except along the western end of the site) and are outlined on the cross sections in Appendix B.

10. Comments

10.1 Site Excavation

10.1.1 Excavation Conditions

Based on the borehole logs, it is anticipated that the proposed bulk excavation will extend through all the units outlined in Table 4. The excavation of soil and very low to low strength rock should be achievable using conventional earthmoving equipment. Excavation of medium and high strength sandstone, however, will require excavator mounted rock hammers, rock saws and/or milling heads.

The excavation rate that can be achieved, particularly within medium and high strength rock, varies considerably and is dependent upon the degree of defects within the rock, rock strength, type of machinery used and the skill of the operator. It is suggested that bulk excavation tenderers be required to make with own assessment of the equipment required to undertake the work.

10.1.2 Dilapidation Surveys

Dilapidation surveys should be carried out on surrounding buildings, retaining walls, pavements and footpaths that may be affected by the basement construction. The dilapidation surveys should be undertaken before the commencement of any excavation work in order to document any existing defects so that any claims for damage due to construction related activities can be accurately assessed.

10.1.3 Vibration

Noise and vibration will be caused by excavation works. Precautions will be required when excavating close to site boundaries, particularly where adjacent buildings are nearby and where existing retaining walls are to be retained (e.g. along the northern boundary of the site). The level of acceptable vibration is dependent on various factors including the type of building/structure (e.g. reinforced concrete, brick, etc.), its structural condition, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s peak particle velocity (PPVi). This is generally much lower than the vibration levels required to cause structural damage to buildings. The Australian Standard AS2670.2-1990 "Evaluation of human exposure to whole-body vibrations – continuous and shock induced vibrations in buildings (1-80 Hz)" indicates an acceptable day time limit of 8 mm/s PPVi for human comfort.

Based on the experience of DP and with reference to AS2670, it is suggested that a maximum PPVi of 8 mm/s (applicable at the foundation level of existing buildings) be adopted at this site for both architectural and human comfort considerations, although this vibration limit may need to be reduced if there are sensitive structures or equipment in the area. Where nearby buildings (including the sandstone block retaining wall) are founded on loose sand, it is suggested that the vibration limit should be reduced to 3 mm/s to reduce the risk of vibration induced settlement. It is noted that the proposed maintaining of the existing retaining walls along the northern boundary means that the wall will be situated directly at or close to the line of excavation and may not be founded on structural footing systems.

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial is undertaken at the commencement of rock excavation. The trial may indicate that smaller or different types of excavation equipment should be used for bulk (or detailed) excavation purposes.

10.1.4 Disposal of Excavated Material

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the Waste Classification Guidelines (EPA, 2014). This includes fill and natural materials that may be removed from the site. Reference should be made to DP's DSI report for this site.

10.2 Excavation Support

Vertical excavations in fill, natural soils and very low to low strength rock (Units 1, 2 and 3) are not expected to be stable. For shallow height batters (say up to 2 m) that are located away from the site perimeter, the creation of temporary batters may be possible, subject to geotechnical assessment during construction. Elsewhere, it will be necessary to provide temporary and permanent retaining walls to the full depth of all excavations and on all sides.

10.2.1 Batter Slopes

Suggested maximum temporary batter slopes for unsupported excavations up to a maximum height of 2 m are shown in Table 5. If surcharge loads are applied near the crest of the slope, then further geotechnical review and probably flatter batters may be required.

Table 5: Recommended Maximum Batter Slopes for Exposed Material

Units	Exposed Material	Maximum Temporary Batter Grade (H:V)	Maximum Permanent Batter Grade (H:V)
1	Filling	1.5:1	2:1
2	Sand	2:1	3:1
3	VL-L Sandstone	0.5:1*	1:1
4	M & H Sandstone	Vertical*	Vertical*

*Note: * Subject to geotechnical inspection during construction*

Competent medium strength or stronger sandstone will generally be stable when cut vertically provided there are no adversely orientated joints or other defects. All near vertical faces in rock should be inspected by an experienced geotechnical engineer or engineering geologist as the excavation progresses in depth intervals of no deeper than 1.5 m. The purpose of the inspection is to identify the extent of shotcrete protection required and to check for the presence of any adverse defects daylighting into the excavation face which may require additional stabilisation measures (such as rock bolts and/or shotcrete).

10.2.2 Retaining Walls

Where batter slopes cannot be used, shoring walls will be required to support the Unit 1 fill, Unit 2 Sand and Unit 3 very low to low strength sandstone as outlined in Table 1. Anchored soldier pile walls are often used to provide temporary retaining support to soils and weathered rock, however due to the sandy profile a secant pile wall will be required above the rock surface. A contiguous pile wall comprising closely spaced/touching CFA piles or augered piles with casing may be considered however for both options gaps between the piles must be progressively filled using grout or shotcrete to prevent loss of sand from behind the shoring wall and undermining the adjacent heritage wall footing.

Measures will need to be put in place to ensure that excessive collapse of the sand and decompression (draw in) of the sand does not occur during drilling of the piles.

It is anticipated that at least two rows of temporary anchors may be required to provide lateral restraint to shoring piles for the excavation, particularly in areas where deeper soil is encountered and wall movements must be reduced. In particular, careful attention will need to be given to the design of excavation support along the:

- Northern site boundary, where the proposed basement excavation extends up to the base of the heritage sandstone block wall and adjoining brick wall.
- Eastern site boundary, where the proposed basement excavation extends up to the boundary, along which there are neighbouring structures.
- Southern site boundary, where the proposed basement excavation extends to the street frontage of New South Head Road, a Transport for New South Wales(TfNSW) road.
- Western side of the site, where the excavation extends to the building that is to be retained on 136 New South Head Road.

It is recommended that prior to final design both the footing type and founding level of any neighbouring buildings is confirmed so that the proposed excavation methods and shoring support is appropriately designed.

It may be possible to terminate the shoring piles within unsupported Unit 4 medium and high strength sandstone above bulk excavation level. In this case it will be essential for an experienced geotechnical engineer or engineering geologist to assess the stability of the rock directly beneath each pile toe immediately after it is exposed during bulk excavation. No passive pressure will be available and as such, it will generally be necessary to restrain the toe of the piles with temporary or permanent rock bolts or anchors, as appropriate.

It is suggested that the preliminary design of cantilever shoring systems (or shoring with one row of anchors or propping) be based on a triangular earth pressure distribution using earth pressure coefficients provided in Table 6. 'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable, and 'at rest' earth pressure coefficient (K_0) values should be used where the wall movement needs to be reduced (i.e. adjacent to the heritage wall, existing structures or utilities). Cantilevered walls should not be used to support adjacent structures.

Table 6: Recommended Design Parameters for Shoring Systems

Unit	Material	Unit Weight (kN/m3)	Earth Pressure Coefficient		Effective Cohesion c' (kPa)	Effective Friction Angle (Degrees)
			Active (K_a)	At Rest (K_o)		
1	Fill	20	0.3	0.5	0	20
2	Sand	20	0.3	0.5	0	25
3	VL-L Sandstone	22	0.15	0.25	10	25
4	M-H & H Sandstone	24	0*	0*	30	40

Notes: VL = Very Low Strength, L = Low Strength, M = Medium Strength, H = High Strength
** Subject to jointing assessment by experienced Geotechnical Engineer/Engineering Geologist*

The design for lateral earth pressures where multiple rows of anchors or propping are used (i.e. two rows or more of anchors or props) may be based on a trapezoidal earth pressure distribution. The following earth pressure magnitudes are considered appropriate, where H is the height of soil and very low to low strength rock to be retained, in metres:

- 4H kPa, where some lateral movement is allowed; and
- 6H kPa, where lateral movements need to be limited (e.g. next to buildings and services).

In each case the maximum pressure generally acts over the central 60% of the wall, reducing to zero at the top and base of the wall.

The design of the shoring should allow for all surcharge loads, including building footings, inclined slopes behind the wall, traffic, site sheds, and construction related activities.

Shoring walls should also be designed for full hydrostatic pressures unless drainage of the ground behind impermeable walls can be provided. This is unlikely to be the case for secant or contiguous pile walls. Below the termination depth of secant and contiguous pile walls, drainage could comprise 150 mm wide strip drains pinned to the face at 1 m to 2 m centres behind shotcrete in-fill panels. The base of the strip drains should extend out from the shoring wall to allow any seepage to flow into a perimeter toe drain which is connected to the stormwater drainage system.

10.2.3 Passive Resistance

Passive resistance for piles founded below the base of the bulk excavation (including allowance for services or footings) may be based on the preliminary ultimate passive restraint values provided in Table 7. These ultimate values will need to incorporate a factor of safety to limit the wall movement that is required to mobilise the full passive resistance. The top 0.5 m of the socket should be ignored due to possible disturbance (e.g. over-excavation) and tolerance effects. The passive restraint adopted in the design must not exceed the shear capacity of the pile.

Table 7: Preliminary Passive Resistance Values

Foundation Stratum	Ultimate Passive Pressure (kPa)
Very Low strength sandstone	400*
Low strength sandstone	2000*
Medium strength or stronger sandstone	6000*

*Note: * Subject to Geotechnical Inspection.*

10.2.4 Ground Anchors

The preliminary design of temporary and permanent ground anchors/rock bolts for the support of excavations and/or shoring systems may be carried out on the basis of the preliminary maximum bond stresses given in Table 8.

Table 8: Preliminary Bond Stresses for Rock Anchor Design

Material Description	Maximum Allowable Bond Stress (kPa)	Maximum Ultimate Bond Stress (kPa)
Very low to low strength rock	100	100
Low strength rock	200	300
Medium strength rock	500	1000
High strength rock	1200	3000

The parameters given in Table 8 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind a line drawn up at 45 degrees from the base of the shoring or the top of free standing medium strength or stronger rock, and 'lift-off' tests should be carried out to confirm the anchor capacities. It is suggested that ground anchors should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load.

It is anticipated that the building will support the basement excavation over the long term and therefore the ground anchors are expected to be temporary only. The use of permanent anchors would require careful attention to corrosion protection including full column grouting and the use of an internal corrugated sheathing over the full length of the anchor. A detailed specification would need to be prepared for the installation and stressing of permanent anchors.

10.3 Excavation Induced Ground Movement

Horizontal movements due to stress relief of the sandstone bedrock may occur during the excavation works. Based on published literature and DP's experience, the lateral displacement associated with excavation in Hawkesbury Sandstone may be in the order of 0.05% to 0.15% of the excavation height in rock.

The above predicted design displacements would generally be greatest at the centre of the excavated faces and would reduce with towards the corners of the shoring wall.

It is possible that deflections at the surrounding buildings and the heritage wall along the north boundary of the site, which typically have setback of less than 1 m from the proposed basement excavation, may be within this range. It is expected that structures with a setback of about 2 m or more from the proposed excavation are likely to experience deflections less than the values indicated above.

It is generally not possible/practical to provide restraint (i.e. shoring or anchoring) for the relatively high in situ horizontal stresses associated with stress relief movements. Therefore, it is recommended that appropriate allowance be made for movements of this order in the design, planning and construction.

Based on the above, it is recommended that, the structural engineer assess whether the existing heritage sandstone block wall and neighbouring buildings can tolerate the possible ground movements as the current architectural drawings indicate vertical cuts (in medium and high strength rock) adjacent to the heritage sandstone block wall and site boundaries.

If a more accurate assessment of predicated ground movements at surrounding buildings is required, as a result of the proposed excavations and stress relief, then numerical modelling (using commercially available software such as Plaxis 2D or RS2) should be undertaken. DP can complete this numerical modelling during the detailed design stage.

A geotechnical monitoring plan (GMP) will need to be prepared and implemented for the site due to the presence of the heritage wall, as well as the site being located adjacent to a state (TfNSW) road. The GMP will likely require survey and inclinometer monitoring of excavation faces, nearby buildings / structures and the adjacent state road to assess vertical and horizontal movements during the excavation. The survey and/or inclinometer monitoring should commence prior to excavation to provide a baseline and should continue every 1.5 m drop of the excavation. If deflections show an increase in the rate of movement or exceed the predicted movements, then the structural engineer and geotechnical engineer should be contacted for immediate review. DP can assist with development of a GMP and on-going inclinometer surveys during the construction stage.

10.4 Footings

10.4.1 General

Bulk excavation for a three level basement is likely to expose medium and/or high strength sandstone at the base of the excavation. It is anticipated that the footing systems will include pad footings and piles. If shoring piles are founded below the bulk excavation level, the shoring piles may also be designed to carry the proposed building loads. The foundation design parameters provided assume that the footing excavations are clean and free of loose debris.

Recommended preliminary maximum pressures for the various rock strata are presented in Table 9. For piles, shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the values for compression.

Table 9: Design Parameters for Foundation Design

Unit	Foundation Stratum	Maximum Allowable Pressure (Serviceability)		Maximum Ultimate Pressure (Ultimate)		Young's Modulus (MPa)
		End Bearing (kPa)	Shaft Adhesion* (Compression) (kPa)	End Bearing (kPa)	Shaft Adhesion* (Compression) (kPa)	
3	VL-L Sandstone	1,000	100	3,000	150	100
4	Medium Strength Sandstone (or better)	3,500	350	20,000	800	1000

*Note: * Shaft adhesion applies to pile foundations for which the socket sidewalls are adequately cleaned and roughened to "R2" standard (or better) as defined in Pells et. al. (1998).*

Higher allowable bearing pressures of about 6,000 kPa could be adopted in the Unit 3 medium to high and high strength (or stronger) sandstone provided spoon testing is completed in at least 1/3 of the footings. Spoon testing involves drilling a 50 mm diameter hole below the base of the footing, to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak/clay bands. If weak seams are detected, then footings may need to be taken deeper to reach suitable foundation material.

Footings (i.e. pads or piles) founded on the edge or within the zone of influence of vertical rock excavations would be subject to assessment of jointing in the rock during construction. Examples of where such a scenario could occur include:

- Proposed footings adjacent to a deeper lift or stair pits.
- Neighbouring structures founded on rock.

Generally, the allowable bearing pressure for (both existing or proposed) footings founded near the edge of vertical rock excavations on Unit 4 medium to high and high strength sandstone (or stronger) should be limited to about 2,000 kPa, which is subject to inspection by a geotechnical engineer during construction.

If deeper excavation exposes adverse jointing in the rock below the footings, then stabilisation using rock bolts/anchors and or underpinning may be required. Alternatively, the footings may be taken down below the zone of influence of a vertical cut face, in which case there would be no need to reduce the bearing pressure.

Foundations proportioned on the basis of the allowable bearing pressure in Table 9 would be expected to experience total settlements of less than 1% of the footing width under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

Footings designed using ultimate values and Limit State Design will need to consider serviceability which usually governs the design in this case. For pile design, a basic geotechnical strength reduction factor, Φgb, of about 0.52 (or possibly higher) calculated from Table 4.3.2 (A, B, and C) of AS2159-2009: Piling Design and Installation, is considered feasible. However, the structural engineer will need to make their own assessment with the final (Φgb) number being dependent on the design and installation method (and associated risk rating) adopted by the structural engineer. A Φgb of 0.4 is required if pile load testing is not carried out.

All footings should be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters.

10.4.2 Heritage Retaining Wall

The results of the test pit excavated adjacent to the sandstone boulder wall is presented in Table 10. Reference should be made to the footing exposure drawing (Drawing 4) presented in Appendix B.

It should be noted that DP has not assessed the structural capacity of the existing footing or the load applied by the wall on its footing. If the footing is required to carry any additional load, then the structural engineer would need to assess the load carrying capacity of the footing and associated settlements and differential settlements as a result of the additional load. DP can assist with this if required.

Table 10: Summary of Footing Exposure

Test Pit ID	Inferred Footing Type	Depth to Base of Footing (m)	Estimated Width of Footing (m)	Material Exposed Below the Base of Footing	Allowable Bearing Capacity of Existing Foundation (kPa)
TP1	Sandstone Block Strip Footing	0.6	1.6^	Medium Dense Sand	250*

Note: ^ The footing was found to be 0.2 m wider on the south side of the wall. It has been estimated that the footing is also 0.2 m wider on the northern side and that the base of the wall is 1.2 m wide.

** The allowable bearing capacity of the wall foundation has not been reduced as it is assumed the heritage wall will be retained by a secant pile shoring wall.*

The footings exposed in the footing exposure test pit appeared to comprise a sandstone block footing founded on medium dense sand with dense sand at depth, which would typically be suitable for an allowable bearing capacity of 250 kPa. However, given that these footings will be adjacent to the shoring wall of the proposed basement, geotechnical input will be required to inform the detailed design of the shoring wall.

It is important that the during construction the heritage wall footing is not undermined and that the founding sand is not loosened. The design and construction methodology will greatly influence the impact of the excavation on the heritage wall (i.e. the choice of construction sequence, design of shoring, and the surface level of the capping beam). It is anticipated that that numerical analysis to determine the interaction between the loading of the heritage wall on the proposed shoring and the lateral deflection of the shoring wall during excavation will be required to inform shoring design.

Alternatively, it may be viable to underpin/jet grout the founding material of the heritage wall so that it is founds directly on bedrock eliminating the possible settlement. However, this would require discussion and consultation with a specialist jet grouting contractor.

10.5 Groundwater

It is anticipated that the regional groundwater table would be well below the proposed bulk excavation on the site. Seepage should, however, be expected along the top of the rock and through fractures and beddings in the rock, particularly after periods of wet weather.

During construction and in the long term, it is anticipated that any seepage into the excavation could be controlled by perimeter and subfloor drainage connected to a sump-and-pump system. On this basis, a drained basement is considered appropriate for this site. A drained basement will however be subject to approval by Council and WaterNSW. Disposal to the stormwater system will also be subject to assessment of groundwater quality and approval from Council.

It is possible that seepage into the basement may give rise to precipitation of red brown iron oxide residue from the groundwater and therefore perimeter and subfloor drains should be designed for easy access to allow for inspection, maintenance and periodic cleaning.

10.6 Subgrade Preparation

It is expected that the subgrade for the new pavement/driveway entry will generally comprise of sandy fill, sand or sandstone. It is recommended that a preliminary CBR value of 5% be adopted for pavement design purposes and once the existing surface levels at the location of the proposed driveway have been stripped, an inspection should be carried out by an experienced geotechnical engineer to confirm the appropriate CBR value to use for design.

Site preparation will be required prior to construction of the proposed pavement/driveway entry. Earthworks recommendations provided in this report should be complemented by reference to AS 3798 – 2007 Guidelines on earthworks for commercial and residential developments.

The following methodology is suggested for subgrade preparation of the pavement/driveway entries and for raising of site levels using engineered fill:

- Strip the existing fill to remove any organic, root affected and uncontrolled material.
- Where soil/fill is exposed, proof rolling of the subgrade will be required. Proof rolling of the exposed subgrade should be carried out prior to placement of any fill or the construction of slabs. Proof rolling should comprise six passes of a smooth drum roller (say at least 10 tonne). The final pass should be carried out under the observation of a geotechnical engineer to identify any soft or saturated zones. Any such zones should be over-excavated to a maximum depth of 600 mm or to top of rock (whichever is shallower) and replaced with compacted durable granular material.
- If any fill is required to raise surface levels, it should be placed in layers not greater than 200 mm loose thickness and compacted to between 98% to 100% of Standard dry density, with moisture content within ±2% of the optimum moisture content.

The fill and rock on the site are considered suitable for reuse as engineered fill provided it has a maximum particle size of 100 mm and free of organic material. Reuse should also consider the contamination status and is subject to approval by an environmental consultant.

As heavy plant may be required to operate on the sandy subgrade, it is recommended that a working platform be constructed. The platform should be constructed from good quality granular material with low fines, such as recycled concrete or high strength ripped sandstone. The thickness of the platform should be assessed once specific details of the heavy plant that will operate within the basement are known. It is expected that the rockfill layer will be necessary to achieve compaction of the sandy subgrade material. This layer should provide the necessary ‘confinement’ of the sands expected at the subgrade level, to achieve a reasonable level of compaction. The use of heavy vibratory compaction plant should also consider the likely effects of vibrations the plant may induce on adjoining structures.

10.7 Seismic Design

In accordance with the Earthquake Loading Standard, AS1170.4, 2007, the site has a site sub-soil class of rock (B_e).

10.8 Soil Aggressivity

In accordance with AS2159-2009, the results of the chemical laboratory testing indicate that the soils (i.e. fill and sand) are mildly aggressive to buried concrete and non-aggressive to buried steel.

11. Limitations

Douglas Partners (DP) has prepared this report for this project at 136-148 New South head Road, Edgecliff in accordance with DP’s proposal SYD201438.P.002.Rev0 dated 20 December 2020 and acceptance received from Mr. Dennis Meyer of Edgecliff Central Pty Ltd. The work was carried out under DP’s Conditions of Engagement. This report is provided for the exclusive use of Edgecliff Central Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

The assessment of atypical safety hazards arising from this advice is restricted to the components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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

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

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

Site Anomalies

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

Information for Contractual Purposes

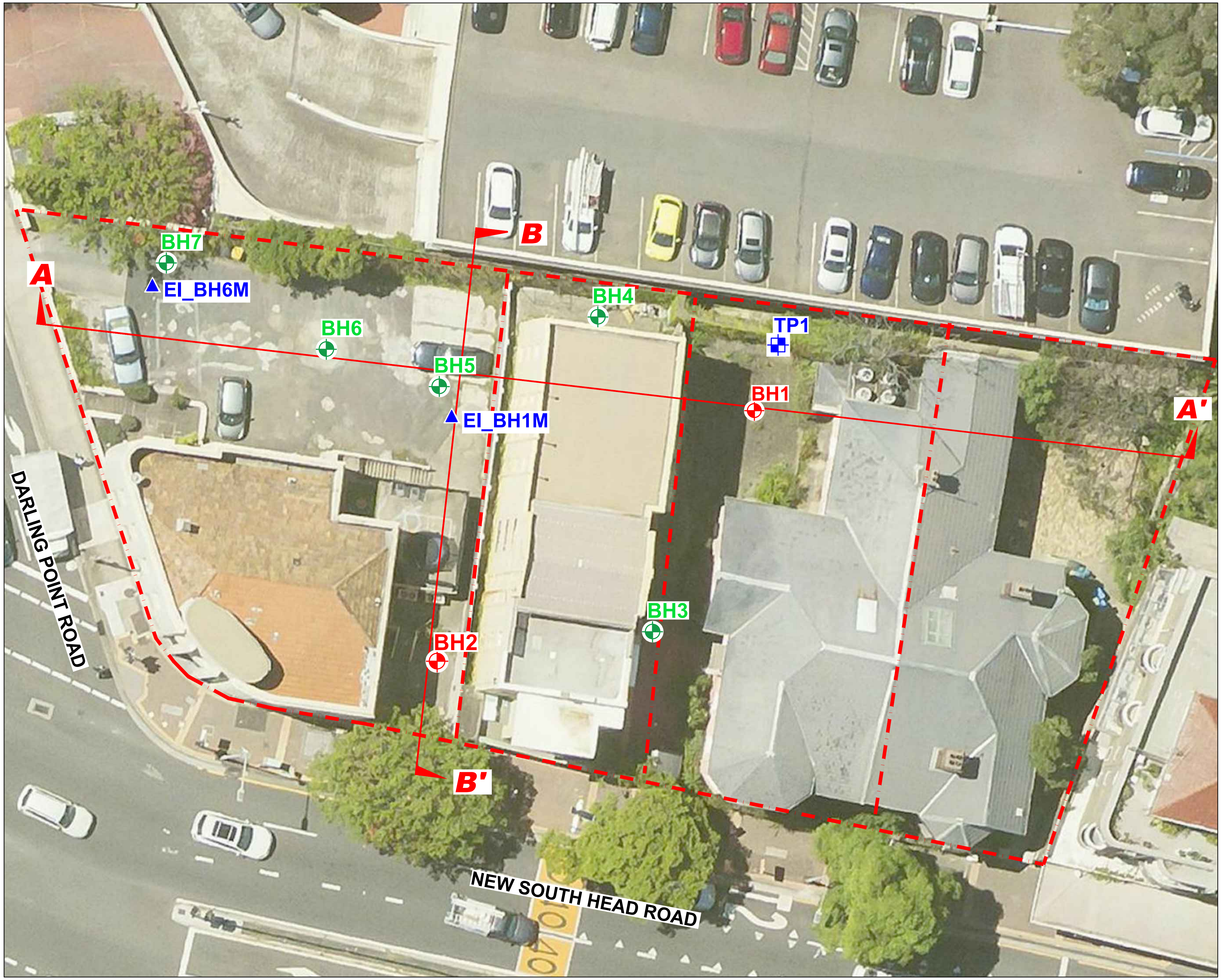
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

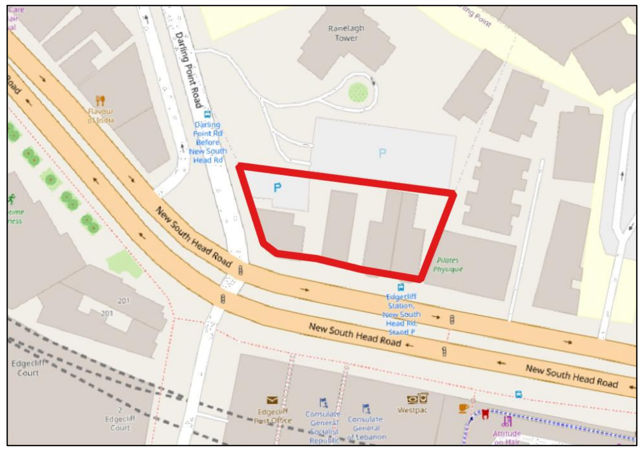
Site Inspection

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

Appendix B

Drawings





SITE LOCALITY

LEGEND

⊕	Borehole Location
⊕	Environmental Borehole
⌖	Test Pit Location
▲	EI Australia's Borehole Location
– – –	Site Boundary
⌊⌋	Geological Cross Section

NOTE:
1: Base image from Metromap.com.au (Dated 04.12.2020)

0 1 2 3 4 5 6 7 8 9 10 15 20 25m
1:250 @ A3

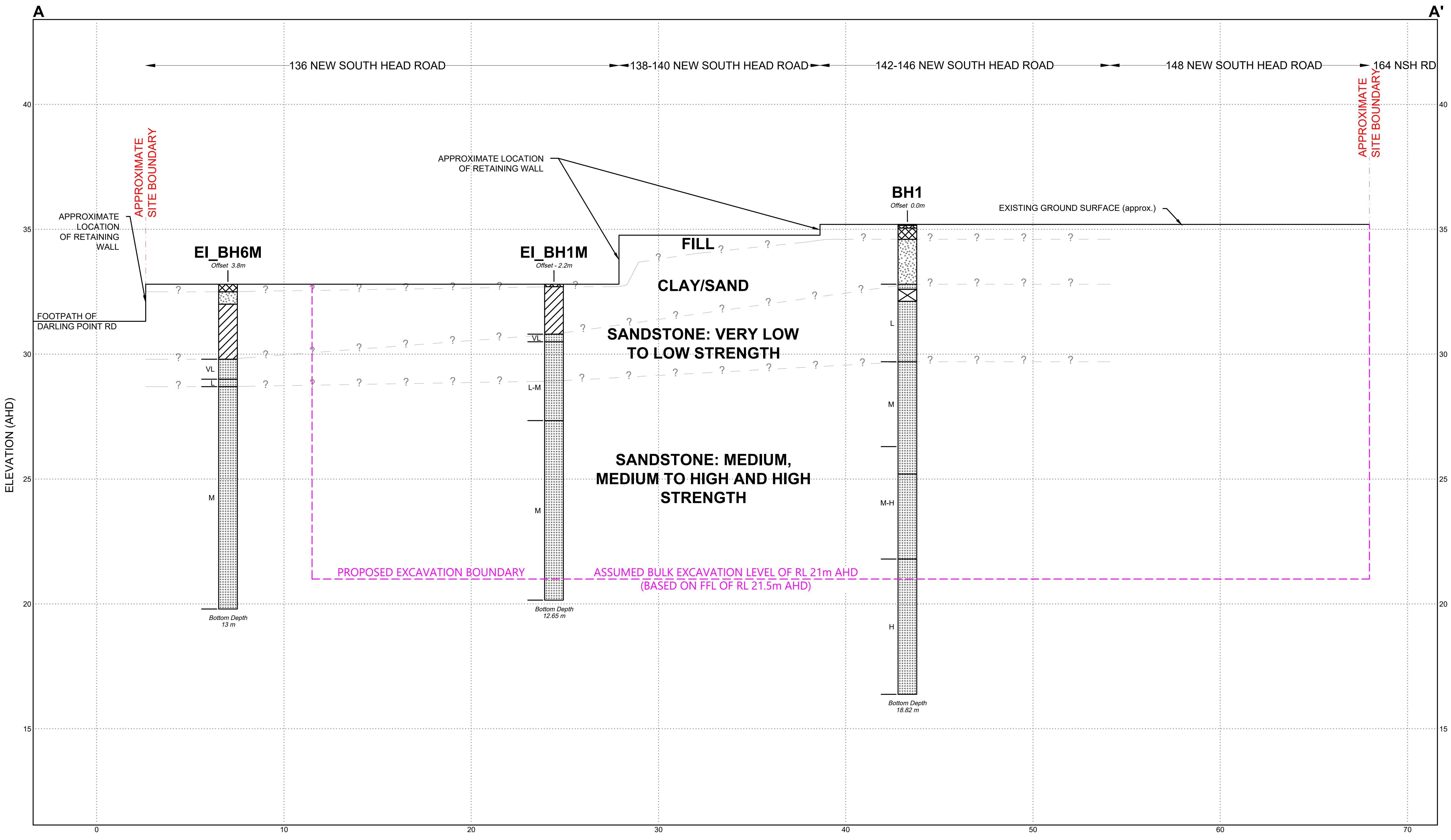
Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Edgecliff Central Pty Ltd
OFFICE: Sydney
DRAWN BY: CJ
SCALE: 1:250 @ A3
DATE: 16.02.2021

TITLE: **Boreholes Location Plan**
Proposed Mixed Use Development
136-148 New South Head Road, Edgecliff

N

PROJECT No: 200333.01
DRAWING No: 1
REVISION: 0



LEGEND

☒ Core Loss

▨ Clay

▩ Filling

▤ Pavers

░ Sand

▒ Sandstone

NOTES

1. Subsurface conditions are accurate at the borehole locations only.
   Variations in subsurface conditions may occur between borehole locations.
   Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

ROCK STRENGTH

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH- Very High

TESTS / OTHER

— ? — — - Interpreted geotechnical boundary

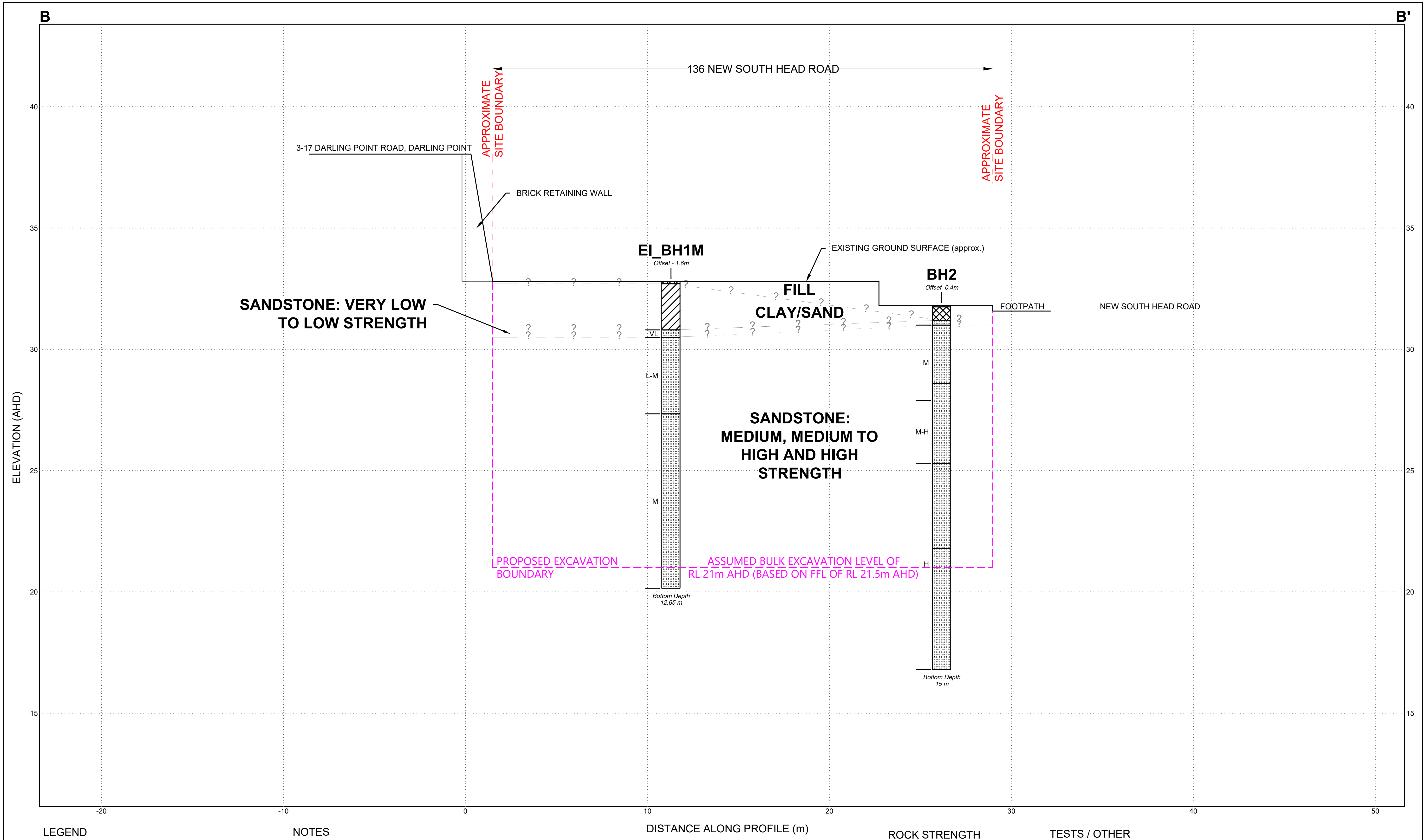
0 4
Horizontal Scale (metres)
Vertical Exaggeration = 1.3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Edgecliff Central Pty Ltd
OFFICE: Sydney
DRAWN BY: MG
SCALE: 1:200 (H) 1:150 (V) @ A3
DATE: 15.02.2021

TITLE: **Cross-section A-A'**
Proposed Mixed Use Development
136 - 148 New South Head Road, Edgecliff

PROJECT No: 200333.01
DRAWING No: 2
REVISION: 0



LEGEND

▨	Concrete
▩	Filling
░	Sandstone
▨	Clay

NOTES

1. Subsurface conditions are accurate at the borehole locations only.
   Variations in subsurface conditions may occur between borehole locations.
   Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

ROCK STRENGTH

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH- Very High

TESTS / OTHER

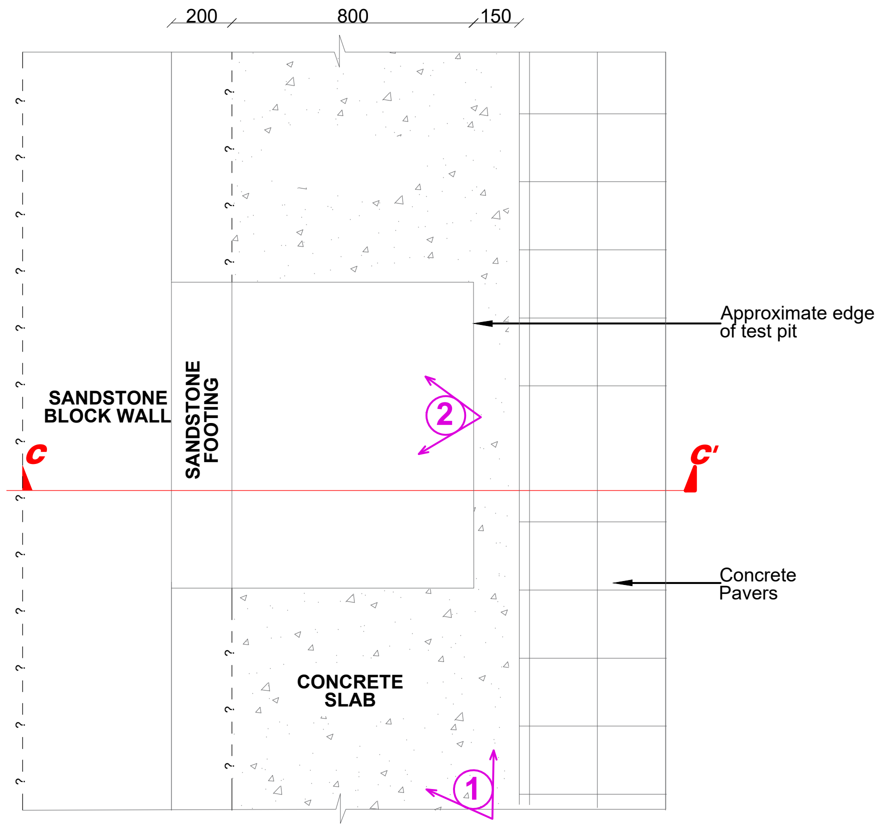
— ? — — - Interpreted geotechnical boundary

0 4
Horizontal Scale (metres)
Vertical Exaggeration = 1.3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Edgecliff Central Pty Ltd		TITLE:	**Cross-section B-B'**	PROJECT No: 200333.01
OFFICE: Sydney	DRAWN BY: MG		**Proposed Mixed Use Development**	DRAWING No: 3
SCALE: 1:200 (H) 1:150 (V) @ A3	DATE: 15.02.2021		**136 - 148 New South Head Road, Edgecliff**	REVISION: 0

PLAN VIEW



SECTION C-C'

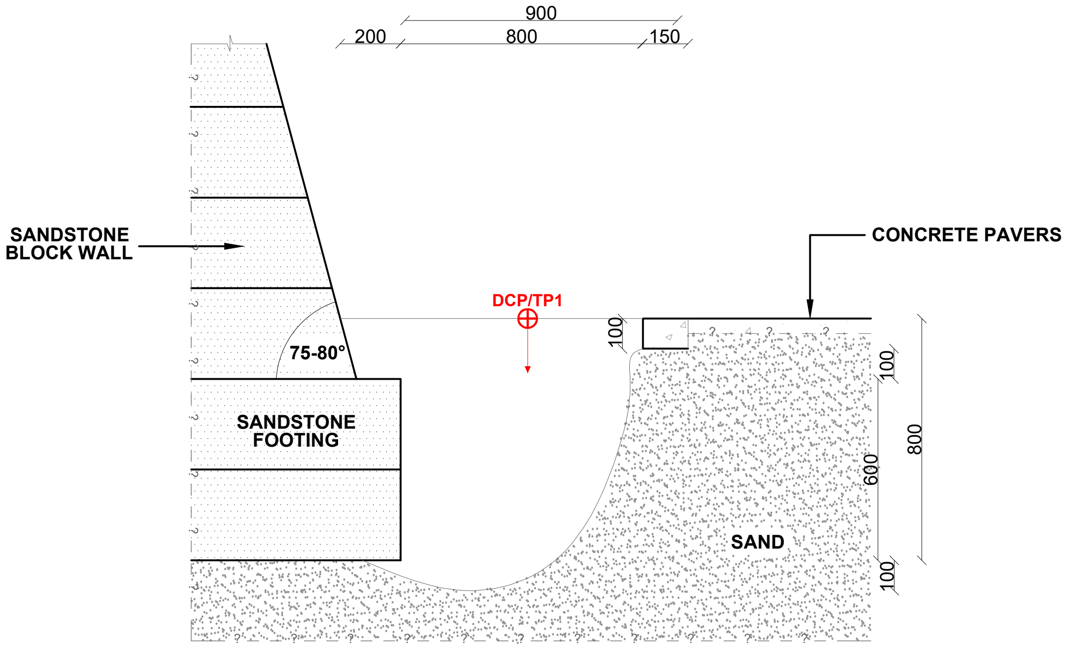


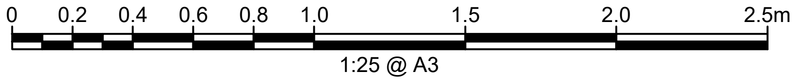
Photo 1

Photo 2

LEGEND

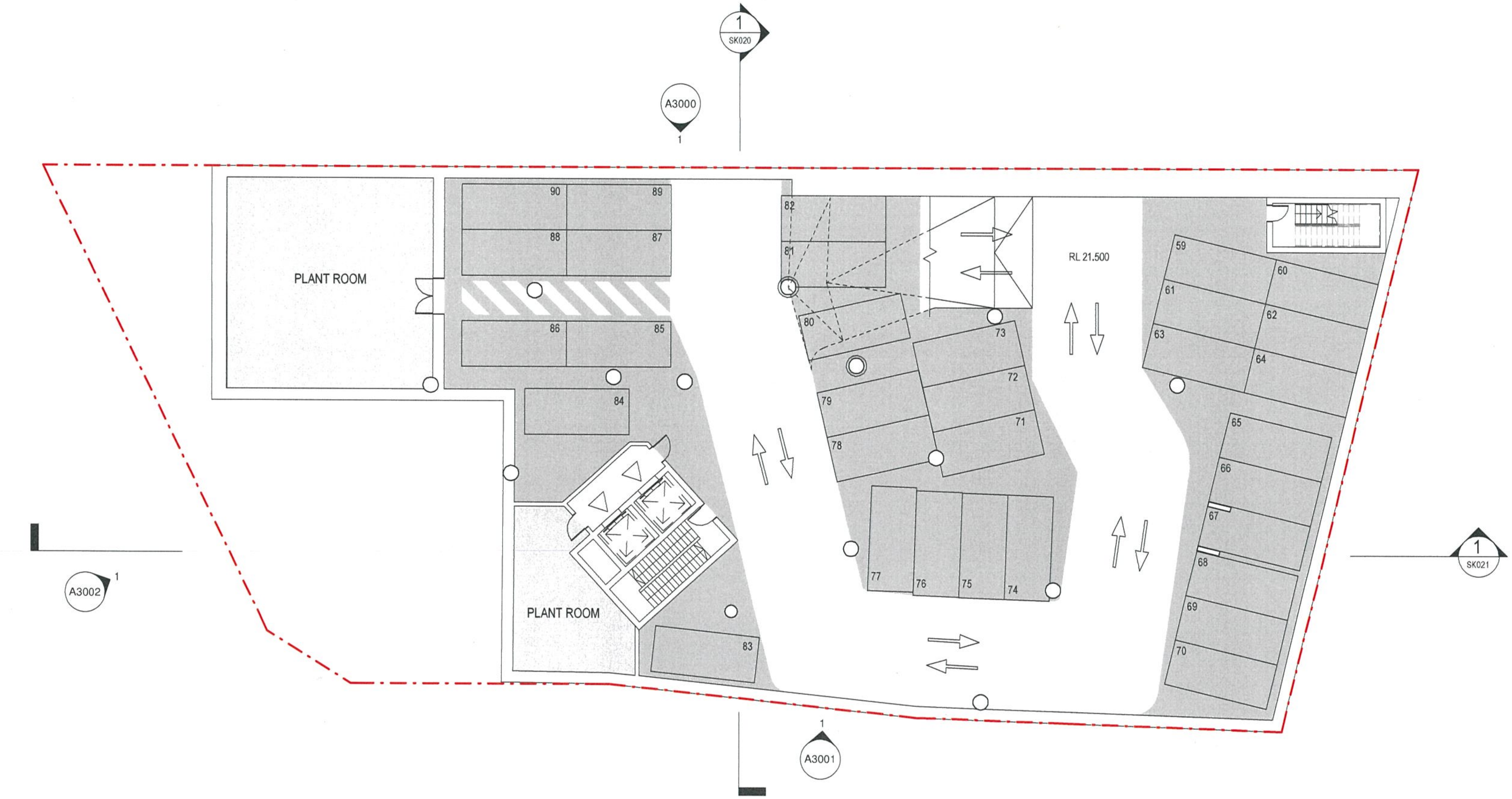
⌴	Geological Cross Section
⊕	DCP Location and Number
①	Photo number with direction of view

NOTE:
1: All dimensions in millimeters (mm).



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Edgecliff Central Pty Ltd		TITLE: **Footing Exposure - Test Pit 1**	PROJECT No: 200333.01
OFFICE: Sydney	DRAWN BY: CJ	**Proposed Mixed Use Development**	DRAWING No: 4
SCALE: 1 : 25 @ A3	DATE: 26.02.2021	**136-148 New South Head Road, Edgecliff**	REVISION: 0



1 CAR PARK P3

1 : 200

FOR

DRAWING
CARPARK LEVEL 3

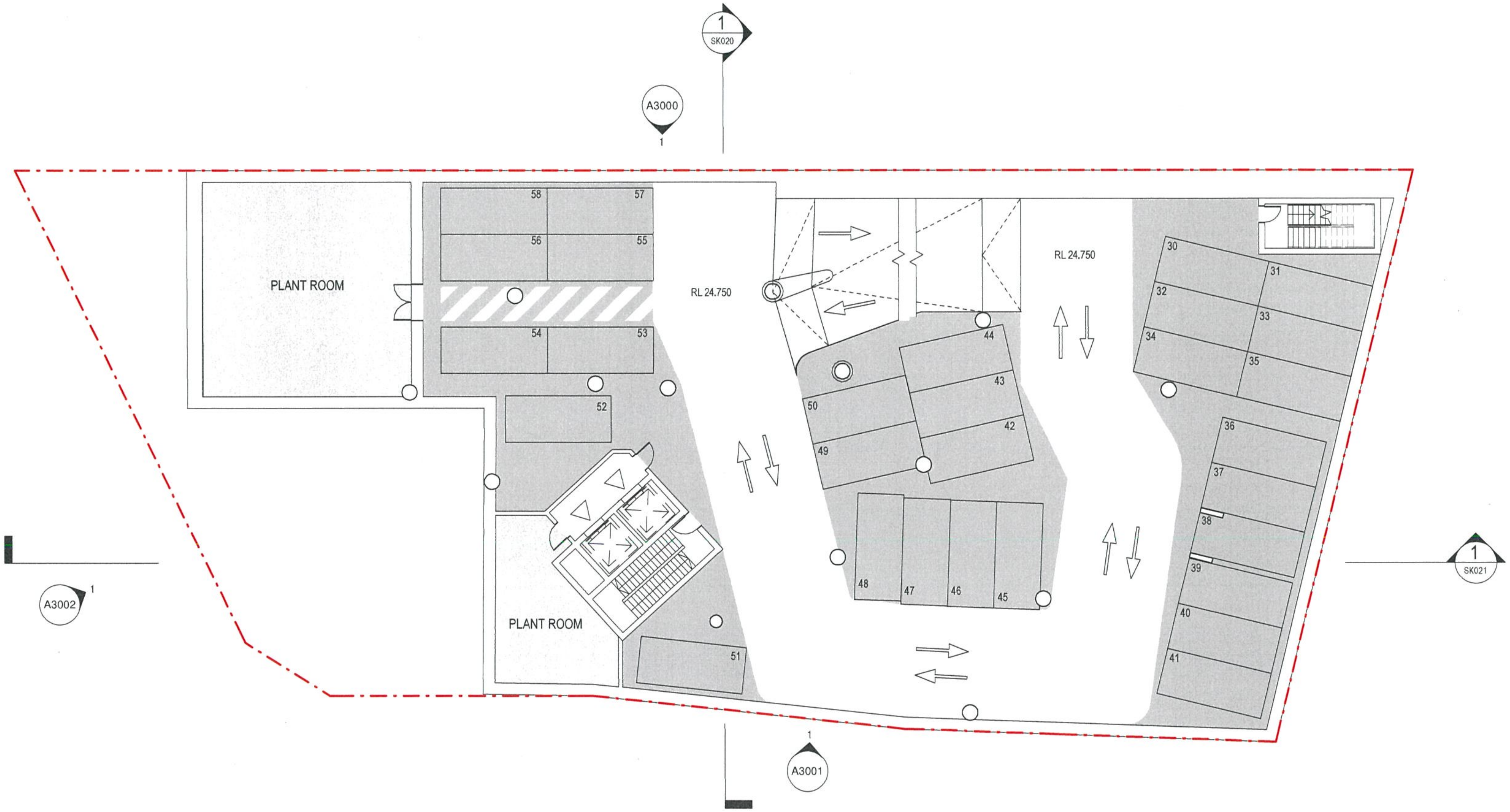
NUMBER
A2000

REVISION

DATE
08/20/20

SCALE
1 : 200@ A3

EDGECLIFF TOWER
© GROUP GSA



1 CAR PARK P2

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GROUPGSA FOR

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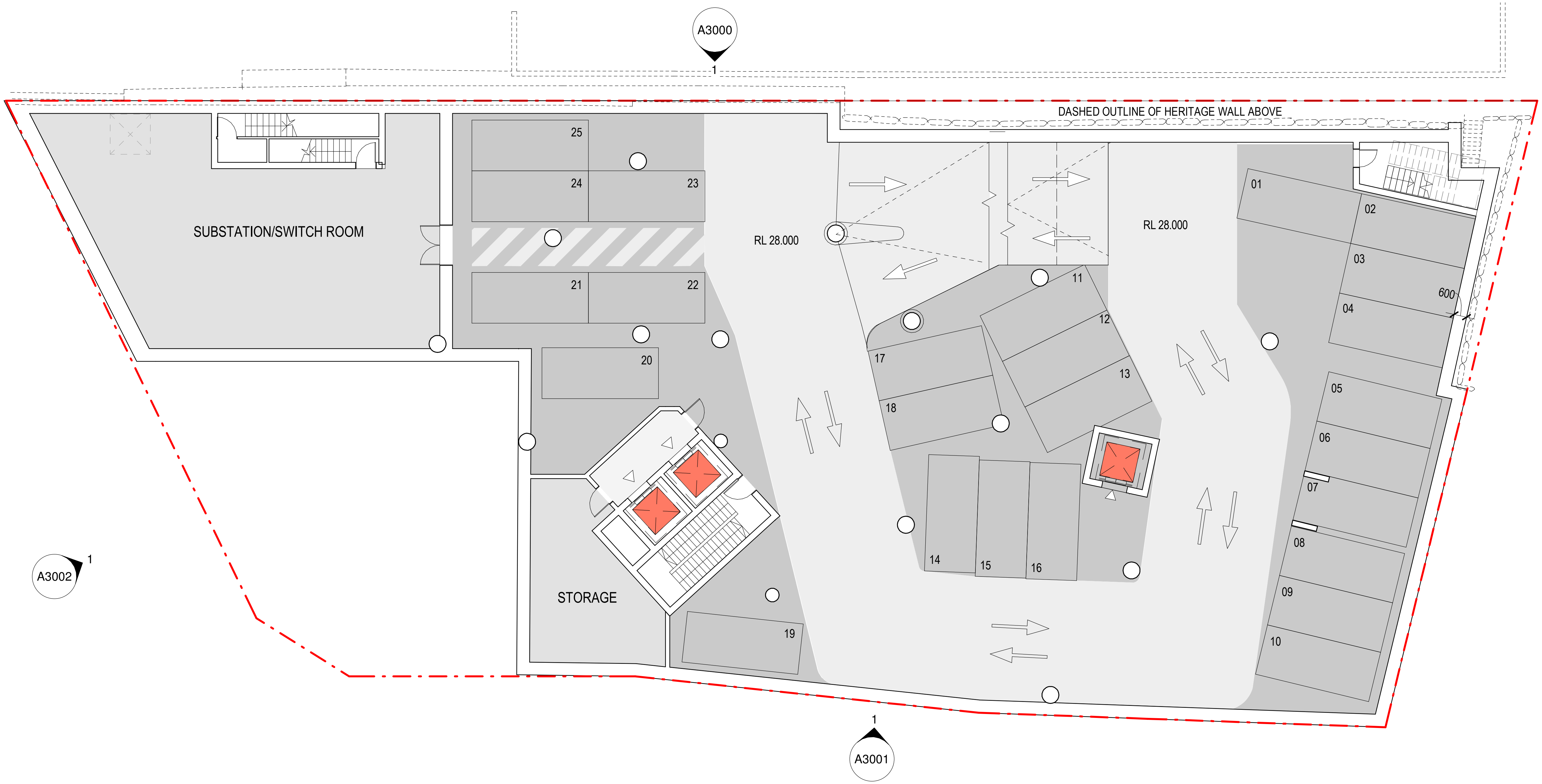
EDGECLIFF TOWER



1 CAR PARK P1

1 : 200

GROUPGSA

FOR Anka Property Group

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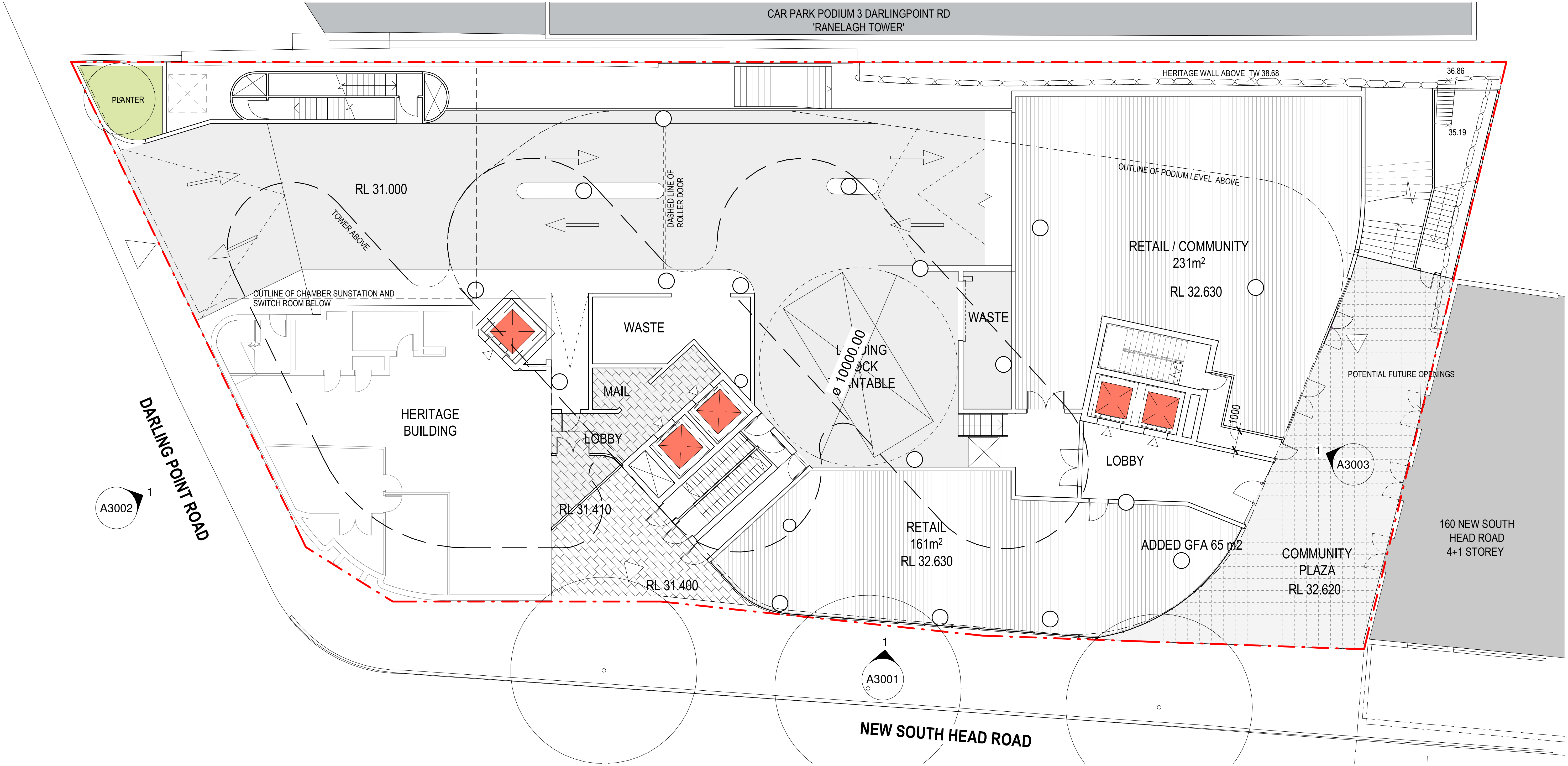

1 GROUND LEVEL

1 : 200

GROUPGSA

FOR Anka Property Group

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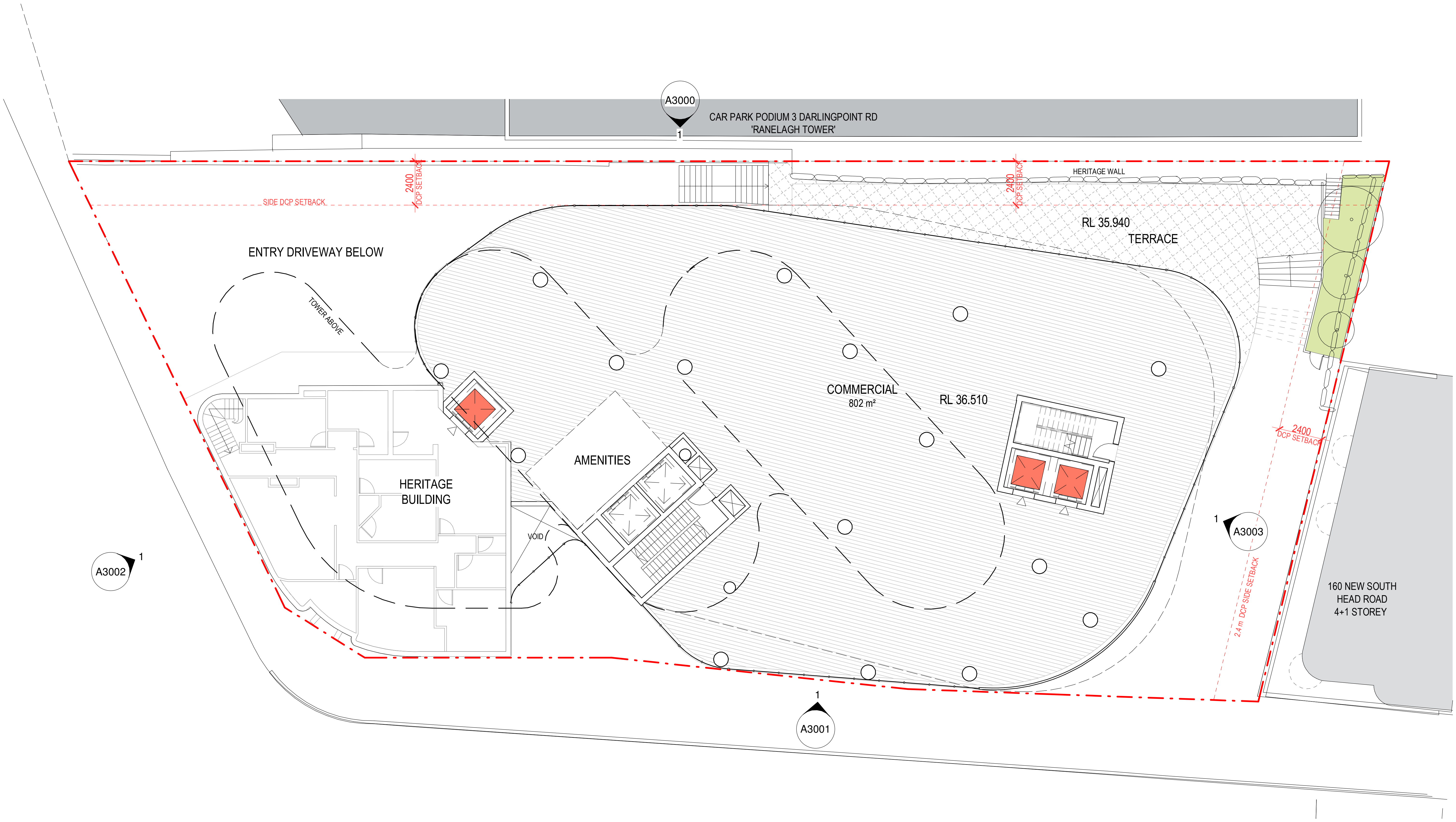

1 LEVEL 1

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GROUPGSA

FOR Anka Property Group

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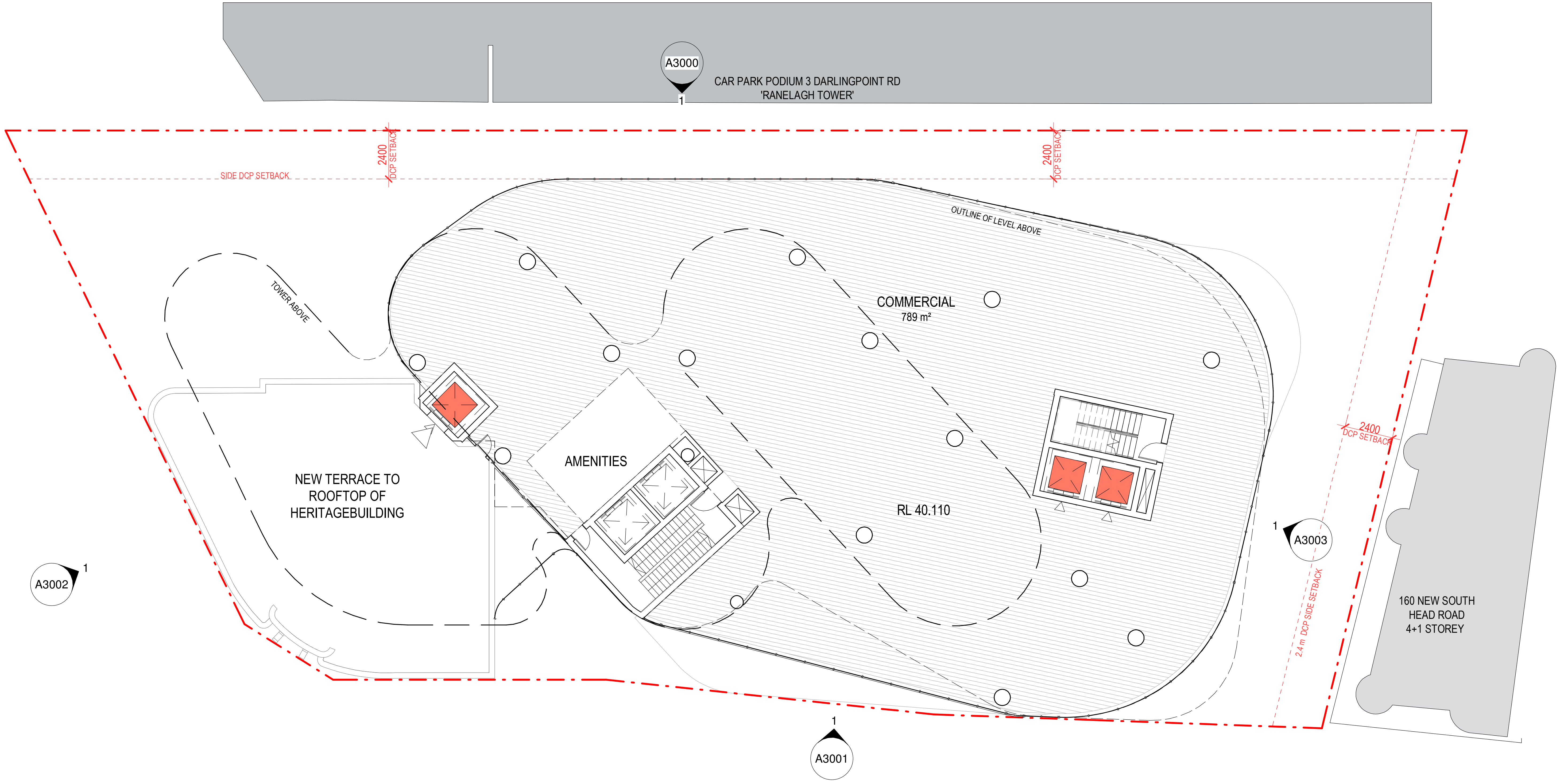
EDGECLIFF TOWER



1 LEVEL 2

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FOR Anka Property Group

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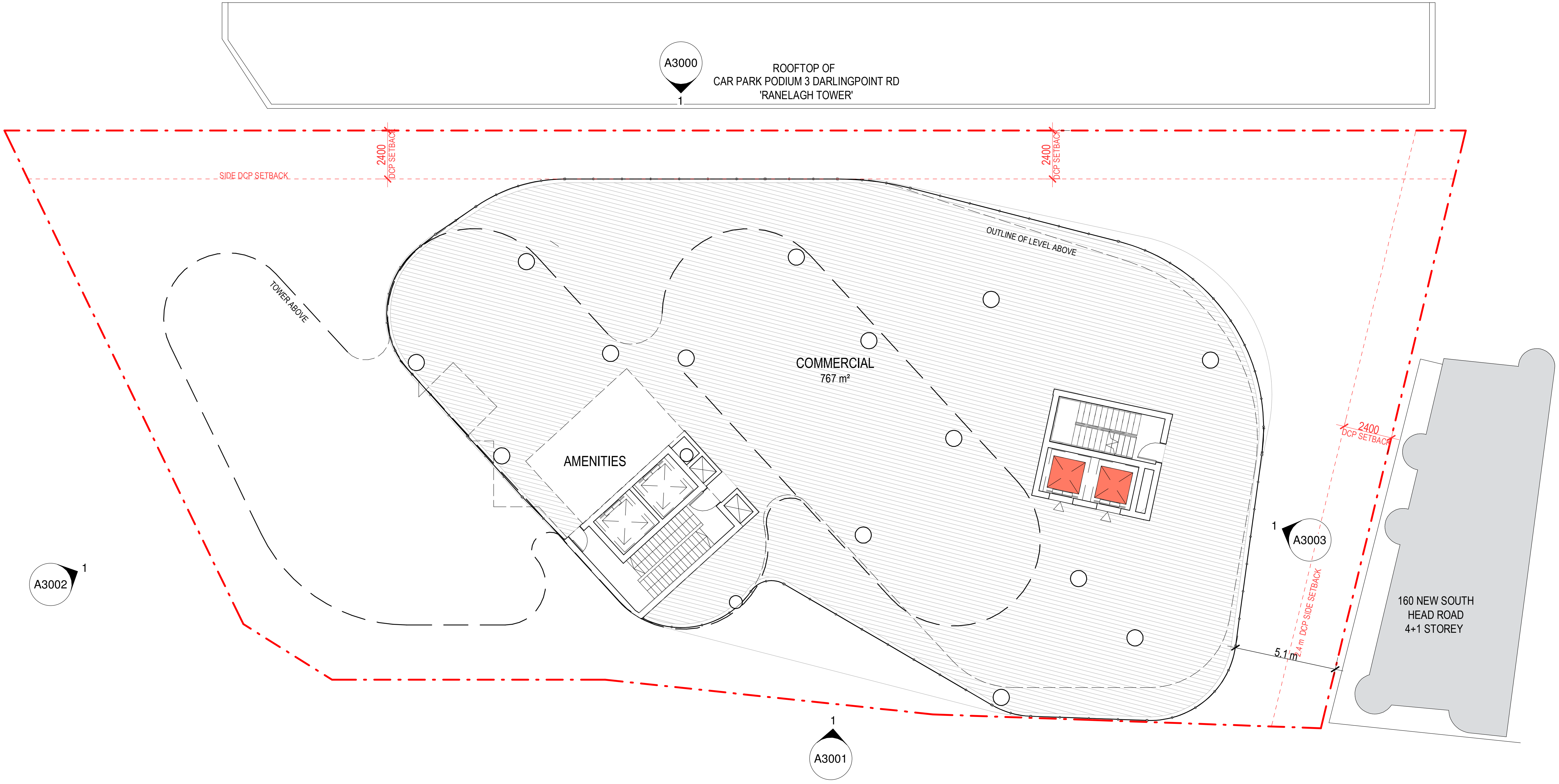

FOR Anka Property Group

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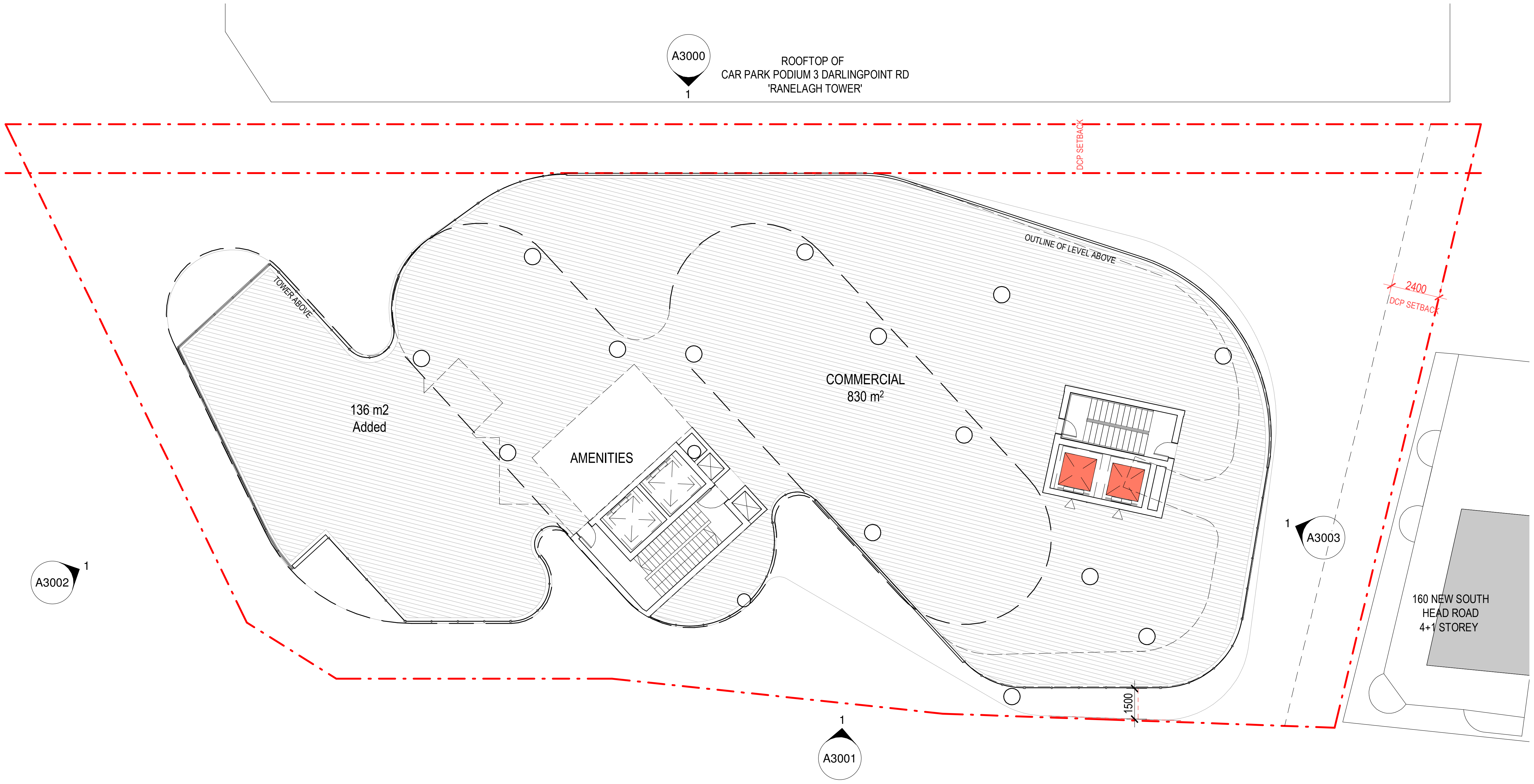
EDGECLIFF TOWER



1 LEVEL 4

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FOR Anka Property Group

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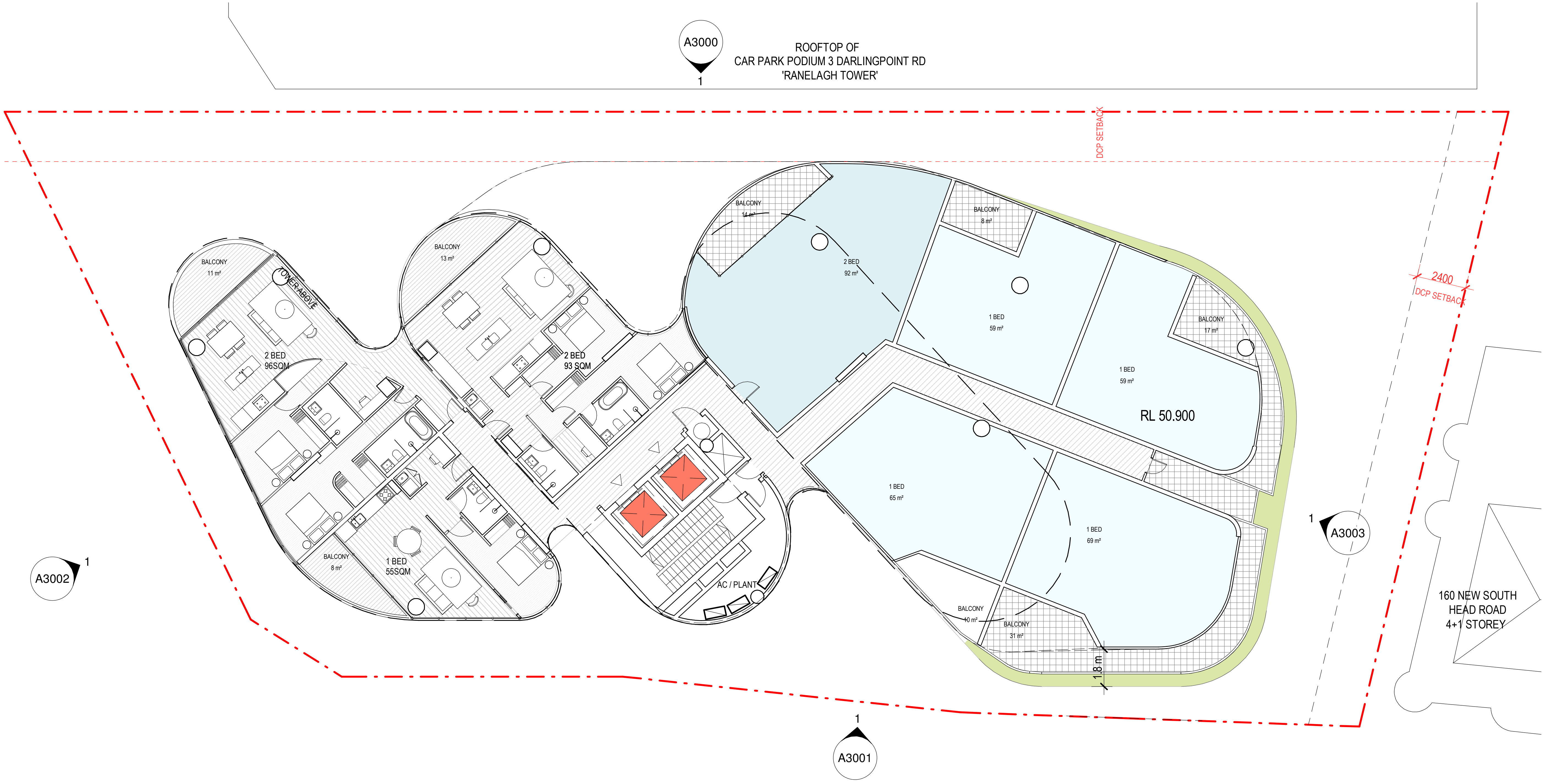

1 LEVEL 5

1 : 200

GROUPGSA

FOR Anka Property Group

DRAWING
LEVEL 5

NUMBER
A2008

REVISION

DATE
17/12/20

SCALE
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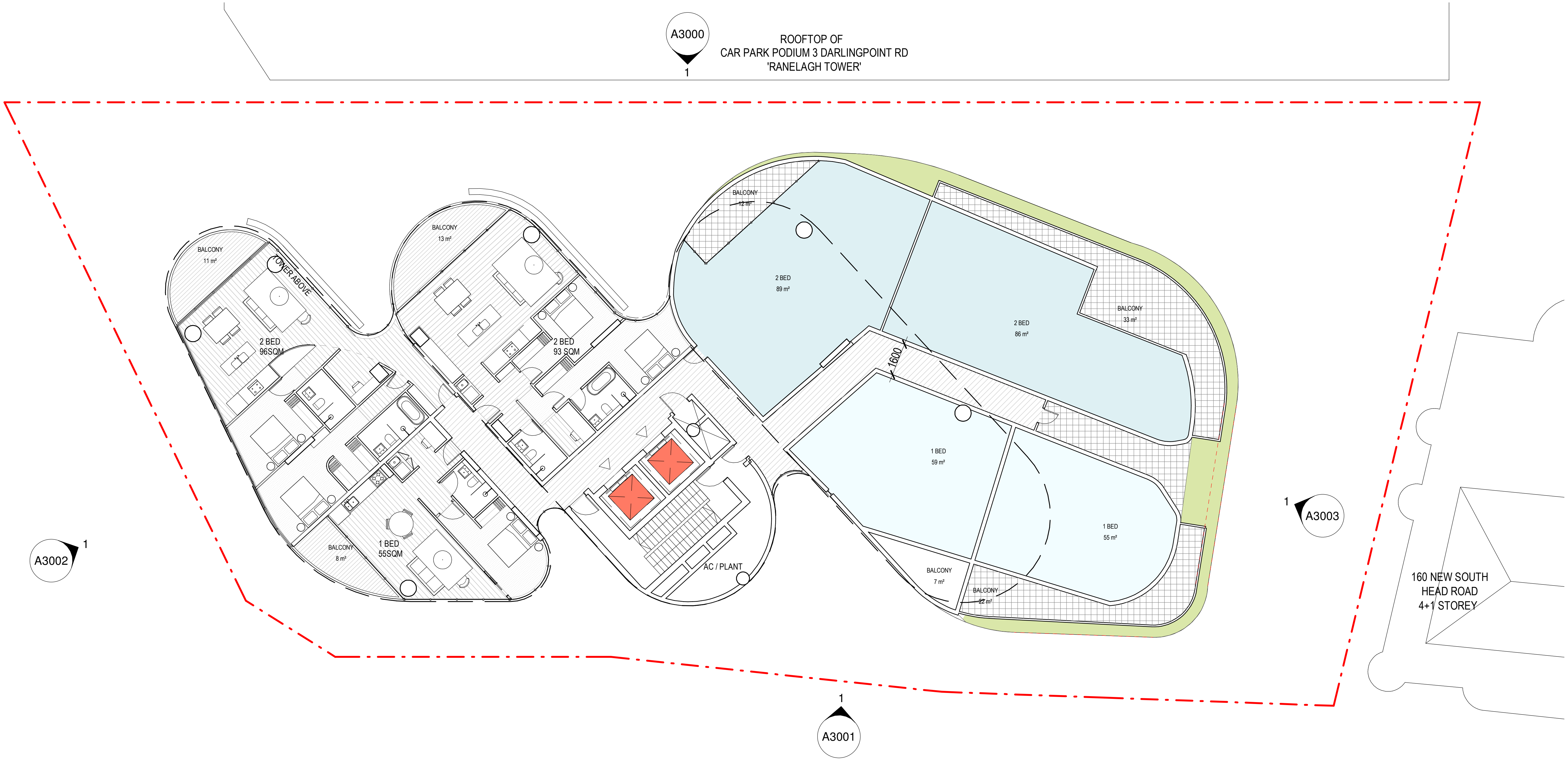
EDGECLIFF TOWER
© GROUP GSA



1 LEVEL 6

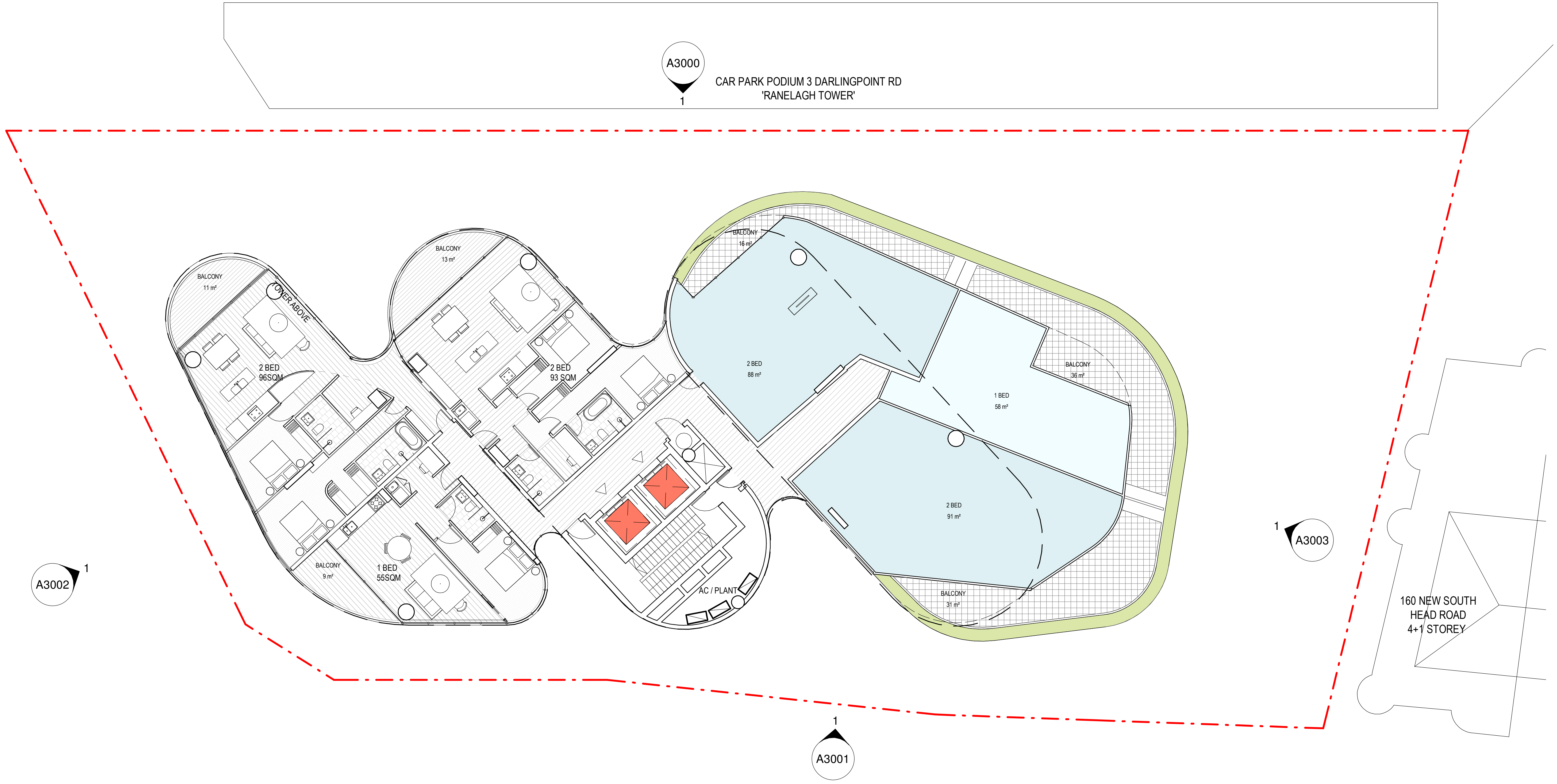
1 : 200

GROUPGSA

FOR Anka Property Group

DRAWING	NUMBER	REVISION	DATE	SCALE
LEVEL 6	A2009		17/12/20	1 : 200@ A3

EDGECLIFF TOWER



1 **LEVEL 7**

1 : 200

FOR Anka Property Group

DRAWING	NUMBER	REVISION	DATE	SCALE
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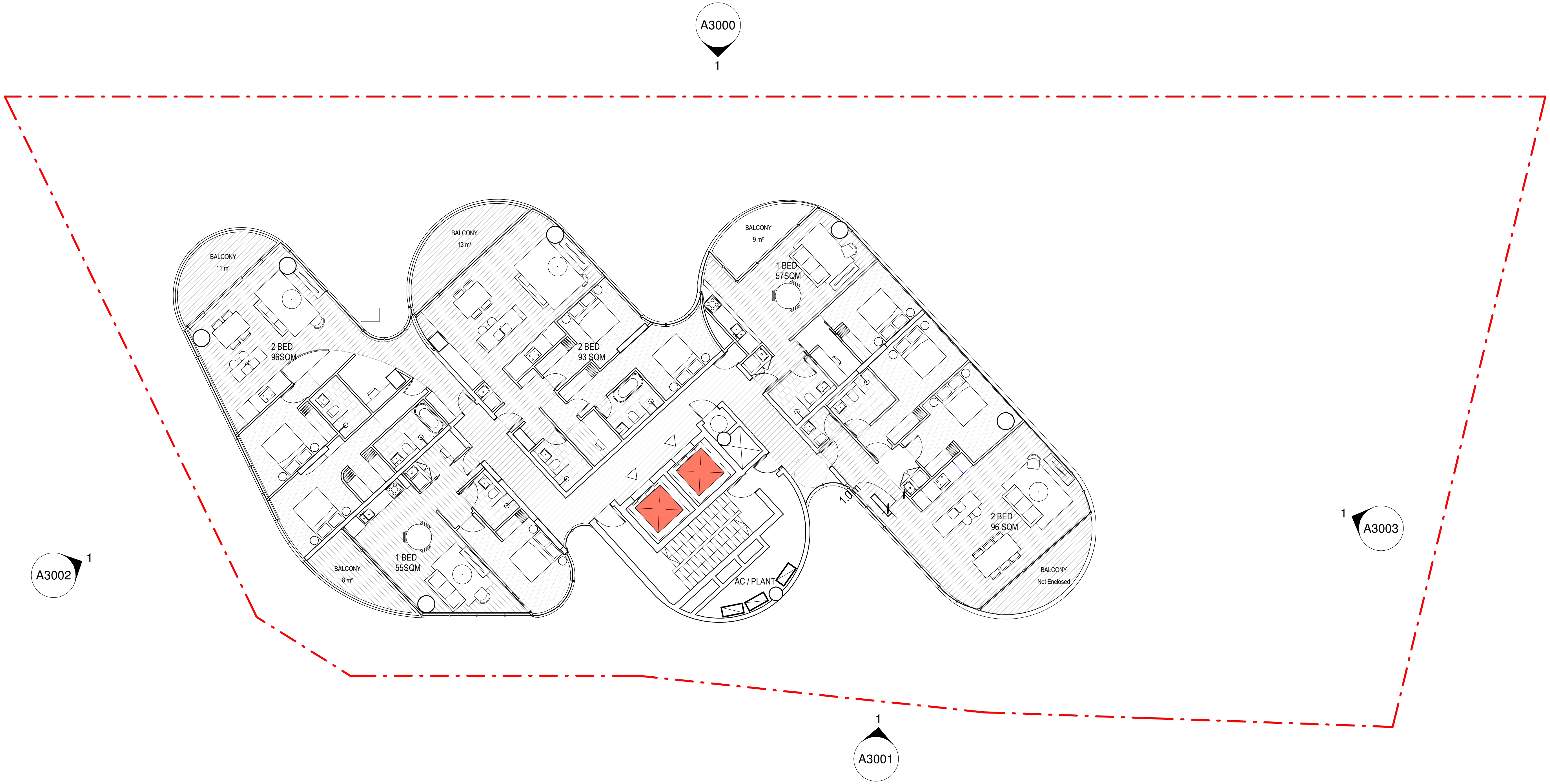
EDGECLIFF TOWER



1 LEVEL 8 -14

1 : 200

FOR Anka Property Group

DRAWING	NUMBER	REVISION	DATE	SCALE	EDGECLIFF TOWER
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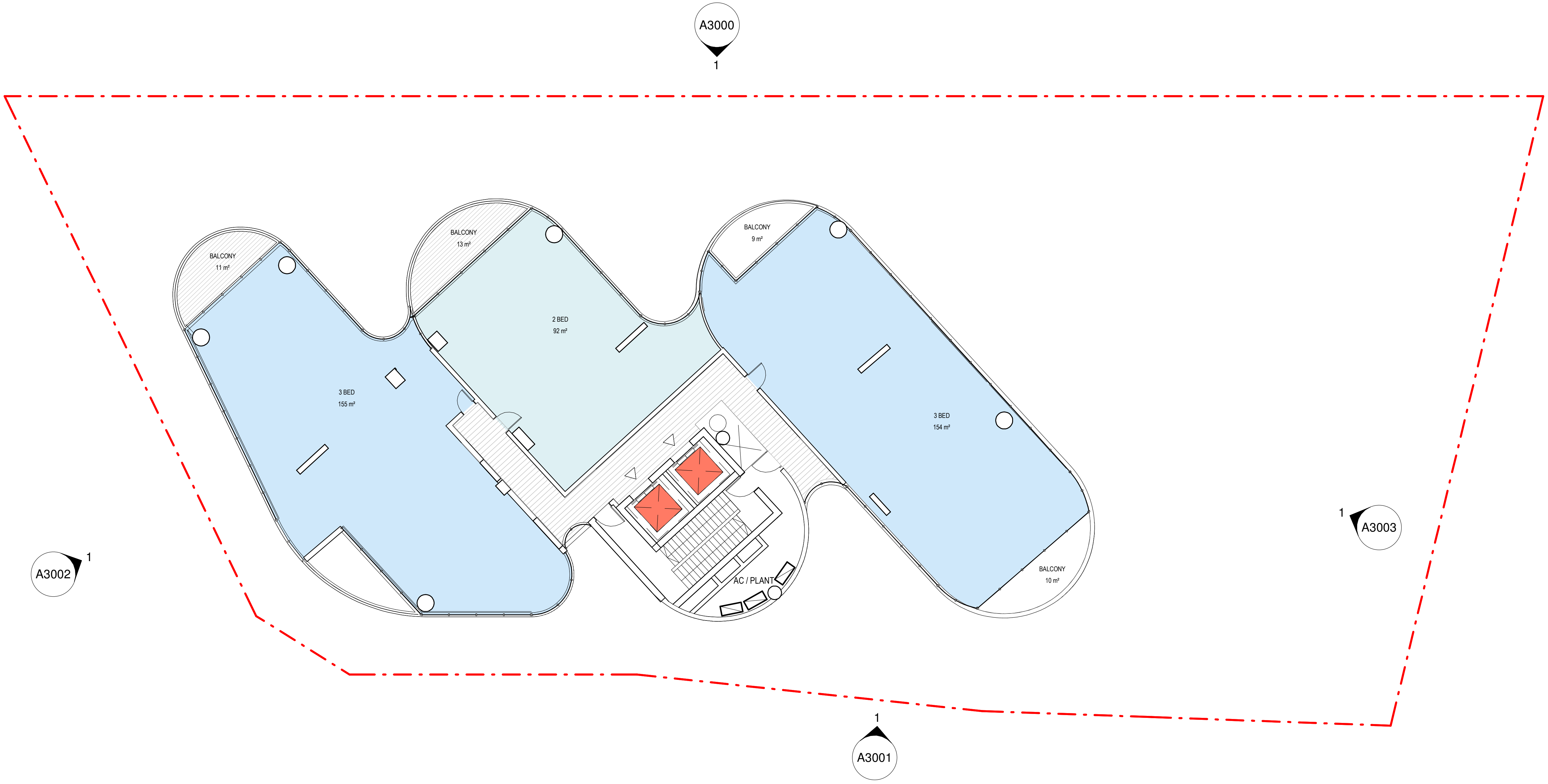

1 LEVEL 15 - 16

1 : 200

GROUPGSA

FOR Anka Property Group

DRAWING	NUMBER	REVISION	DATE	SCALE	EDGECLIFF TOWER
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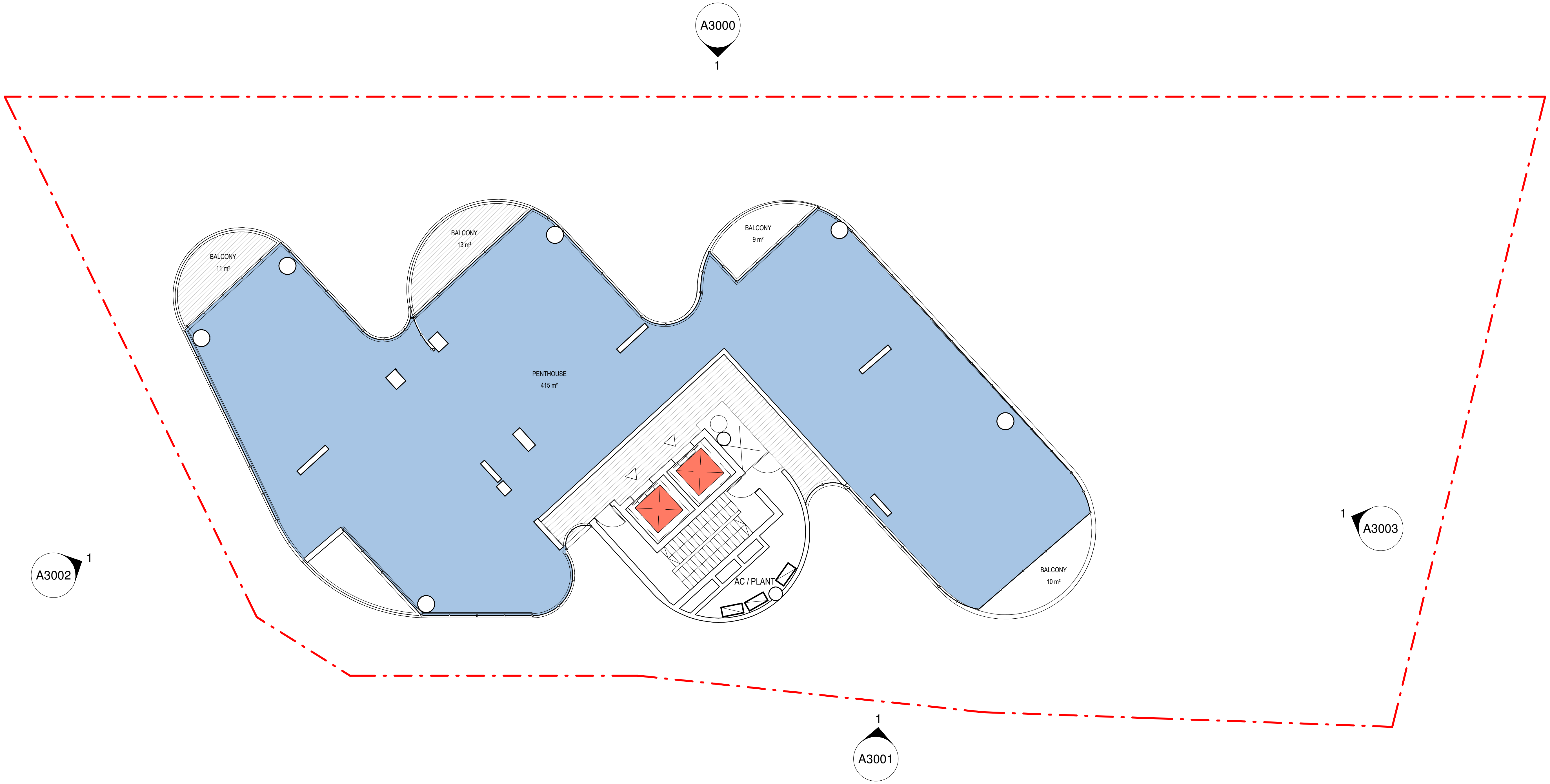


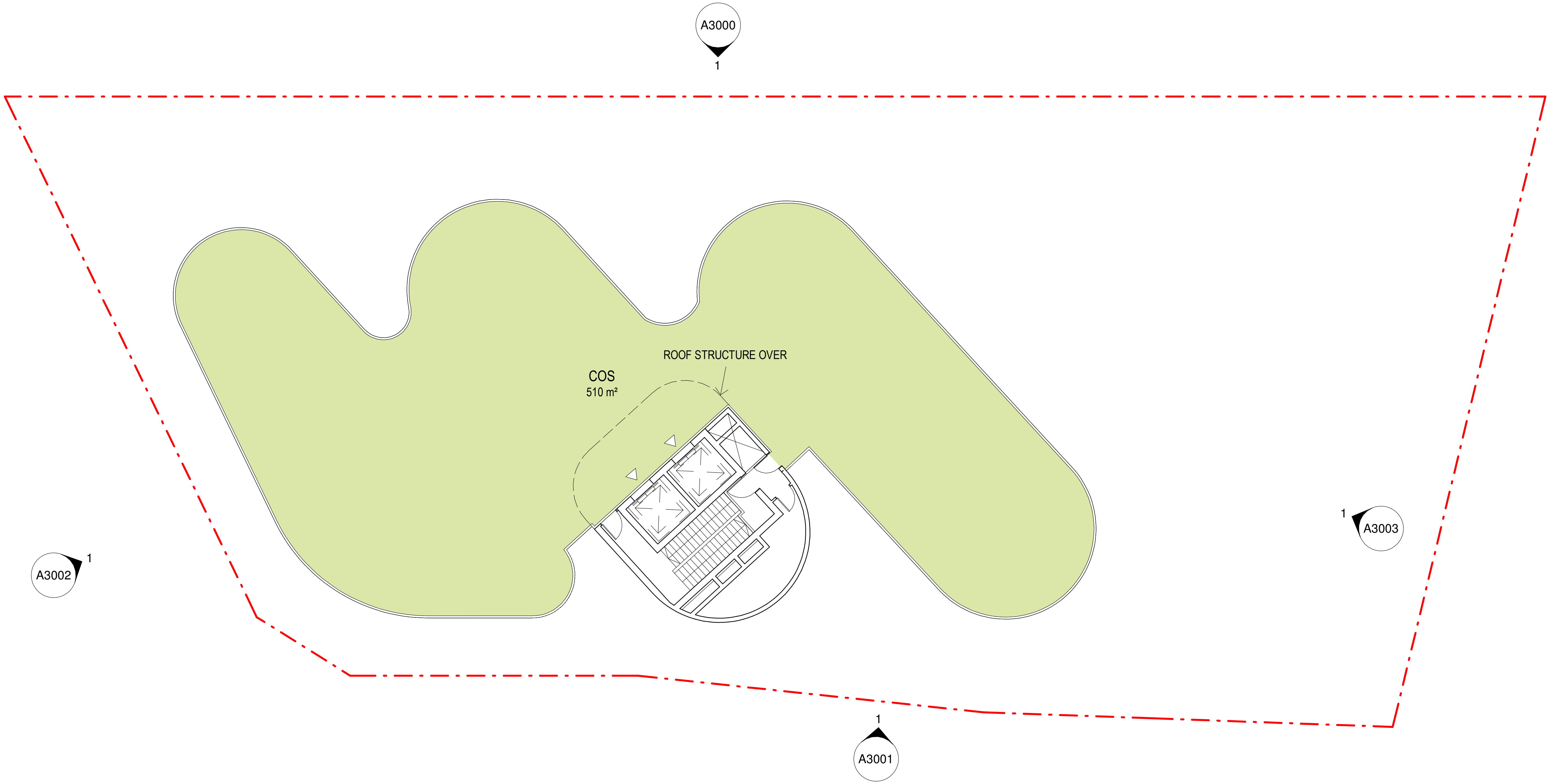
1 LEVEL 17

1 : 200

FOR Anka Property Group

DRAWING	NUMBER	REVISION	DATE	SCALE	
LEVEL 17	A2013		12/17/20	1 : 200@ A3	

EDGECLIFF TOWER

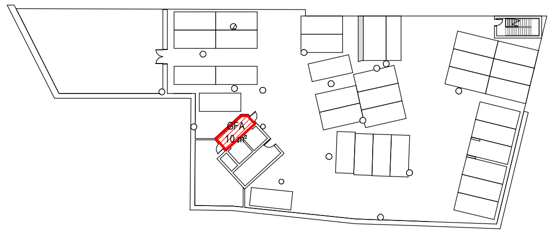


COS REQUIRED : 434 m2 (25% of 1738 m2)

FOR Anka Property Group

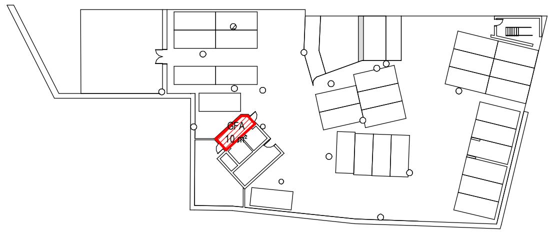
DRAWING	NUMBER	REVISION	DATE	SCALE
ROOF COS	A2014		17/12/20	1 : 200@ A3

EDGECLIFF TOWER



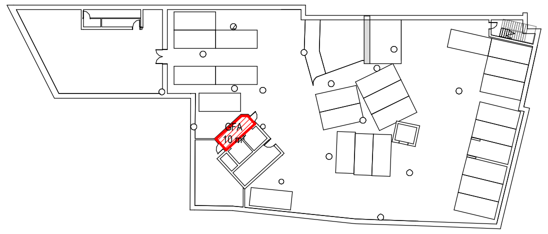
1 CAR PARK P3

1 : 1000



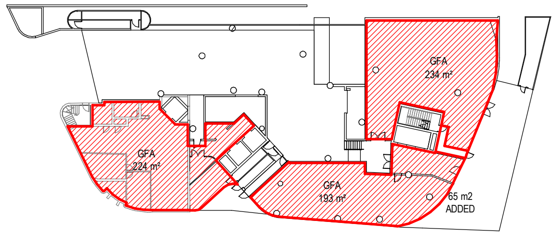
2 CAR PARK P2

1 : 1000



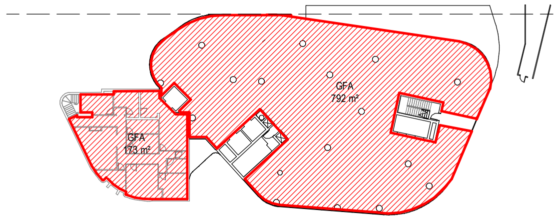
3 CAR PARK P1

1 : 1000



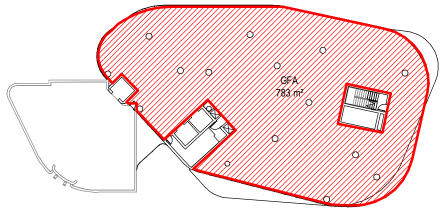
4 GROUND LEVEL

1 : 1000



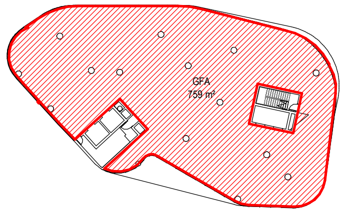
5 LEVEL 1

1 : 1000



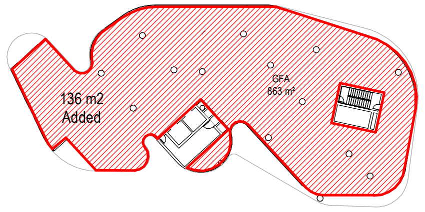
6 LEVEL 2

1 : 1000



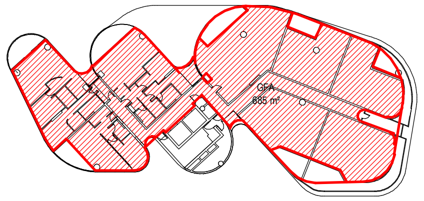
7 LEVEL 3

1 : 1000



8 LEVEL 4

1 : 1000



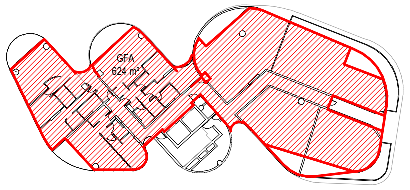
9 LEVEL 5

1 : 1000

Area Schedule (GFA)

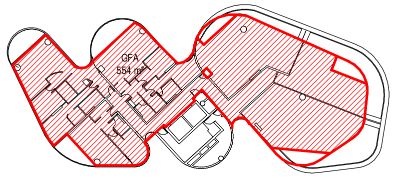
Area	Level
Not Placed	Not Placed
10 m²	CAR PARK P3
10 m²	CAR PARK P2
10 m²	CAR PARK P1
224 m²	GROUND LEVEL
193 m²	GROUND LEVEL
234 m²	GROUND LEVEL
792 m²	LEVEL 1
173 m²	LEVEL 1
783 m²	LEVEL 2
759 m²	LEVEL 3
863 m²	LEVEL 4
685 m²	LEVEL 5
624 m²	LEVEL 6
554 m²	LEVEL 7
452 m²	LEVEL 8
452 m²	LEVEL 9
452 m²	LEVEL 10
452 m²	LEVEL 11
452 m²	LEVEL 12
452 m²	LEVEL 13
452 m²	LEVEL 14
452 m²	LEVEL 15
452 m²	LEVEL 16
452 m²	LEVEL 17

10432 m²



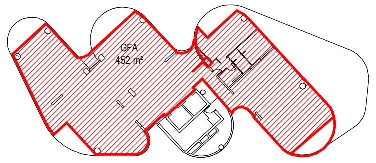
11 LEVEL 6

1 : 1000



10 LEVEL 7

1 : 1000



12 LEVEL 8-17

1 : 1000

FOR Anka Property Group

DRAWING
AREA PLANS - GFA

NUMBER
A2700

REVISION

DATE
08/25/20

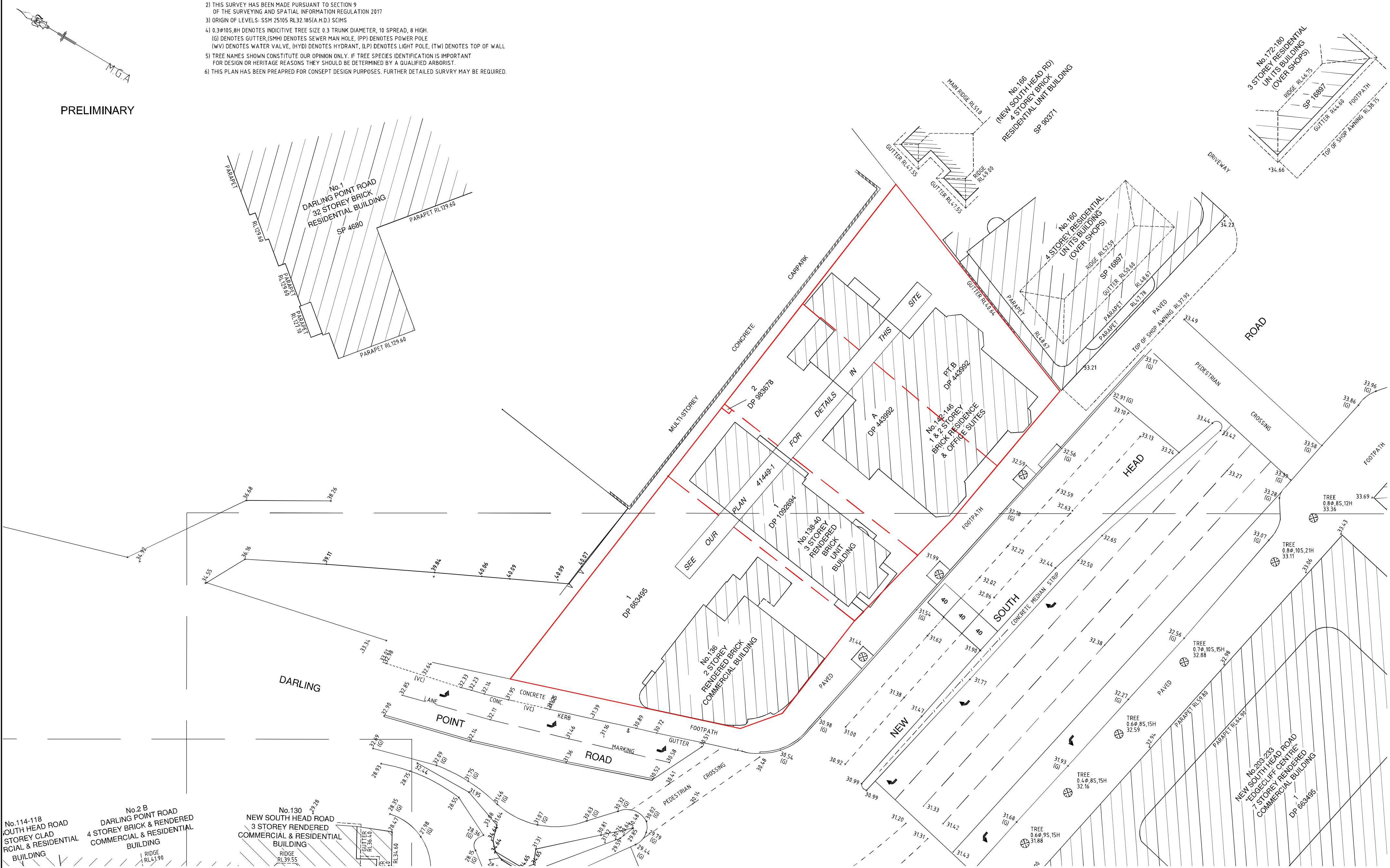
SCALE
1 : 1000@ A3

EDGECLIFF TOWER

NOTES:

1) TITLE BEARINGS AND DIMENSIONS ARE SHOWN.
2) THIS SURVEY HAS BEEN MADE PURSUANT TO SECTION 9
OF THE SURVEYING AND SPATIAL INFORMATION REGULATION 2017
3) ORIGIN OF LEVELS: SSM 25105 RL32.185(A.H.D.) SCIMS
4) 0.3Ø10S,8H DENOTES INDICITIVE TREE SIZE 0.3 TRUNK DIAMETER, 10 SPREAD, 8 HIGH.
(G) DENOTES GUTTER,(SMH) DENOTES SEWER MAN HOLE, (PP) DENOTES POWER POLE
(WV) DENOTES WATER VALVE, (HYD) DENOTES HYDRANT, (LP) DENOTES LIGHT POLE, (TW) DENOTES TOP OF WALL
5) TREE NAMES SHOWN CONSTITUTE OUR OPINION ONLY. IF TREE SPECIES IDENTIFICATION IS IMPORTANT
FOR DESIGN OR HERITAGE REASONS THEY SHOULD BE DETERMINED BY A QUALIFIED ARBORIST.
6) THIS PLAN HAS BEEN PREAPRED FOR CONSEPT DESIGN PURPOSES. FURTHER DETAILED SURVRY MAY BE REQUIRED.

PRELIMINARY



ISSUE	DATE	AMENDMENT

TITLE:
PLAN SHOWING DETAIL & LEVELS OVER PARTS OF
NEW SOUTH HEAD ROAD, EDGECLIFF

LGA: WOOLLAHRA
REFERENCE: 41449
CLIENT : ANKA PROPERTY GROUP
DATE: 17.07.20
SCALE (AT A1) 1:400
DATUM : AHD
SURVEYOR: MA
SHEET COM1

Norton Survey Partners
SURVEYORS & LAND TITLE CONSULTANTS
A.C.N. 618 980 475
SUITE 1
670 DARLING STREET
ROZELLE N.S.W. 2039
PH +61 2 9555 2744
office@nspartners.com.au

Appendix C

Field Work Results

Sampling Methods

Douglas Partners

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Soil Descriptions

Description and Classification Methods

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

Soil Types

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

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

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

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

The proportions of secondary constituents of soils are described as:

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

Definitions of grading terms used are:

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

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Descriptions

Soil Origin

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

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

Transported soils may be further subdivided into:

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

Rock Strength

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

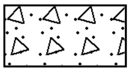
Symbols & Abbreviations

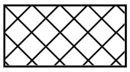
Graphic Symbols for Soil and Rock

General

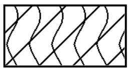
■ Asphalt

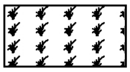

Road base

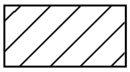

Concrete

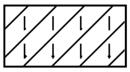

Filling

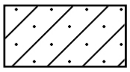
Soils


Topsoil

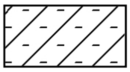

Peat

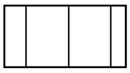

Clay

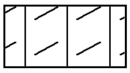

Silty clay

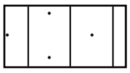

Sandy clay

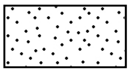

Gravelly clay

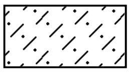

Shaly clay

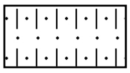

Silt


Clayey silt


Sandy silt

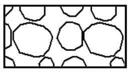

Sand

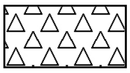

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

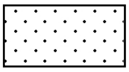

Talus

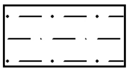
Sedimentary Rocks

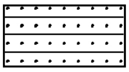

Boulder conglomerate

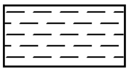

Conglomerate


Conglomeratic sandstone

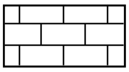

Sandstone


Siltstone

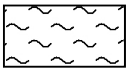

Laminite

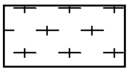

Mudstone, claystone, shale

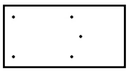
■ Coal


Limestone

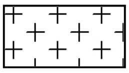
Metamorphic Rocks

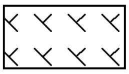

Slate, phyllite, schist

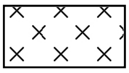

Gneiss

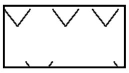

Quartzite

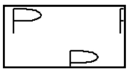
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

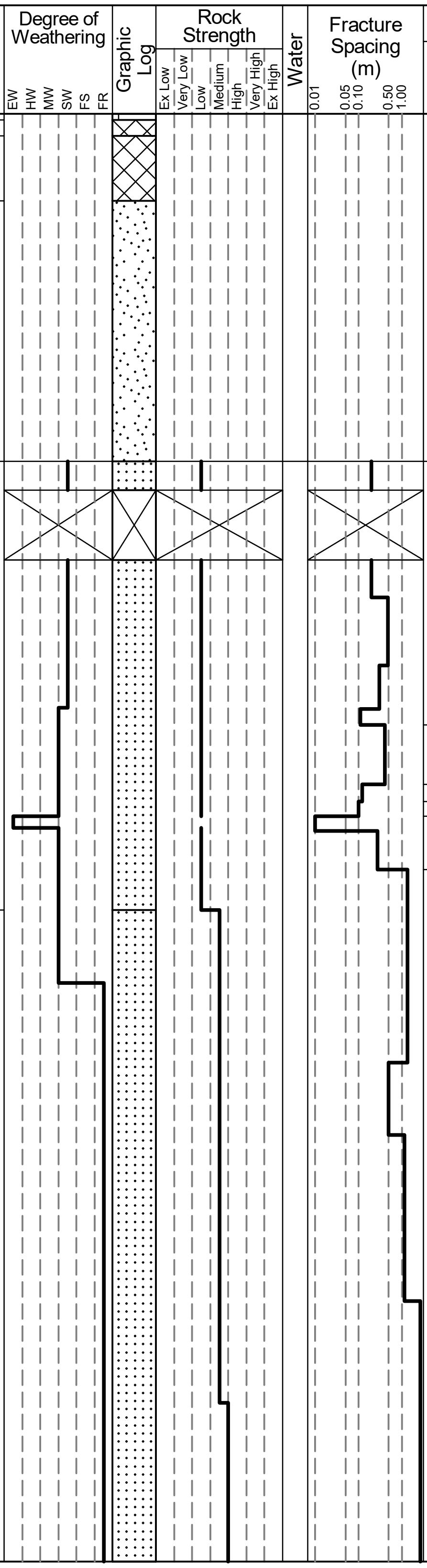
BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136 - 148 New South Head Road, Edgecliff

SURFACE LEVEL: 35.2 AHD
EASTING: 336829
NORTHING: 6249929
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 200333.01
DATE: 1-2-2021
SHEET 1 OF 2

Depth (m)	Description of Strata
0.04	CONCRETE PAVER: 40mm thick
0.15	FILL/SAND:medium, pale brown to brown, dry to moist, bedding sand
0.6	FILL/SAND: medium, brown to grey-brown, with ripped sandstone gravel, trace of igneous gravel, dry to moist, apparently moderately compacted
	SAND SP: medium, pale brown to brown, dry to moist, medium dense to dense, colluvial Below 1.8m: becoming pale brown to yellow, moist
2.4	SANDSTONE: medium grained, pale grey to pale brown, low strength, slightly weathered then moderately weathered, fractured, Hawkesbury Sandstone
3.08	4.85 to 4.93m: 80mm thick clay seam
5.5	SANDSTONE: medium grained, pale grey, 0-5% dark grey siltstone laminations, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone Below 8.9m: becoming medium to high strength
10.0	



Discontinuities

B - Bedding J - Joint
S - Shear F - Fault

- 2.6m: CORE LOSS: 480mm
- 3.34m: B, 0-10°, pl, ro, cly co
- 3.81m: J, 20-30°, pl, ro, cln
- 4.11m: B, 0-10°, pl, ro, cly co
- 4.22m: B, 0-10°, pl, ro, cly co
- 4.63m: J, 20-30°, pl, ro, cly co
- 4.75m: B, 0-10°, pl, ro, cly 20mm
- 4.85m: Cs, 80mm
- 5.22m: B, 0-10°, pl, ro, cly co
- 6.55m: B, 0-10°, pl, ro, cln
- 7.05m: B, 0-10°, pl, ro, cly co
- 8.2m: B, 0-10°, pl, ro, cly 20mm

Sampling & In Situ Testing

Type	Core Rec. %	RQD %	Test Results & Comments
A/E			PID = <1 ppm
A/E			PID = <1 ppm
A/E			PID = <1 ppm
A/E			PID = <1 ppm
C	100	100	PL(A) = 0.1
C	18	0	
			PL(A) = 0.2
C	100	70	PL(A) = 0.3
C	100	73	PL(A) = 0.2
			PL(A) = 0.8
C	100	100	
			PL(A) = 0.6
C	100	99	PL(A) = 0.6
C	100	100	PL(A) = 1
C	100	100	

RIG: Underpinner **DRILLER:** SS **LOGGED:** AT **CASING:** 100mm PVC to 2.4m
TYPE OF BORING: Auger (TC-Bit) to 2.4m, NMLC Coring to 18.00m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

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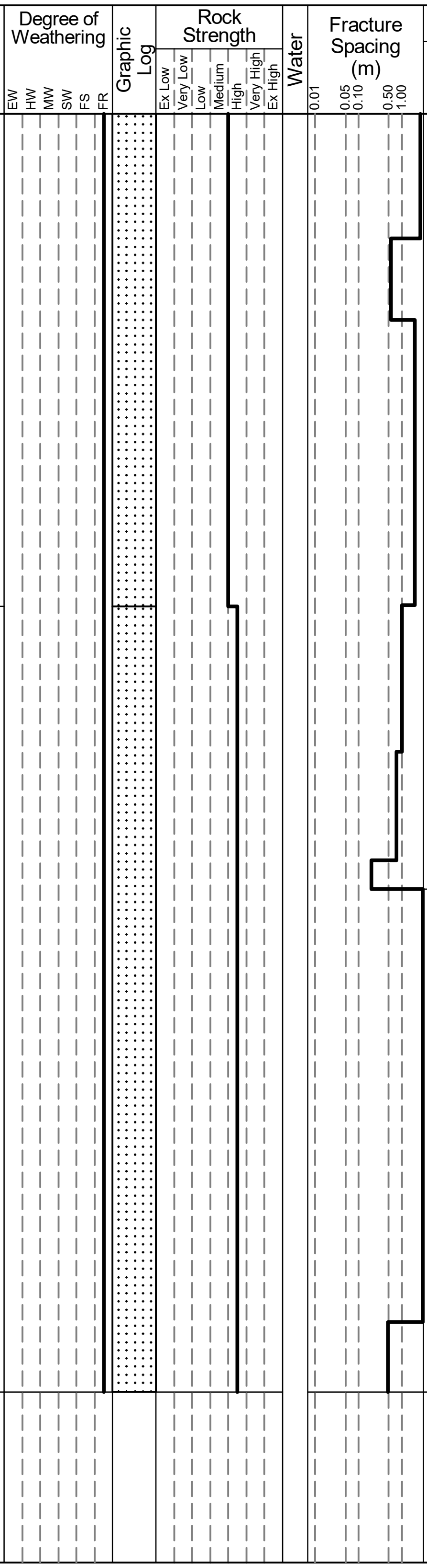
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136 - 148 New South Head Road, Edgecliff

SURFACE LEVEL: 35.2 AHD
EASTING: 336829
NORTHING: 6249929
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 200333.01
DATE: 1-2-2021
SHEET 2 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
25		SANDSTONE: medium grained, pale grey, 0-5% dark grey siltstone laminations, medium to high strength, fresh, unbroken, Hawkesbury Sandstone					PL(A) = 1.4
				C	100	100	
			10.86m: B, 0-10°, pl, ro, cly co				
	11						PL(A) = 0.9
24							
			11.42m: B, 0-10°, pl, ro, cly co				
	12			C	100	100	PL(A) = 1.2
23							
	13						PL(A) = 1
22							
	13.4	SANDSTONE: medium grained, pale grey, generally massive with siltstone flecks, high strength, fresh, unbroken, Hawkesbury Sandstone	13.39m: B, 0-10°, pl, ro, cly 10mm	C	100	100	
	14						PL(A) = 1
21							
			14.4m: J, 80°, pl, ro, cln				
	15			C	100	100	
20			15.15m: J, 80°, pl, ro, cln				
			15.35m: B, 0-10°, pl, ro, cly co				PL(A) = 1.5
	16						
19							PL(A) = 1.4
				C	100	100	
	17						
18							PL(A) = 1.9
				C	100	100	
	18						PL(A) = 1.7
17							
			18.34m: B, 0-10°, pl, ro, cly co				
	18.82	Bore discontinued at 18.82m					
	19						
16							

RIG: Underpinner **DRILLER:** SS **LOGGED:** AT **CASING:** 100mm PVC to 2.4m

TYPE OF BORING: Auger (TC-Bit) to 2.4m, NMLC Coring to 18.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH1 PROJECT: 200333.01 FEBRUARY 2021

2.40 – 7.00m

BORE: BH1 PROJECT: 200333.01 FEBRUARY 2021

7.00 – 12.00m

BORE: BH1 PROJECT: 200333.01 FEBRUARY 2021

12.00 – 17.00m

BORE: BH1 PROJECT: 200333.01 FEBRUARY 2021

17.00 – 19.00m

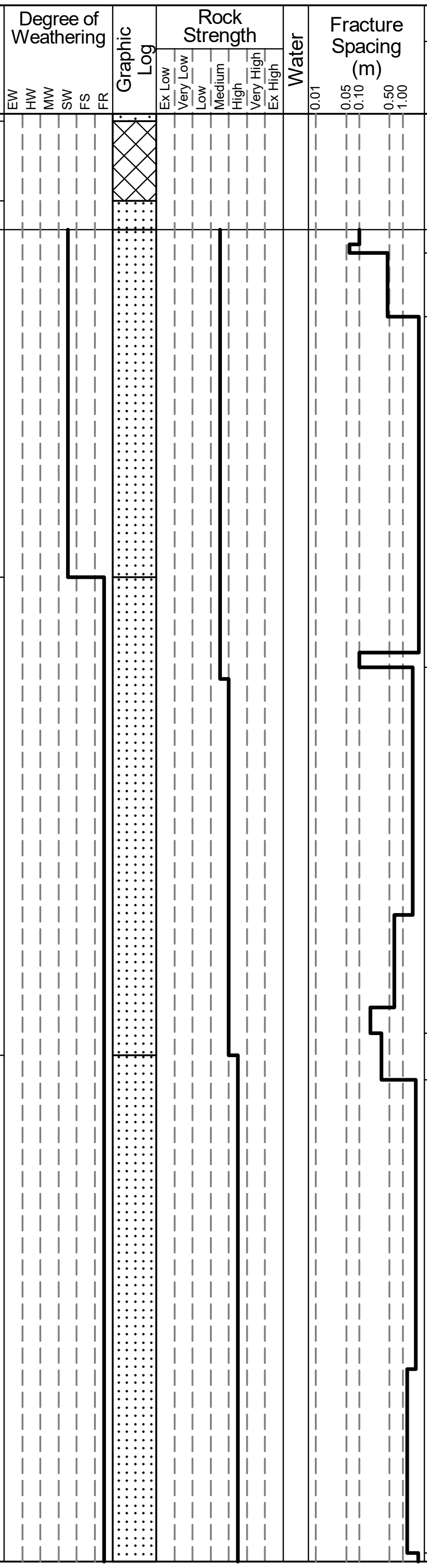
BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136 - 148 New South Head Road, Edgecliff

SURFACE LEVEL: 31.8 AHD
EASTING: 336810
NORTHING: 6249914
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 200333.01
DATE: 3-2-2021
SHEET 1 OF 2

Depth (m)	Description of Strata
0.05	CONCRETE SLAB: 50mm thick
0.6	FILL/SAND: medium, grey to brown, with ripped sandstone gravel and cobbles, dry to moist, apparently variably compacted
0.8	SANDSTONE: medium grained, pale grey and pale brown, apparently low strength,Hawkesbury Sandstone
	SANDSTONE: medium grained, pale grey and pale brown, medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone
3.2	SANDSTONE: medium grained, pale grey, 10-20% siltstone laminations, medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone
6.5	SANDSTONE: medium grained, pale grey, 10-20% siltstone laminations, high strength with some medium strength bands, fresh, slightly fractured to unbroken, Hawkesbury Sandstone
10.0	



Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)

- 0.9m: J, 45°, pl, ro, healed
- 0.96m: B, 0-10°, pl, ro, cly co
- 1.4m: B, 0-10°, pl, ro, cln
- 3.72m: B, 0-10°, pl, ro, cly co
- 3.82m: B, 0-10°, pl, ro, cly co
- 5.53m: B, 0-10°, pl, ro, cly co
- 6.17m: B, 0-10°, pl, ro, cly co
- 6.35m: B, 0-10°, pl, ro, cly co
- 6.67m: B, 0-10°, pl, ro, cly co
- 8.67m: B, 0-10°, pl, ro, cly co

Sampling & In Situ Testing

Type	Core Rec. %	RQD %	Test Results & Comments
A/E			PID = <1 ppm
A/E			PID = <1 ppm
C	100	94	PL(A) = 0.5
C	100	100	PL(A) = 0.6
C	100	100	PL(A) = 0.7 PL(A) = 0.9
C	100	100	PL(A) = 1.1
C	100	100	PL(A) = 0.6 PL(A) = 1.2
C	100	100	PL(A) = 1
C	100	100	PL(A) = 1.5

RIG: Underpinner **DRILLER:** SS **LOGGED:** AT **CASING:** 100mm PVC to 0.6m

TYPE OF BORING: Auger (TC-Bit) to 0.6m, Rotary to 0.8m, NMLC Coring to 18.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136 - 148 New South Head Road, Edgecliff

SURFACE LEVEL: 31.8 AHD
EASTING: 336810
NORTHING: 6249914
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 200333.01
DATE: 3-2-2021
SHEET 2 OF 2

Degree of Weathering: EW HW MW SW FS FR
Rock Strength: Ex Low, Very Low, Low, Medium, High, Very High, Ex High
Fracture Spacing (m): 0.01, 0.05, 0.10, 0.50, 1.00
Discontinuities: B - Bedding, J - Joint, S - Shear, F - Fault

Depth (m)	Description of Strata	Discontinuities	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: medium grained, pale grey, generally massive with siltstone flecks and clasts, high strength, fresh, unbroken, Hawkesbury Sandstone	9.94m: B, 0-10°, pl, ro, cly co	C	100	100	PL(A) = 1
11			C	100	100	PL(A) = 1
12		12.18m: B, 0-10°, pl, ro, fe stn	C	100	100	PL(A) = 1.9 PL(A) = 1.2
14			C	100	100	PL(A) = 1.4
15.0	Bore discontinued at 15.0m					

RL scale: 21, 20, 19, 18, 17, 16, 15, 14, 13, 12
Depth scale: 11, 12, 13, 14, 15, 16, 17, 18, 19

RIG: Underpinner **DRILLER:** SS **LOGGED:** AT **CASING:** 100mm PVC to 0.6m

TYPE OF BORING: Auger (TC-Bit) to 0.6m, Rotary to 0.8m, NMLC Coring to 18.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH2 PROJECT: 200333.01 FEBRUARY 2021

0.80 – 5.00m

BORE: BH2 PROJECT: 200333.01 FEBRUARY 2021

5.00 – 10.00m

BORE: BH2 PROJECT: 200333.01 FEBRUARY 2021

10.00 – 15.00m

BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136-148 New South Head Road, Edgecliff

SURFACE LEVEL: ~34^
EASTING: 336823
NORTHING: 6249915
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 200333.00
DATE: 3/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE SLAB: 10mm Terracotta Tile							
	0.18	FILL/SAND: medium, brown, trace fine igneous gravel, moist		E*	0.2 0.3		PID = <1 ppm		
		Below 0.5 m: grading to brown mottled grey		E	0.5 0.6		PID = <1 ppm		
	1			E	1.0 1.1		PID = <1 ppm		1
	1.3	SAND SP: medium, yellow, moist, aeolian							
				E	1.5 1.6		PID = <1 ppm		
	1.8	Bore discontinued at 1.8m Target depth achieved							

RIG: Hand Tools **DRILLER:** JH **LOGGED:** JH **CASING:** Uncased

TYPE OF BORING: Concrete core to 0.18 m, hand auger to 1.8 m.

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Blind replicate BD1/20210203 at 0.2 to 0.3 m, ^Surface levels interpolated from survey drawing, Coordinates estimated from georeferenced site plan

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136-148 New South Head Road, Edgecliff

SURFACE LEVEL: ~34.5^
EASTING: 336820
NORTHING: 6249935
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 200333.00
DATE: 3/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Well Construction Details
		BRICK PAVER							
	0.07	FILL/SAND: medium to coarse, brown mottled orange, trace white fine sandstone and fine igneous gravel, moist		E	0.1 0.2		PID = <1 ppm		
	0.6	SAND SP: medium, yellow mottled red, trace sandstone gravel, moist, aeolian		E	0.6 0.7		PID = <1 ppm		
	0.7	Bore discontinued at 0.7m Refusal on inferred sandstone							
	1								1

RIG: Hand Tools **DRILLER:** JH **LOGGED:** JH **CASING:** Uncased

TYPE OF BORING: Concrete core to 0.07 m, hand auger to 0.7 m.

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Surface levels interpolated from survey drawings, Coordinates estimated from georeferenced site plan

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136-148 New South Head Road, Edgecliff

SURFACE LEVEL: 32.7^
EASTING: 336810
NORTHING: 6249930
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 200333.00
DATE: 3/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Well Construction Details
	0.01	ASPHALTIC CONCRETE							
	0.15	FILL/SAND: medium, yellow, trace sandstone and asphaltic concrete, moist		E	0.05 0.15		PID = <1 ppm		
	0.45	FILL/SAND: medium, pale grey, trace clay and sandstone gravel, moist		E	0.3 0.4		PID = <1 ppm		
		Bore discontinued at 0.45m Refusal on inferred sandstone							
	1								1

RIG: Hand Tools **DRILLER:** JH **LOGGED:** JH **CASING:** Uncased

TYPE OF BORING: Concrete core to 0.01 m, hand auger to 0.45 m.

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Surface levels interpolated from survey drawings, Coordinates estimated from georeferenced site plan

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136-148 New South Head Road, Edgecliff

SURFACE LEVEL: 32.7^
EASTING: 336803
NORTHING: 6249933
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 200333.00
DATE: 3/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details
				Type	Depth	Sample	Results & Comments		
	0.01	ASPHALTIC CONCRETE	■						
		FILL/SAND: medium, yellow, trace fine to medium igneous gravel, moist	▨	E*	0.1 0.2		PID = <1 ppm		
	0.2	FILL/SAND: medium, pale grey, trace clay and sandstone gravel, moist Below 0.3 m: grading to red mottled pale grey, with sandstone gravel	▨	E	0.3 0.4		PID = <1 ppm		
	0.4	Bore discontinued at 0.4m Refusal on inferred sandstone							
	1								1

RIG: Hand Tools **DRILLER:** JH **LOGGED:** JH **CASING:** Uncased

TYPE OF BORING: Concrete core to 0.01 m, hand auger to 0.4 m.

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Blind replicate BD2/20210203 at 0.1 to 0.2 m, ^Surface levels interpolated from survey drawings, Coordinates estimated from georeferenced site plan

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Edgecliff Central Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 136-148 New South Head Road, Edgecliff

SURFACE LEVEL: 32.8^
EASTING: 336794
NORTHING: 6249938
DIP/AZIMUTH: 90°/--

BORE No: BH7
PROJECT No: 200333.00
DATE: 3/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		ASPHALTIC CONCRETE	■						
	0.04	FILL/Gravelly SAND: medium, brown mottled black, medium igneous gravel, trace asphaltic concrete, moist	▨	E	0.05 0.15		PID = 1 ppm		
	0.15	FILL/SAND: medium, yellow mottled pale grey, trace clay, moist Below 0.3 m: grading to pale grey, with sandstone gravel	▨	E	0.4 0.5		PID = <1 ppm		
	0.6	Bore discontinued at 0.6m Refusal on inferred sandstone							
	1								1

RIG: Hand Tools **DRILLER:** JH **LOGGED:** JH **CASING:** Uncased
TYPE OF BORING: Concrete core to 0.04 m, hand auger to 0.6 m.
WATER OBSERVATIONS: No free groundwater observed
REMARKS: ^Surface levels interpolated from survey drawings, Coordinates estimated from georeferenced site plan

SAMPLING & IN SITU TESTING LEGEND

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

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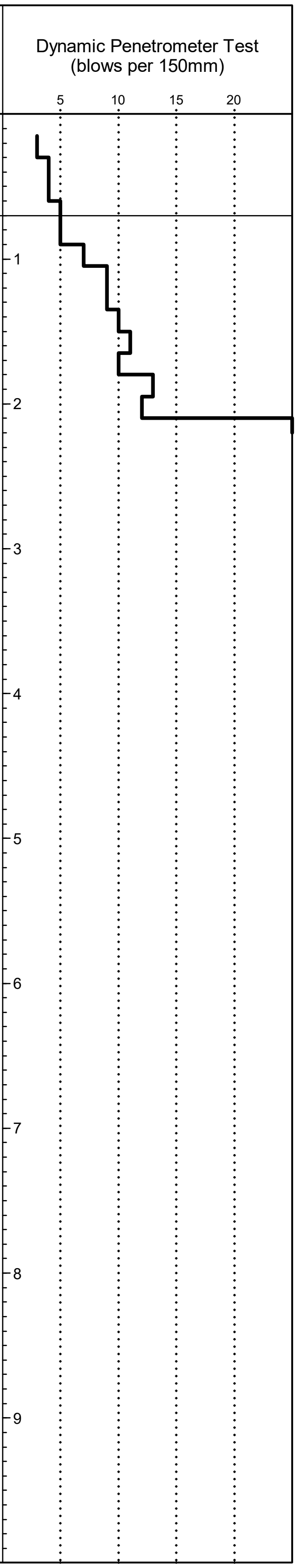
TEST PIT LOG

CLIENT: Anka Property Group
PROJECT: Proposed Mixed Use Development
LOCATION: 136 - 148 New South Head Road, Edgecliff

SURFACE LEVEL: 35.2 AHD
EASTING: 336830
NORTHING: 6249933

PIT No: TP1
PROJECT No: 200333.01
DATE: 1-2-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water
35	0.1	Concrete Slab: 100mm thick						
	0.5	FILL/SAND SP: medium, brown, with brick fragments and sandstone gravels, moderately compacted, dry to moist						
	0.7	SAND SP: medium, yellow to pale brown, moist, medium dense to dense, colluvial						
		Pit discontinued at 0.7m						



RIG: Hand tools **LOGGED:** AT **SURVEY DATUM:** MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed during excavation

REMARKS: Refer to Drawing 4 for further footing exposure details, DPT test undertaken from below concrete

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
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Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
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96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
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Results of Dynamic Penetrometer Tests

Client Edgecliff Central Pty Ltd
Project Proposed Mixed Use Development
Location 136 – 148 New South Head Road, Edgecliff

Project No. 200333.01
Date 01/02/2021
Page No. 1 of 1

Test Locations	BH1	BH2	TP1							
RL of Test (AHD)	35.2	31.8	35.2							
Depth (m)	**Penetration Resistance** Blows/150 mm									
0.00 – 0.15	-	-	-							
0.15 – 0.30	2	25	3							
0.30 – 0.45	4	13	4							
0.45 – 0.60	4	25/130	4							
0.60 – 0.75	6		5							
0.75 – 0.90	7		5							
0.90 – 1.05	8		7							
1.05 – 1.20	9		9							
1.20 – 1.35	10		9							
1.35 – 1.50	12		10							
1.50 – 1.65	11		11							
1.65 – 1.80	10		10							
1.80 – 1.95	11		13							
1.95 – 2.10	13		12							
2.10 – 2.25	13		25/100							
2.25 – 2.40	25/130									
2.40 – 2.55										
2.55 – 2.70										
2.70 – 2.85										
2.85 – 3.00										
3.00 – 3.15										
3.15 – 3.30										
3.30 – 3.45										
3.45 – 3.60										

Test Method AS 1289.6.3.2, Cone Penetrometer ☐
AS 1289.6.3.3, Sand Penetrometer ■

Tested By AT
Checked By RCB

Remarks Ref = Refusal, 25/130 indicates 25 blows for 130 mm penetration

Appendix D

Laboratory Test Results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200   fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 261518

Client Details

Client	Douglas Partners Pty Ltd
Attention	Ray Blinman
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**200333.01, Edgecliff**
Number of Samples	2 Soil
Date samples received	11/02/2021
Date completed instructions received	11/02/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	18/02/2021
Date of Issue	18/02/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Soil Aggressivity			
Our Reference		261518-1	261518-2
Your Reference	UNITS	BH1 2.0-2.1	BH2 0.1-0.2
Date Sampled		01/02/2021	03/02/2021
Type of sample		Soil	Soil
pH 1:5 soil:water	pH Units	8.5	7.8
Electrical Conductivity 1:5 soil:water	µS/cm	51	140
Chloride, Cl 1:5 soil:water	mg/kg	10	32
Sulphate, SO4 1:5 soil:water	mg/kg	<10	90

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

Client Reference: 200333.01, Edgecliff

QUALITY CONTROL: Soil Aggressivity					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	8.5	8.4	1	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	51	52	2	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	10	<10	0	99	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	<10	0	87	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

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

Report Comments

pH/EC

Samples were out of the recommended holding time for this analysis.

Appendix E

EI Australia Pty Ltd Borehole Logs

BOREHOLE LOG

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BH NO. 1M

Project	Proposed Residential Development	**Sheet**	1 of 3
Location	136 New South Head Road, Edgecliff NSW	**Date Started**	04/02/2019
Position	Refer to Figure 2	**Date Completed**	04/02/2019
Job No.	E24119.G03	**Logged By** AA	**Date** 04/02/2019
Client	Edgecliff Prime Pty Ltd	**Reviewed By** NJ	**Date** 07/03/2018

Drilling Contractor	Geosense Drilling Pty Ltd	**Surface RL**	≈32.70 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

Drilling					**Sampling**	**Field Material Description**						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0	*0.10* 32.60				-	ASPHALT; 100 mm thick.	-		PAVEMENT
			1		BH1M_0.5-1.0 DS			CI	Sandy CLAY; medium plasticity, pale grey, grading into extremely weathered sandstone material.	M (>PL)	-	RESIDUAL SOIL
	L		2	*2.00* 30.70 *2.30*	BH1M_2.0-2.3 DS			-	SANDSTONE; fine to medium grained, pale grey, very low strength.			BEDROCK
			3						Continued as Cored Borehole			
			4									
			5									
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 1M

Project	Proposed Residential Development	**Sheet**	2 OF 3
Location	136 New South Head Road, Edgecliff NSW	**Date Started**	04/02/2019
Position	Refer to Figure 2	**Date Completed**	04/02/2019
Job No.	E24119.G03	**Logged By** AA	**Date** 04/02/2019
Client	Edgecliff Prime Pty Ltd	**Reviewed By** NJ	**Date** 07/03/2018

Drilling Contractor	Geosense Drilling Pty Ltd	**Surface RL**	≈32.70 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) 30 100 300 1000 3000
				0 – 2.30	*2.30*		Continuation from non-cored borehole				
NMLC	90% RETURN	100	65	2.30	30.40		SANDSTONE; medium grained, grey-brown, wth iron staining.	DW		2.80: BP, 0°, Fe SN, PR, RF	
				3.48	29.22		From 3.48 to 4.3 m, coarse grained, grey-brown, with iron staining.			3.46: BP, 0°, Fe SN, PR, RF 3.86: BP, 0°, PR, RF 4.16: BP, 10°, Fe SN, PR, RF 4.24: BP, 0°, Fe SN, PR, RF	
				4.30	28.40		From 4.3 to 5.46 m, medium grained, grey.			4.80: BPx2, 5°, PR, RF 4.84-5.37: JT, 65°, PR, RF	
			81	5.46	27.24		From 5.46 to 7.06 m, medium grained, grey.	SW			
				7.06	25.64		From 7.06 to 11.54 m, coarse grained, grey.	FR		7.04: SM, Clay, <1 mm 7.10: SM, Clay, 20 mm	
			203								
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 1M

Project	Proposed Residential Development	**Sheet**	3 OF 3
Location	136 New South Head Road, Edgecliff NSW	**Date Started**	04/02/2019
Position	Refer to Figure 2	**Date Completed**	04/02/2019
Job No.	E24119.G03	**Logged By** AA	**Date** 04/02/2019
Client	Edgecliff Prime Pty Ltd	**Reviewed By** NJ	**Date** 07/03/2018

Drilling Contractor	Geosense Drilling Pty Ltd	**Surface RL**	≈32.70 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) 30 100 300 1000 3000
NMLC	90% RETURN	100	38	10 11 12	*12.65* 20.05		SANDSTONE; medium grained, grey-brown, wth iron staining.	FR		10.23: BP, 5°, PR, RF 11.23: SM, Clay, 10 mm	
				13 14 15 16 17 18 19 20			Hole Terminated at 12.65 m				

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

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CORE PHOTOGRAPH OF BOREHOLE: 1M

Project	Proposed Residential Development	**East**	336810.4	**Depth Range**	2.3m to 12.65m BEGL		
Location	136 New South Head Road, Edgecliff NSW	**North**	6249929.7	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 32.7m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24119.G03	**Inclination**	-90°	**Logged**	AA	**Date**	04 / 02 / 2019
Client	Edgecliff Prime Pty Ltd	**Box**	1 of 3	**Checked**	NJ	**Date**	08 / 03 / 2019

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CORE PHOTOGRAPH OF BOREHOLE: 1M

Project	Proposed Residential Development	**East**	336810.4	**Depth Range**	2.3m to 2.65m BEGL		
Location	136 New South Head Road, Edgecliff NSW	**North**	6249929.7	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 32.7m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24119.G03	**Inclination**	-90°	**Logged**	AA	**Date**	04 / 02 / 2019
Client	Edgecliff Prime Pty Ltd	**Box**	2-3 of 3	**Checked**	NJ	**Date**	08 / 03 / 2019

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BOREHOLE LOG

BH NO. 6M

Project	Proposed Residential Development	**Sheet**	1 of 3
Location	136 New South Head Road, Edgecliff NSW	**Date Started**	04/02/2019
Position	Refer to Figure 2	**Date Completed**	04/02/2019
Job No.	E24119.G03	**Logged By** AA	**Date** 04/02/2019
Client	Edgecliff Prime Pty Ltd	**Reviewed By** NJ	**Date** 07/03/2018

Drilling Contactor	Geosense Drilling Pty Ltd	**Surface RL**	≈32.80 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0	*0.10* 32.70				-	ASPHALT; 100 mm thick.	-		PAVEMENT
				0.30 32.50	BH6M_0.3-0.5 DS			-	FILL: SAND; coarse grained, pale brown-black, with some sub-angular sandstone gravel.	M		FILL
								SC	Clayey SAND; medium grained, pale brown.	-		RESIDUAL SOIL
			1 2	*0.80* 32.00	BH6M_0.8-1.5 DS			CI	Sandy CLAY; medium plasticity, pale brown-grey, grading into extremely weathered sandstone material.	M (>PL)	-	
	L		3	*3.00* 29.80				-	SANDSTONE; pale brown, very low strength.	-		BEDROCK
			4 5 6 7 8 9 10	*3.80*					Continued as Cored Borehole			

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 6M

Project	Proposed Residential Development	**Sheet**	2 OF 3
Location	136 New South Head Road, Edgecliff NSW	**Date Started**	04/02/2019
Position	Refer to Figure 2	**Date Completed**	04/02/2019
Job No.	E24119.G03	**Logged By** AA	**Date** 04/02/2019
Client	Edgecliff Prime Pty Ltd	**Reviewed By** NJ	**Date** 07/03/2018

Drilling Contactor	Geosense Drilling Pty Ltd	**Surface RL**	≈32.80 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) 30 100 300 1000 3000
				0 – 3.80	*3.80*		Continuation from non-cored borehole				
NMLC	90% RETURN	100	75	3.80	29.00		SANDSTONE; medium grained, pale grey-brown, with iron staining.	DW		4.10: BP, 0°, Fe SN, PR, RF 4.18: BP, 0°, Fe SN, PR, RF 4.38: SM, Clay, 10 mm 4.72: BP, 10°, PR, RF 4.90: BP, 10°, PR, RF	
				5.00	*5.00* 27.80		From 5.0 to 5.5 m, coarse grained, pale grey-brown, with iron staining, carbonous laminations.				
			87	5.50	*5.50* 27.30		From 5.5 to 13.0 m, coarse grained, pale grey.	SW		5.50-5.53: CS, Clay, 30 mm 7.00: SM, Clay, 10 mm	
								FR		7.18: BP, 10°, PR, RF 8.20: SM, Clay, 10 mm	
			83	10						9.30: BPx2, 0°, PR, RF	

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 6M

Project	Proposed Residential Development	**Sheet**	3 OF 3
Location	136 New South Head Road, Edgecliff NSW	**Date Started**	04/02/2019
Position	Refer to Figure 2	**Date Completed**	04/02/2019
Job No.	E24119.G03	**Logged By** AA	**Date** 04/02/2019
Client	Edgecliff Prime Pty Ltd	**Reviewed By** NJ	**Date** 07/03/2018

Drilling Contractor	Geosense Drilling Pty Ltd	**Surface RL**	≈32.80 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) 30 100 300 1000 3000
NMLC	90% RETURN		83	10 – 11			SANDSTONE; medium grained, pale grey-brown, with iron staining.	FR			
		84		12						12.00: SM, Clay, 20 mm 12.27: SM, Clay, 20 mm 12.30: SM, Clay, 20 mm	
				13	*13.00* 19.80		Hole Terminated at 13.00 m				
				14 – 20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: 6M

Project	Proposed Residential Development	**East**	336793.4	**Depth Range**	3.8m to 13.0m BEGL		
Location	136 New South Head Road, Edgecliff NSW	**North**	6249936.9	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 32.8m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24119.G03	**Inclination**	-90°	**Logged**	AA	**Date**	04 / 02 / 2019
Client	Edgecliff Prime Pty Ltd	**Box**	1 of 3	**Checked**	NJ	**Date**	08 / 03 / 2019

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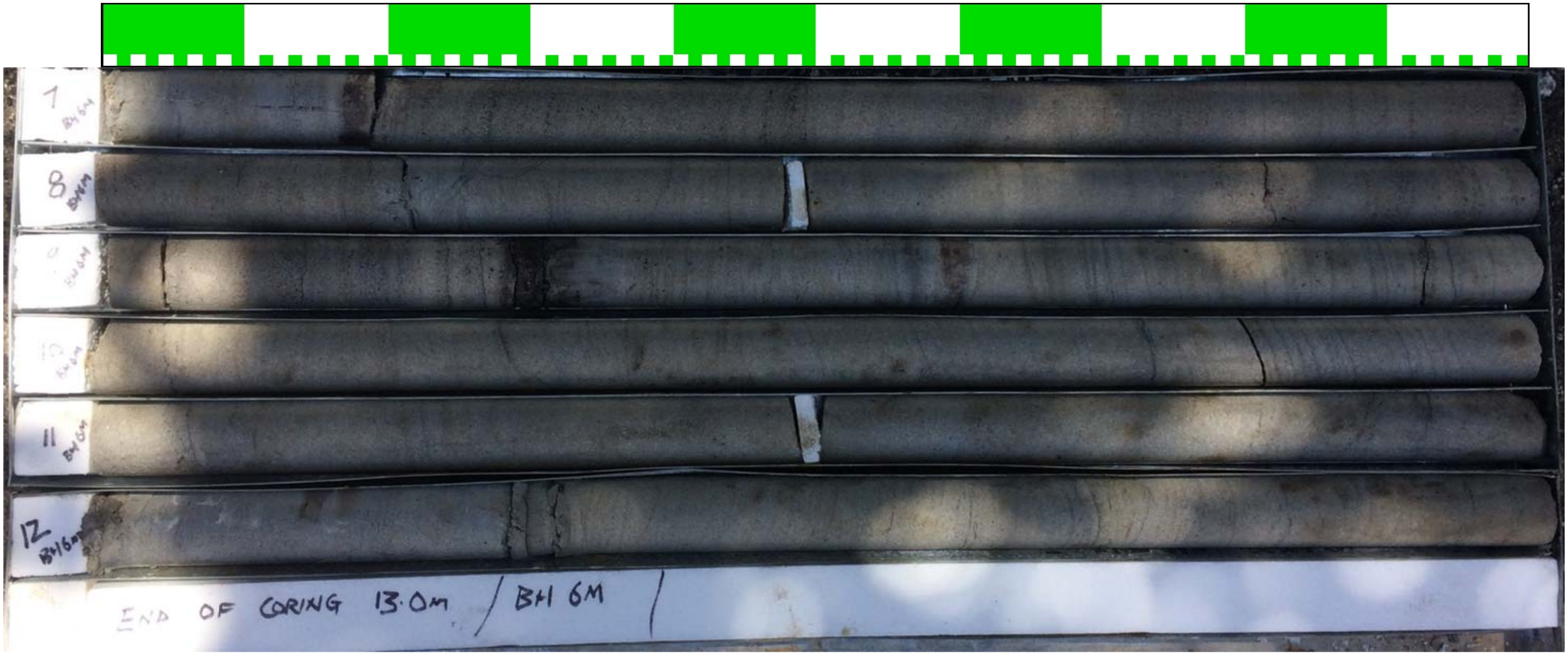
CORE PHOTOGRAPH OF BOREHOLE: 6M

Project	Proposed Residential Development	**East**	336793.4	**Depth Range**	3.8m to 13.0m BEGL		
Location	136 New South Head Road, Edgecliff NSW	**North**	6249936.9	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 32.8m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24119.G03	**Inclination**	-90°	**Logged**	AA	**Date**	04 / 02 / 2019
Client	Edgecliff Prime Pty Ltd	**Box**	2-3 of 3	**Checked**	NJ	**Date**	08 / 03 / 2019



EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT LOGS

DRILLING/EXCAVATION METHOD

HA	Hand Auger	**ADH**	Hollow Auger	**NQ**	Diamond Core - 47 mm
DT	Diatube Coring	**RT**	Rotary Tricone bit	**NMLC**	Diamond Core - 52 mm
NDD	Non-destructive digging	**RAB**	Rotary Air Blast	**HQ**	Diamond Core - 63 mm
AD*	Auger Drilling	**RC**	Reverse Circulation	**HMLC**	Diamond Core - 63 mm
***V**	V-Bit	**PT**	Push Tube	**EX**	Tracked Hydraulic Excavator
***T**	TC-Bit, e.g. AD/T	**WB**	Washbore	**HAND**	Excavated by Hand Methods

PENETRATION RESISTANCE

L	**Low Resistance**	Rapid penetration/ excavation possible with little effort from equipment used.
M	**Medium Resistance**	Penetration/ excavation possible at an acceptable rate with moderate effort from equipment used.
H	**High Resistance**	Penetration/ excavation is possible but at a slow rate and requires significant effort from equipment used.
R	**Refusal/Practical Refusal**	No further progress possible without risk of damage or unacceptable wear to equipment used.

These assessments are subjective and are dependent on many factors, including equipment power and weight, condition of excavation or drilling tools and experience of the operator.

WATER

▽ **Standing Water Level**	◁ **Partial water loss**
▷ **Water Seepage**	◀ **Complete Water Loss**

GWNO	GROUNDWATER NOT OBSERVED - Observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave-in of the borehole/ test pit.
GWNE	GROUNDWATER NOT ENCOUNTERED - Borehole/ test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/ test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following a 150mm seating drive
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported, N is not reported
RW	Penetration occurred under the rod weight only, N<1
HW	Penetration occurred under the hammer and rod weight only, N<1
HB	Hammer double bouncing on anvil, N is not reported
Sampling	
DS	Disturbed Sample
ES	Sample for environmental testing
BDS	Bulk disturbed Sample
GS	Gas Sample
WS	Water Sample
U50	Thin walled tube sample - number indicates nominal sample diameter in millimetres
Testing	
FP	Field Permeability test over section noted
FVS	Field Vane Shear test expressed as uncorrected shear strength (sv= peak value, sr= residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket Penetrometer test expressed as instrument reading in kPa
WPT	Water Pressure tests
DCP	Dynamic Cone Penetrometer test
CPT	Static Cone Penetration test
CPTu	Static Cone Penetration test with pore pressure (u) measurement

GEOLOGICAL BOUNDARIES

————————	= Observed Boundary (position known)
– –––––––––––	= Observed Boundary (position approximate)
– –?– –?– –?– –	= Boundary (interpreted or inferred)

ROCK CORE RECOVERY

TCR=Total Core Recovery (%)

$$= \frac{Length\ of\ core\ recovered}{Length\ of\ core\ run} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum Axial\ lengths\ of\ core > 100mm}{Length\ of\ core\ run} \times 100$$

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT LOGS

▩	FILL	▦	ORGANIC SOILS (OL, OH or Pt)	☰	CLAY (CL, CI or CH)
⬡	COUBLES or BOULDERS	▨	SILT (ML or MH)	⁘	SAND (SP or SW)
○	GRAVEL (GP or GW)		Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay		

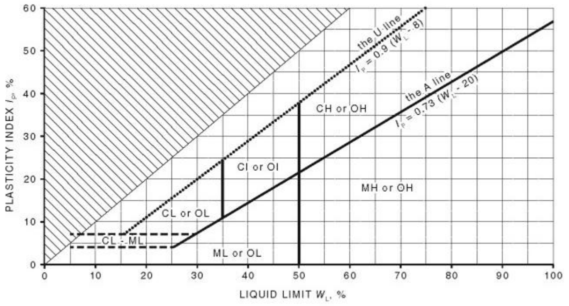
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS 1726:2017, Section 6.1 – Soil description and classification.

PARTICLE SIZE CHARACTERISTICS

Fraction	Components	Sub Division	Size mm
Oversize	BOULDERS		>200
	COBBLES		63 to 200
Coarse grained soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine grained soil	SILT		0.002 to 0.075
	CLAY		<0.002

PLASTICITY PROPERTIES



GROUP SYMBOLS

Major Divisions		Symbol	Description
COARSE GRAINED SOILS More than 65% of soil excluding oversize fraction is greater than 0.075mm	**GRAVEL** More than 50% of coarse fraction is >2.36mm	GW	Well graded gravel and gravel-sand mixtures, little or no fines, no dry strength.
		GP	Poorly graded gravel and gravel-sand mixtures, little or no fines, no dry strength.
		GM	Silty gravel, gravel-sand-silt mixtures, zero to medium dry strength.
		GC	Clayey gravel, gravel-sand-clay mixtures, medium to high dry strength.
	SAND More than 50% of coarse fraction is <2.36 mm	SW	Well graded sand and gravelly sand, little or no fines, no dry strength.
		SP	Poorly graded sand and gravelly sand, little or no fines, no dry strength.
		SM	Silty sand, sand-silt mixtures, zero to medium dry strength.
		SC	Clayey sand, sandy-clay mixtures, medium to high dry strength.
FINE GRAINED SOILS More than 35% of soil excluding oversized fraction is less than 0.075mm	Liquid Limit less < 50%	ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands, zero to medium dry strength.
		CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, medium to high dry strength.
		OL	Organic silts and organic silty clays of low plasticity, low to medium dry strength.
	Liquid Limit > than 50%	MH	Inorganic silts of high plasticity, high to very high dry strength.
		CH	Inorganic clays of high plasticity, high to very high dry strength.
		OH	Organic clays of medium to high plasticity, medium to high dry strength.
Highly Organic soil		PT	Peat muck and other highly organic soils.

MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Non- cohesive and free-running.
M	Moist	Soils feel cool, darkened in colour. Soil tends to stick together.
W	Wet	Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling.

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit (w < PL); Moist, near plastic limit (w ≈ PL); Moist, wet of plastic limit (w < PL); Wet, near liquid limit (w ≈ LL), Wet, wet of liquid limit (w > LL),

CONSISTENCY

Symbol	Term	Undrained Shear Strength (kPa)	SPT "N" #
VS	Very Soft	≤ 12	≤ 2
S	Soft	>12 to ≤ 25	>2 to ≤ 4
F	Firm	>25 to ≤ 50	>4 to 8
St	Stiff	>50 to ≤ 100	>8 to 15
VSt	Very Stiff	>100 to ≤ 200	>15 to 30
H	Hard	>200	>30
Fr	Friable	-	

DENSITY

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	≤ 15	0 to 4
L	Loose	>15 to ≤ 35	4 to 10
MD	Medium Dense	>35 to ≤ 65	10 to 30
D	Dense	>65 to ≤ 85	30 to 50
VD	Very Dense	>85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.
SPT correlations are not stated in AS1726:2017, and may be subject to corrections for overburden pressure, moisture content of the soil, and equipment type.

MINOR COMPONENTS

Term	Assessment Guide	Proportion by Mass
Add 'Trace'	Presence just detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: ≤ 5% Fine grained soil: ≤ 15%
Add 'With'	Presence easily detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: 5 - 12% Fine grained soil: 15 - 30%
Prefix soil name	Presence easily detectable by feel or eye in conjunction with the general properties of primary component	Coarse grained soils: >12% Fine grained soil: >30%

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TERMS FOR ROCK MATERIAL STRENGTH AND WEATHERING

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL STRENGTH CLASSIFICATION

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa) #	Field Guide
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

# **Rock Strength Test Results**	▼	Point Load Strength Index, $Is_{(50)}$, Axial test (MPa)
	●	Point Load Strength Index, $Is_{(50)}$, Diametral test (MPa)

Relationship between rock strength test result ($Is_{(50)}$) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. However UCS is typically 20 x $Is_{(50)}$.

ROCK MATERIAL WEATHERING CLASSIFICATION

Symbol		Term	Field Guide
RS		Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
XW		Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW		
SW		Slightly Weathered	Rock slightly discoloured but shows little or no change of strength relative to fresh rock.
FR		Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

DETAILED ROCK DEFECT SPACING

Defect Spacing

Term	Description
Massive	No layering apparent
Indistinct	Layering just visible; little effect on properties
Distinct	Layering (bedding, foliation, cleavage) distinct; rock breaks more easily parallel to layering

Bedding Thickness (Stratification)

Term	Spacing (mm)
Thinly laminated	<6
Laminated	6 – 20
Very thinly bedded	20 – 60
Thinly bedded	60 – 200
Medium bedded	200 – 600
Thickly bedded	600 – 2,000
Very thickly bedded	> 2,000

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES

Defect Type	Abbr.	Description
Joint	JT	Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water or soil or rock substance, which acts as cement.
Bedding Parting	BP	Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/ bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material.
Contact	CO	The surface between two types or ages of rock.
Sheared Surface	SSU	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.
Sheared Seam/ Zone (Fault)	SS/SZ	Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50 mm) parallel and usually smooth or slickensided joints or cleavage planes.
Crushed Seam/ Zone (Fault)	CS/CZ	Seam or zone composed of disoriented usually angular fragments of the host rock substance, with roughly parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these.
Extremely Weathered Seam/ Zone	XWS/XWZ	Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places.
Infilled Seam	IS	Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity.
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.

NOTE: Defects size of <100mm SS, CS and XWS. Defects size of >100mm SZ, CZ and XWZ.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS

Shape	Abbr.	Description	Roughness	Abbr.	Description
Planar	PR	Consistent orientation	Polished	POL	Shiny smooth surface
Curved	CU	Gradual change in orientation	Slickensided	SL	Grooved or striated surface, usually polished
Undulating	UN	Wavy surface	Smooth	SM	Smooth to touch. Few or no surface irregularities
Stepped	ST	One or more well defined steps	Rough	RO	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper
Irregular	IR	Many sharp changes in orientation	Very Rough	VR	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper

Orientation: **Vertical Boreholes –** The dip (inclination from horizontal) of the defect.
Inclined Boreholes – The inclination is measured as the acute angle to the core axis.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING

Coating	Abbr.	Description
Clean	CN	No visible coating or infilling
Stain	SN	No visible coating but surfaces are discoloured by staining, often limonite (orange-brown)
Veneer	VNR	A visible coating of soil or mineral substance, usually too thin to measure (< 1 mm); may be patchy

DEFECT APERTURE

Aperture	Abbr.	Description
Closed	CL	Closed.
Open	OP	Without any infill material.
Infilled	-	Soil or rock i.e. clay, silt, talc, pyrite, quartz, etc.

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	136 New South Head Road - Edgecliff (E24119 G03)	**Report No:**	S45735-PL
Job No:	S19041	**Date Tested:**	7/02/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 4/02/2019

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45735	BH1M 2.49 - 2.57m	Sandstone	Axial	51.8	39.0	0.82	0.32	0.32	1
S45736	BH1M 4.37 - 4.45m	Sandstone	Axial	52.1	36.0	0.70	0.29	0.29	1
S45737	BH1M 7.21 - 7.32m	Sandstone	Axial	51.7	41.0	1.18	0.44	0.44	1
S45738	BH1M 9.09 - 9.20m	Sandstone	Axial	51.7	35.0	1.62	0.70	0.69	1
S45739	BH1M 5.57 - 5.64m	Sandstone	Axial	52.0	37.0	0.50	0.20	0.20	1
S45740	BH1M 12.42 - 12.50m	Sandstone	Axial	51.9	35.0	1.42	0.61	0.60	1
S45741	BH6M 4.02 - 4.11m	Sandstone	Axial	51.7	37.0	0.60	0.24	0.24	1
S45742	BH6M 5.24 - 5.36m	Sandstone	Axial	51.6	33.0	1.41	0.65	0.63	1
S45743	BH6M 6.53 - 6.62m	Sandstone	Axial	51.8	39.0	1.39	0.54	0.54	1
S45744	BH6M 8.33 - 8.44m	Sandstone	Axial	51.7	31.0	1.58	0.77	0.74	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

12/03/2019

Date

Macquarie Geotechn
U7/8 10 Bradford
Street
Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	136 New South Head Road - Edgecliff (E24119 G03)	**Report No:**	S45745-PL
Job No:	S19041	**Date Tested:**	7/02/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 4/02/2019

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45745	BH6M 10.58 - 10.67m	Sandstone	Axial	51.8	38.0	2.04	0.81	0.81	1
S45746	BH6M 12.77 - 12.86m	Sandstone	Axial	51.8	34.0	1.18	0.53	0.51	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA

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Authorised Signatory:

Chris Lloyd

9/02/2019

Date

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