FINAL REPORT

Detailed Site Investigation

3 Wiston Gardens, Double Bay NSW

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Executive Summary

Merman Investments Pty Ltd (Merman Investments) are proposing the redevelopment of a property located at 3 Wiston Gardens, Double Bay NSW (the Site) for a medium density residential apartment building. The development comprises a multi-storey building, basement levels for parking and plant rooms and landscaping at the frontage and rear of the building. The Site currently contains a multi-storey residential apartment building that was constructed with no basements at sometime between the 1920s and 1930s.

A steeply terraced sandstone ridge is present across the north-western area of the Site and the ground floor of the building sits at the base of this cliff face which then slopes down to the road. Garages are present at the road level with the frontage of the building located on top of the garages. The building footprint together with the sandstone cliff occupies the majority of the area of the Site. Some minimal garden beds and landscaping areas are present at the northern side and frontage of the current building above the garages and some of the higher sandstone terraces contain some vegetation. The current layout of the Site is shown on Figure 2.

In mid 2020, as part of planning for the redevelopment of the Site a Stage 1 environmental site assessment was completed on the Site by JK Environments Pty Ltd as documented in '*Report to Merman Investment Pty Ltd on Preliminary (Stage 1) Site Investigation for Proposed Residential Development at 3 Wiston Gardens, Double Bay NSW"* dated 17 July 2020 (the PSI). The PSI comprised the completion of desktop and background searches and also included intrusive investigations. As such the PSI also included works that would normally form part of a Stage 2 environmental site assessment or a DSI.

The results of the PSI identified the presence of shallow fill materials within the landscaped areas present above the garages at the front the Site that contained asbestos containing materials (ACM) and concentrations of polycyclic aromatic hydrocarbons (PAHs) that were greater than the criteria for medium density residential land use. The PSI indicated the potential for these fill materials to extend beneath the existing building to depths of up to 1 to 2 m beneath the building. However, the PSI noted that as the majority of the Site area is occupied by the terraced sandstone ridge and the current building footprint, areas in which intrusive investigations could be completed were limited. The PSI concluded that due to the presence of asbestos and PAH contaminated fill materials and that the contamination had not been able to be delineated, the Site is not suitable for residential land use with minimal opportunities for access to soils, however, given the nature of the redevelopment that the Site could be made suitable if remediation and validation works were undertaken. Despite the access constraints on the Site the PSI also included a recommendation that a DSI be undertaken prior to the development of a remediation action plan.

This report has been prepared to satisfy the PSI's recommendation for the completion of a DSI. This DSI provides more complete and definitive assessment on the matters raised in the PSI through the completion of a detailed review of the PSI, the development of a detailed conceptual model of the Site, an assessment of adequacy and completeness of all information available for use in the assessment of risk and for the identification of remaining data gaps and uncertainties and demonstration that further intrusive investigations, as recommended by the PSI, are not required in order to determine how suitability of the Site can be achieved as part of the redevelopment on the Site.

Based on the information presented in this report and the scope of the proposed redevelopment, the Site is considered to not be suitable for the proposed redevelopment and remediation works will be required in order to ensure that the Site is made suitable for medium density residential land use with minimal access to soils.

Given the nature and extent of the asbestos and PAH contamination on the Site, the extent of remediation works must address the lateral extent of the Site and the vertical extent being the current surface to the vertical extent or base of the fill materials where they overlay the natural soils and/or sandstone bedrock.

A Remediation Action Plan (RAP) will need to be prepared to document the remediation and validation works that will be required to be undertaken during the redevelopment works to ensure that the Site is suitable for its proposed use.

1 Introduction

CONSARA Pty Ltd (CONSARA) has been commissioned by Merman Investments Pty Ltd (Merman Investments) to undertake a detailed site investigation (DIS) for a property located at 3 Wiston Gardens, Double Bay NSW (the Site). The location of the Site is presented in Figure 1 and the layout of the Site is presented on Figure 2.

Merman Investments are proposing the redevelopment of the Site into a medium density residential apartment building. The development comprises a multi-storey building, basement levels for parking and plant rooms and landscaping at the frontage and rear of the building. The Site currently contains a multi-storey residential apartment building that was constructed with no basements at sometime between the 1920s and 1930s.

A steeply terraced sandstone ridge is present across the north-western area of the Site and the ground floor of the building sits at the base of this cliff face which then slopes down to the road. Garages are present at the road level with the frontage of the building located on top of the garages. The building footprint together with the sandstone cliff occupies the majority of the area of the Site. Some minimal garden beds and landscaping areas are present at the northern side and frontage of the current building above the garages and some of the higher sandstone terraces contain some vegetation. The current layout of the Site is shown on Figure 2.

In mid 2020, as part of planning for the redevelopment of the Site a Stage 1 environmental site assessment was completed on the Site by JK Environments Pty Ltd as documented in '*Report to Merman Investment Pty Ltd on Preliminary (Stage 1) Site Investigation for Proposed Residential Development at 3 Wiston Gardens, Double Bay NSW"* dated 17 July 2020 (the PSI). The PSI comprised the completion of desktop and background searches and also included intrusive investigations. As such the PSI also included works that would normally form part of a Stage 2 environmental site assessment or a DSI.

The results of the PSI identified the presence of shallow fill materials within the landscaped areas present above the garages at the front the Site that contained asbestos containing materials (ACM) and concentrations of polycyclic aromatic hydrocarbons (PAHs) that were greater than the criteria for medium density residential land use. The PSI indicated the potential for these fill materials to extend beneath the existing building to depths of up to 1 to 2 m beneath the building. However, the PSI noted that as the majority of the Site area is occupied by the terraced sandstone ridge and the current building footprint, areas in which intrusive investigations could be completed were limited and that these physical constraints precluded the opportunity for further investigations to be conducted.

The PSI concluded that due to the presence of asbestos and PAH contaminated fill materials and that the contamination had not been able to be delineated, the Site is not suitable for residential land use with minimal opportunities for access to soils, however, given the nature of the redevelopment that the Site could be made suitable if remediation and validation works were undertaken. Despite the access constraints on the Site the PSI also included a recommendation that a DSI be undertaken prior to the development of a remediation action plan.

This report has been prepared to satisfy the PSI's recommendation for the completion of a DSI. It is noted that whilst it is usual for DSI's to include intrusive investigation works, given that access on the Site remains unchanged since the completion of the PSI, further intrusive investigations have not been undertaken. Instead, this DSI provides more complete and definitive assessment on the matters raised in the PSI through the completion of a detailed review of the PSI, the development of a detailed conceptual model of the Site, an assessment of adequacy and completeness of all information available for use in the assessment of risk and for the identification of remaining data gaps and uncertainties and demonstration that further intrusive investigations, as recommended by the PSI, are not required in order to determine how suitability of the Site can be achieved as part of the redevelopment on the Site.

This report, together with the PSI, will then be utilised to inform a Remediation Action Plan that will be implemented as part of the works required for the redevelopment of the Site.

This report has been prepared, where possible and relevant, with reference to the relevant requirements of the *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) – Schedule B 1999 as Amended 2013* (ASC NEPM) National Environment Protection Council (NEPC) and the NSW Environment Protection Authority (NSW EPA, 2020) *Contaminated Land Guidelines - Consultants Reporting on Contaminated Sites* and other relevant guidance made or endorsed by NSW EPA.

It is noted that this report has been prepared as part of the development application to be lodged with the relevant planning authority to achieve development consent for the proposed redevelopment of the Site. The report has been prepared, as part of suite of documents, to ensure that the requirements of State Environment Planning Policy 55 (SEPP 55) in relation to the redevelopment have been appropriately addressed.

1.1 Objective

The objectives of this DSI are to provide an assessment of the environmental condition of the Site, including the potential for soil and/or groundwater contamination to be present and its suitability for its current and proposed ongoing use for medium density residential land use with minimal opportunities for access to soils and recommendations for the requirement for remediation.

1.2 Data Quality Objectives

To ensure that data of appropriate types and reliability were collected and assessed for this work, the seven-step Data Quality Objective (DQO) approach was adopted, in accordance with Appendix B of Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC, 2013) (the NEPM). The DQOs have set quality assurance and quality control parameters for the relevant parts of the works. The DQOs adopted for the works are presented in Appendix B. Attainment of the DQOs has been assessed by reference to the data quality indicators (DQIs) in Appendix C.

1.3 Scope of Works

The scope of works undertaken to achieve the objectives set out above is as follows:

- Detail review of the current redevelopment plans for the Site, as set out in the plans provided in Appendix A;
- Detailed review of the PSI;
- Assessment of the reliability of the field and laboratory procedures completed for the PSI according the requirements of the ASC NEPM;
- Detail a Conceptual Site Model that identifies the sources of contamination, contamination migration pathways, receptors and exposure mechanisms on the Site;
- Identify any data gaps and uncertainties;
- Provide an assessment on the suitability of the Site for medium density residential land use with minimal opportunities for access to soils and recommendations on the requirement for remediation; and
- Recommend a remediation approach that could be implemented under the current redevelopment plans such that successful remediation and validation could be achieved, and, if implemented that would ensure that the Site is made suitable for the proposed residential land use with minimal opportunities for access to soils.

2 Previous Investigation

In mid 2020, as part of planning for the redevelopment of the Site a Stage 1 environmental site assessment was completed on the Site by JK Environments Pty Ltd as documented in *'Report to Merman Investment Pty Ltd on Preliminary (Stage 1) Site Investigation for Proposed Residential Development at 3 Wiston Gardens, Double Bay NSW"* dated 17 July 2020 (the PSI). A detailed review of the PSI has been undertaken as documented below.

2.1 Technical Reliance on the PSI

CONSARA has conducted a detailed assessment of the field and analytical data provided in the PSI by reference to the Data Quality Indicators (DQIs), precision, accuracy, representativeness, completeness and comparability to assess whether the data presented is representative of the conditions at the sample locations.

Overall, this assessment has indicated that the reported field and analytical results in the PSI are representative of the conditions at the sample locations at the time that the investigation was undertaken and that the field and analytical data can be relied upon for the purpose of this RAP. As such the figures and tables from the PSI are included at Appendix D to this report.

2.2 Scope of the PSI

The PSI comprised the completion of desktop and background searches and intrusive investigations at two locations on the Site, one in a landscaped area located at the front of the building above the garages and one on the upper terraced sandstone ridge where some vegetation was growing. The locations are shown in the figure provided in Appendix D. The limited nature of the intrusive investigations was due to the fact that the building and sandstone ridge occupied the majority of the Site area, with only small areas able to accessed.

2.3 Results of the PSI

2.3.1 Background Searches and Historical Information

The results of the background searches identified that the residential apartment building that is currently present on the Site was present on the Site in the early 1940s so was likely to have been constructed prior to this, likely in the 1930s. No changes appeared to have occurred to the building or the Site since this time. The Site appears to have only been historically occupied by residential land use, with the surrounding local region also occupied by low density residential land uses, with increasing residential density apartments occurring on adjacent and surrounding sites since the mid 1960s. There was no evidence of any commercial or industrial activities having been historically undertaken on or near the Site. Review of publicly available contaminated land records held by the NSW EPA did not identify any contaminated sites that are located within 500 m of the Site nor in locations that are up-hydraulic gradient such that the Site could be affected by migration of potentially contaminated groundwater.

2.3.2 Intrusive Investigations

The results of the intrusive investigation identified the presence of fill materials from the surface or beneath concrete hardstand and into the sub-surface to depths of between 0.4 and 0.7 m bgs. The fill materials were reported to comprise silty sands, gravels and some sandy clays with inclusions of sandstone and igneous gravels, ash and building and demolition wastes such as brick and concrete. No perched or other groundwaters were observed to be present. Fragments of asbestos containing materials (ACM) were identified to be present in the fill materials present at depths between 0.4 and 0.6 m bgs in the landscaped area at the front of the building above the garages. Fill materials from this same location reported concentrations of carcinogenic polycyclic aromatic hydrocarbons (PAHs) that were greater than the relevant residential land use criteria. Concentrations of metals, total petroleum hydrocarbons, benzene, toluene, ethylbenzenes, xylenes, organochlorine and organophosphorus pesticides and polychlorinated biphenyls were either less than the laboratory detection limits or less than the

relevant criteria in all other samples that were analysed. Based on the concentrations reported the PSI provided a preliminary waste classification for these fill materials as General Solid Waste (non-putrescible) and Special Waste-Asbestos.

2.4 Discussion and Conclusions of PSI

Based on the results of the works completed the PSI identified that the Site did not have any history of contaminating activity and that the contamination on the Site was limited to the presence of shallow fill materials of unknown origin. It was stated that it was likely that the fill materials extend beneath the building.

Given the limited accessible areas on the Site the PSI stated that the extent of the contaminated fill materials had not been able to be assessed and would require further assessment if delineation was required. In addition the PSI noted the investigations did not include an assessment of groundwater conditions, however, given the historical use of the Site and the surrounding areas that the potential for groundwater contamination to be low and that the groundwater conditions could be assessed as part of the excavation works for the redevelopment.

Results of chemical analysis of samples of topsoils, fill materials and natural clays across the Site did not identify the presence of contamination. The PSI recommended that once the demolition of the residential dwellings had been undertaken that further investigations be completed on the central to eastern part of the Site to assess for the presence of contamination and to determine the requirements for remediation.

The PSI concluded that the due to the presence of asbestos and PAH contaminated fill materials, and that the contamination had not been delineated, that the Site was rendered not suitable for residential land use with minimal opportunities for access to soils. Due to the nature of the redevelopment on the Site which required major excavation works across the Site, the PSI considered that the Site could be suitable for residential land use with minimal opportunities for access to soils if remediation and validation works were undertaken.

3 Conceptual Site Model

Based on the information provided in the PSI and further review of available topographical and geological information of the local region in which the Site is located, a detailed conceptual site model for the Site is provided below. This CSM has been developed with reference to the proposed plans for the redevelopment of the Site, as provided in Appendix A and that the redevelopment of the Site does not require a change in land use setting, being medium density residential with minimal opportunities for access to soils.

3.1 Site Condition and Surrounding Environment

3.1.1 Site Identification

The Site is located at 3 Wiston Gardens, Double Bay NSW (the Site) within the Woollahra Municipal Council (the Council) area. The Site is identified as Lot 4 in Deposited Plan (DP) 15968. The Site has an area of approximately 830 m^2. The Site is zoned R3 Medium Density Residential under the Woollahra Local Environment Plan 2014.

3.1.2 Current and Proposed Use

The Site is located across a steeply terraced and sloping sandstone ridge, with the lowest area of the Site in the south-east, near level with the road at 2.49 metres Australian Height Datum (m AHD) and the highest area in the north-west on top of the sandstone ridge at 21.49 m AHD. The Site is occupied by a multi-storey residential apartment building that has four storeys across the lower south-eastern areas of the Site but then only two storeys further to the central to north-western parts of the Site. It appears the building construction was terraced to match the sandstone ridge. Garages are located on the lower levels in the south-eastern area of the Site, beneath the building with a short sloping concrete driveway providing access to the road.

Concrete footpaths and stairs and sandstone retaining walls are located on either side of the building and around the rear of the building. Some small gardens beds are located on the sides of the buildings and a courtyard is present at the rear that is surrounded by sandstone retaining walls, batters and terraced sandstone bedrock. Vegetation was present on some terraced areas of the sandstone bedrock. The frontage of the building, located above the garages, also has some limited landscaping that appears to have been formed as part of the construction of the building.

The Site is proposed to redeveloped, with all existing buildings and structures and much of the existing sandstone ridge to be removed and replaced with a seven storey building with a number of basement levels to depths of between 2.7 to 3.5 metres below the current relative level (RL) of Wiston Gardens. Due to the slope of the Site, excavation will be required to a depths of up to 20 metres below the current ground surface levels, particularly in the north-western areas of the Site. After completion of demolition of the existing building and in order to achieve the required RLs on which to commence construction a program of stripping of fill materials and any underlying natural soils will be undertaken followed by the excavation of the sandstone bedrock. Once complete this will create the sub-grade levels that are required for the commencement of the construction of the building. The demolition plans and construction plans for the redevelopment are provided in Appendix A. The redevelopment of the Site does not require a change in zoning or land use.

3.1.3 Surrounding Land Use

At the time of preparation of this report the Site was bound by:

- A mix of low and medium density residential property to the north, south, east and west;
- Wiston Garden, which is an open space park, is located at the end of the Wiston Garden road to the south and south-east of the Site;

- Double Bay, which is located on the southern extent of the larger Sydney Harbour, is located 50 m to the east to south east of the Site.

3.1.4 Topography and Soils

The Site is located across a south-east facing sandstone ridgeline that runs along a north/south alignment and that slopes down to Double Bay. The Site is located across part of the ridge that then steeply terraces down to the more gentle slope of the toe of the ridge. Overall, the Site has a grade of approximately 10° to 15° down to Double Bay.

The soils present beneath the Site are likely to be minimal and are likely to primarily comprise fill materials that may have been historically placed to achieve the current RLs. Given that sandstone ridge outcrops within the Site and that the existing building has been constructed to step down with the slope and then toe of the rock face, it likely that any filling that has occurred across the toe of the ridge on which the current building has been constructed would be minimal and it is expected that sandstone bedrock will be encountered either directly beneath the building or up to 1 to 2 metres below the lower levels of the building. Some natural sands or sandy clays may also be present, though it would expected that such soils would be limited to terraced areas of sandstone given the steepness of the sandstone ridge. It is understood that sandstone bedrock outcrops and forms the rear northern wall of the garages present on the lower, street level, part of the Site.

The 1:25 000 Botany Bay Acid Sulfate Soil Risk Map (DLWC, 1997) indicates that the Site is located on area which is noted to have disturbed terrain to depths of up to 4 metres below existing ground levels and that assessment is required in order to determine the potential for acid sulphate soils to be present. However, given that the Site and surrounding areas are located on and across a sandstone ridge and toe that sits higher than the waters of Double Bay the conditions required for acid sulphate soils to be present are not considered to exist. The excavation works to be completed on the Site will be well into and within sandstone bedrock and any soils or fill materials present are present above the sandstone bedrock and above any groundwater that may be present at depth in the bedrock. As such there is considered to be no potential for acid sulphate soils to be present or able to be formed on the Site.

3.1.5 Surface Water, Drainage and Flood Potential

A constructed surface water drainage system is present along Wiston Gardens roadway and outside of the boundaries of the Site which drains surface water flows to the south-east to Double Bay. However, there appears to be no constructed surface water drainage system on the Site and it is likely that all surface water drains with the sloping topography down to Wiston Gardens roadway and then to Double Bay.

The potential for localised flooding across the Site under high rainfall conditions is considered to be low given the steeply sloping topography and that the Site is located proximal to Double Bay. Double Bay is located on Sydney Harbour proximal to the harbour's connection with the Pacific Ocean. The Double Bay is tidal and any risk of flooding is likely to be primarily related to extreme high tide events rather than being related to rainfall.

The redevelopment of the Site will involve the construction of a building and associated utilities that will include a constructed stormwater system that will discharge to the local stormwater system on Wiston Garden.

3.1.6 Geology and Hydrogeology

The Site and surrounding area is underlain by Middle Triassic aged Hawkesbury Sandstone of the Wianamatta Group (DMR, 1991). The Hawkesbury Sandstone consists of medium to coarse-grained quartz sandstone, very minor shale, siltstone and laminite lenses.

Prior to any historical filling that may have occurred to achieve the current surface RLs, the soil landscape of the Site is likely to have been comprised of a sandstone rocky outcrops dominated by shallow lithosols and siliceous sands with some podzolic soils present in less exposed areas (SCS, 2009). It is well known that this foreshore area

of Double Bay, was historically dominated by areas of sandstone outcrops and cliffs that continue to despite extensive development, to govern the local landscape and topography.

Regional groundwater is expected to be present at depth within the Hawkesbury Sandstone underlying the Site and areas to the north-west and is likely to be present as flow through fractures such as joints and bedding plane partings or via permeable lenses of siltstone or laminate. Thus, the transmissivity of the sandstone aquifer is dependent on the frequency, openness and orientation of the fracturing present. Groundwater present in sandstone is expected to be generally of reasonable quality with low salinity, whilst groundwater present in any siltstone and laminite lenses is expected to be of higher salinity (Pells 1985). Based on local topography and surface drainage, groundwater in the bedrock is expected to flow to the east to south-east toward Double Bay.

Locally, it is considered unlikely that perched groundwater is present in any underlying fill materials or natural sandy soils such that it would be present as a groundwater system or would be require consideration in assessing the environmental condition of the Site. However, it is noted that should perched groundwaters be present in the fill materials or natural soils that any lateral or vertical migration would be primarily influenced by the permeability of the surrounding materials and the topography of the surface of the bedrock.

It is noted that regional or local groundwater in the region of the Site is not known to be used for any beneficial purpose.

3.2 Areas and Contaminants of Concern identified by the PSI

The results of the PSI identified the presence of asbestos and PAH contaminated shallow fill materials in landscaped areas located on the south-eastern part of the Site, in front of the building above the existing garages. Given the location of the fill materials it is clear that these materials were placed as part of the establishment of the landscaped areas or to achieve surface levels required for the construction of the building. Due to the presence of the building, further intrusive investigations were not able to extend beneath the existing building. The PSI stated that it was likely that the fill materials extend and to shallow depths beneath the building.

Given the limited accessible areas on the Site the PSI stated that the extent of the contaminated fill materials had not been able to be assessed and would require further assessment if delineation was required. In addition the PSI noted the investigations did not include an assessment of groundwater conditions, however, given the historical use of the Site and the surrounding areas that the potential for groundwater contamination to be low and that the groundwater conditions could be assessed as part of the excavation works for the redevelopment.

3.3 Potential Receptors

The proposed redevelopment of the Site will not change the use of the Site with the Site continuing to be occupied by medium density residential use in which there will be minimal opportunity to access soils. As such the potential receptors for potential contaminants sourced from the redeveloped Site are considered below.

3.3.1 Human Receptors

Given that the Site will be used for medium density residential use in which there will be minimal opportunity to access soils, with respect to human use the potential future receptors (and the associated exposure pathways) for potential contaminants sourced from the Site include the following:

- Occupiers and users (Children through to Adults) of the Site who have access to the Site's outdoor areas – inhalation of dusts generated from surface soils; ingestion from surface soils or dusts generated from surface soils; and
- Workers involved in intrusive maintenance works on the Site– inhalation of dusts generated from surface soils, ingestion from surface soils or dusts generated from surface/sub-surface soils or from perched groundwaters.

It is noted that currently and under the future use of the Site that the nearest off-site human receptors would be in residential properties located directly to the north, east and west.

3.3.2 Environmental Receptors

Given the location of the Site the environmental receptors (aquatic and terrestrial) for potential contaminants sourced from the Site are windblow dust or the physical movement of asbestos and PAH containing fill materials to Double Bay.

It is considered that the local area is within a highly disturbed environment and the waters of Double Bay and the greater Sydney Harbour have been the receiving body for historical wastes, wastewaters and discharges from domestic and industrial sources that historically occupied and currently occupy the catchment of Sydney Harbour. Whilst the quality of the waters and sediments in such catchments have been demonstrated to have improved over the past few decades, mainly due to increased regulation around discharges from industrial sites and urban areas, the harbour still receives significant flows of stormwater and surface water runoff from the surrounding urban areas. In addition, with respect to human use, groundwater beneath and in the local region surrounding the Site is known to be unsuitable for any beneficial purpose and is not accessed for beneficial use. The value of this groundwater resource is considered to be low.

4 Data Gap and Uncertainty Assessment

A data gap and uncertainty assessment has been completed based on the information provided in the PSI and the CSM. This assessment has identified the following:

- The Site has an area of 830 m^2 , the current building, surrounding footpaths, garages and driveway occupies approximately 360 m^2 with the remaining 470 m^2 north-western area of the Site comprised of sandstone cliff and terraced outcrops;
- The area of the Site that has been historically and currently occupied for use is only that portion on which the building is present, with the sandstone cliff and terraced outcrops vegetated but otherwise not historically accessed, used or occupied for any purpose;
- The intrusive investigations completed as part of the PSI were limited to two locations due to access constraints related to the current presence of the building. The PSI concluded that further intrusive investigations should be undertaken to assess the conditions beneath the building and to identify the extent of soil contamination on the Site and that such investigations should include groundwater sampling and waste classification works;
- Whilst the intrusive investigations completed on the Site have been limited to two locations it is noted that the NSW EPA *Sampling Design Guidelines* only recommend up to five locations for a site that has an area of 500 m^2;
- The investigations on the Site have been limited to accessible areas the front and rear of the building. As such there are data gaps in relation to the sub-surface soil and groundwater conditions beneath the building;
- However, it is considered that these data gap does not present an unacceptable level uncertainty in relation to the assessment of the suitability of the Site for the proposed redevelopment. This is due to the following:
    - The Site has been occupied by the current building and land use since at least the late 1920s and there is no evidence of contaminating activities having been conducted on the Site nor on the surrounding properties;
    - The building on the Site has been constructed against a sandstone cliff and sandstone terraces and can be seen to have been founded on sloping sandstone bedrock with little to no evidence of deeper excavations or of the potential presence for extensive filling to have been required prior to or to enable the construction of the current building;
    - The presence of some PAHs and asbestos in surface and shallow sub-surface fill material in garden beds at the frontage of the Site is considered to be directly related to the importation and use of fill in this area of the Site to achieve its current RLs and not due to contaminating activities having been conducted on the Site;
    - It is considered that if fill materials were placed to establish surface levels prior to or as part of the construction of the building, it is reasonable to expect, given the terraced sandstone ridge that dominates the north-western part of the Site and the stepped nature of the building down the toe of the ridge, that any fill materials present beneath the building footprint would likely be vertically limited to 1 to 2 metres depth and would directly overlay sandstone bedrock. Any such filling would likely have been undertaken sometime in the 1920s;
    - Given the above, there is a low likelihood of gross or significant contamination or point source contamination being present on the Site, rather the contamination is likely to be limited to the presence of asbestos and PAHs or similar as part of building and demolition waste in fill materials and as such is likely to be present as diffuse contamination, directly associated with the presence of fill materials with the nature and distribution of any contamination likely to be variable within these materials;
    - Given the absence of any potential point sources of chemical contamination on the Site or from the surrounding land uses or gross chemical contamination in the fill materials, it is considered that that there is a negligible potential for contaminated groundwater to be present. As such it is not considered that there

is any requirement to assess groundwater for the presence of contamination as part of an appropriate assessment of Site suitability;

- In consideration of the historical use of the Site, the nature of the identified contamination and the scope of the proposed redevelopment, in order to make an assessment of Site suitability and to plan for any remediation works that maybe required as part of the redevelopment works, it is not considered necessary to complete further investigation to obtain information on the sub-surface conditions beneath the building on the Site. Rather, it is considered that the current CSM and the nature of the development allow for a reliable assessment on suitability to made and for any remediation works to be adequately planned to be completed as part of the redevelopment works.

In summary it is considered that whilst some data gaps are present in relation to the sub-surface conditions beneath the building, these data gaps are considered to be minor and do not present an unacceptable level of uncertainty that precludes a reliable assessment of suitability nor precludes the development of a remediation strategy that will ensure that the Site can be made suitable.

5 Discussion and Conclusions

5.1 Discussion of Results

The results of the works completed for this DSI have identified that the Site has been occupied for medium density residential land use, with the current building and conditions on the Site unchanged since the 1930s. There is no evidence of the Site being used for contaminating activities prior to this time. The Site has an area of 830 m^2 with the building, surrounding footpaths, garages and driveway occupying approximately 360 m^2 and the remaining 470 m^2 north-western area of the Site comprised of sandstone cliff and terraced outcrops that are heavily vegetated.

The building on the Site has been constructed against a sandstone cliff and sandstone terraces and can be seen to have been founded on sloping sandstone bedrock with little to no evidence of deeper excavations or of the potential presence for extensive filling to have been required prior to or to enable the construction of the current building.

It is noted that the area of the Site that has been historically and currently occupied for use is only that portion on which the building is present, with the sandstone cliff and terraced outcrops vegetated but otherwise not historically accessed, used or occupied for any purpose.

Given that the building occupies the majority of the area of the Site that is accessible, investigations to assess the sub-surface conditions beneath the building were not able to be completed, however, intrusive investigations were completed at one location in front of the building above the garages and another location at the rear of the building in a small courtyard area. These investigations were conducted as part of the PSI and identified the presence of shallow fill materials within the landscaped areas present above the garages at the front the Site that contained asbestos containing materials (ACM) and concentrations of polycyclic aromatic hydrocarbons (PAHs) greater than the criteria for medium density residential land use. Given the nature of the contamination and it's location it is considered to be present as a result of the importation and use of fill in this area of the Site to achieve its current RLs. The PSI indicated that there was a potential for these fill materials to extend beneath the existing building.

It is considered that likely that the fill materials were placed to establish surface levels prior to or as part of the construction of the building and as such it is reasonable to assume, given the terraced sandstone ridge that dominates the north-western part of the Site and the stepped nature of the building down the toe of the ridge and that the garages are constructed into bedrock, that any fill materials present beneath the building footprint would be vertically limited to 1 to 2 metres depth and would directly overlay sandstone bedrock.

Whilst the intrusive investigations on the Site have been limited to accessible areas the front and rear of the building and that there are some data gaps in relation to the sub-surface conditions beneath the building, given the historical use of the Site and the nature of the identified contamination, there is considered to be a low likelihood of gross or significant contamination or point source contamination being present on the Site. Rather the contamination is likely to be limited to the presence of asbestos and PAHs or similar as part of building and demolition waste in fill materials that are likely to be present to shallow depths beneath the building and its surrounding narrow footpaths and limited courtyard areas. Given that it is expected that any fill materials present beneath the building will be limited in their vertical extent it is considered likely that any contamination present in these fill materials will be similar to that identified at the frontage of the Site. Such contamination likely to be present as diffuse contamination, directly associated with the presence of fill materials with the nature and distribution of any contamination likely to be variable within these materials.

In addition, the absence of any potential point sources of chemical contamination on the Site or from the surrounding land uses or gross chemical contamination in the fill materials, indicates there is a negligible potential for contaminated groundwater to be sourced from the Site.

Given the above it is considered that there is no requirement to assess groundwater for the presence of contamination nor for further soil investigations and that the information available for the Site, as presented in the PSI and in this report, is sufficiently adequate and complete for a reliable assessment of suitability to be made and for any remediation works to be adequately planned to be completed as part of the redevelopment works.

5.2 Assessment of Site Suitability

Based on the information presented in this report and the scope of the proposed redevelopment, the Site is considered to not be suitable for the proposed redevelopment and remediation works will be required in order to ensure that the Site is made suitable for medium density residential land use with minimal access to soils.

5.3 Remediation Requirements

Given the nature and extent of the asbestos and PAH contamination on the Site, the extent of remediation works must address the lateral extent of the Site and the vertical extent being the current surface to the vertical extent or base of the fill materials where they overlay the natural soils and/or sandstone bedrock.

The proposed redevelopment of the Site for a new multi-storey residential apartment building will comprise the demolition of the existing building and associated hardstands on the Site, the excavation and removal off-site of all existing materials to depths up to 20 m bgs, including the excavation of part of the sandstone ridge that is present across the north-western area of the Site, then the construction of new multi-storey building with basement level carparking, plant rooms and lift wells and new landscaping and outdoor areas surrounding the building, as set out in the plans provided in Appendix A.

Given the vertical and lateral extent of excavation and construction works required on the Site, all existing fill materials and any overlying natural soils will be removed and disposed off-site to enable the continued excavation into the underlying sandstone bedrock Given that the contamination has been and potentially is present in fill materials on the Site, the process of excavation and off-site disposal of these materials as part of the redevelopment will result in the remediation of the Site. The adoption of a remediation strategy that is commensurate with the redevelopment requirements on the Site, being excavation and off-site disposal, is considered to likely to be preferred remedial option as it is technically justifiable, commercially feasible and environmentally sustainable.

A Remediation Action Plan (RAP) will need to be prepared to document the remediation and validation works that will be required to be undertaken during the redevelopment works to ensure that the Site is suitable for its proposed use.

The RAP will need to be prepared in accordance with the relevant requirements of the ASC NEPM and the NSW EPA (2020) and other relevant guidance made or endorsed by NSW EPA.

6 Limitations

This report has been prepared for the sole purpose of documenting the results of a detailed site investigation completed for the Site as part of the proposed redevelopment of the Site for a new multi-storey residential apartment building, in accordance with generally accepted consulting practice. No other warranty or guarantee expressed or implied is made as to the advice indicated in this report.

This report should not be used for any other purpose without our prior written consent. Accordingly, neither CONSARA nor any member or employee of CONSARA accepts responsibility or liability in any way whatsoever for the use of this report for any purpose other than that for which it has been prepared.

This report should not be released to any other party, in whole or in part, without the express written consent of CONSARA. CONSARA accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

CONSARA has relied upon and presumed accurate information provided by Merman Investments Pty Ltd and/or any third party (or absence thereof) in making the assumptions made in this report. Nothing in this report should be taken to imply that CONSARA has verified or audited any of the information supplied to us other than as expressly stated in this report. We have assumed this information to be both adequate and accurate for the purposes of this report.

Where findings, observations and conclusions are based solely upon information provided by Merman Investments Pty Ltd and/or a third party and CONSARA do not accept, to the maximum extent permitted by law, any liability for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by Merman Investments Pty Ltd or any third party as a result of or in connection with CONSARA's reliance on any such the information to the extent that such information is false, misleading or incomplete and CONSARA give no warranty or guarantee, express or implied as to such findings, observations and conclusions.

If further information becomes available, or additional assumptions need to be made, CONSARA reserves its right to amend any statements or opinions made in this report.

7 References

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Figures

A4

PROJECT No.	**C201009**
FILE NAME	**F003**
DATE	**01.04.21**
DRAWN	**RR**
APPROVED	**RO**

SOURCE: NEARMAP

LEGEND

APPROXIMATE SITE BOUNDARY

CLIENT
MERMAN INVESTMENTS PTY LTD

PROJECT
DETAILED SITE INVESTIGATION
3 WISTON GARDENS
DOUBLE BAY, NSW

TITLE
SITE LOCATION

FIGURE No.
1

CONSARA

A4

PROJECT No.	**C201009**
FILE NAME	**F004**
DATE	**01.04.21**
DRAWN	**RR**
APPROVED	**RO**

SOURCE: NEARMAP

LEGEND

APPROXIMATE SITE BOUNDARY

CLIENT
MERMAN INVESTMENTS PTY LTD

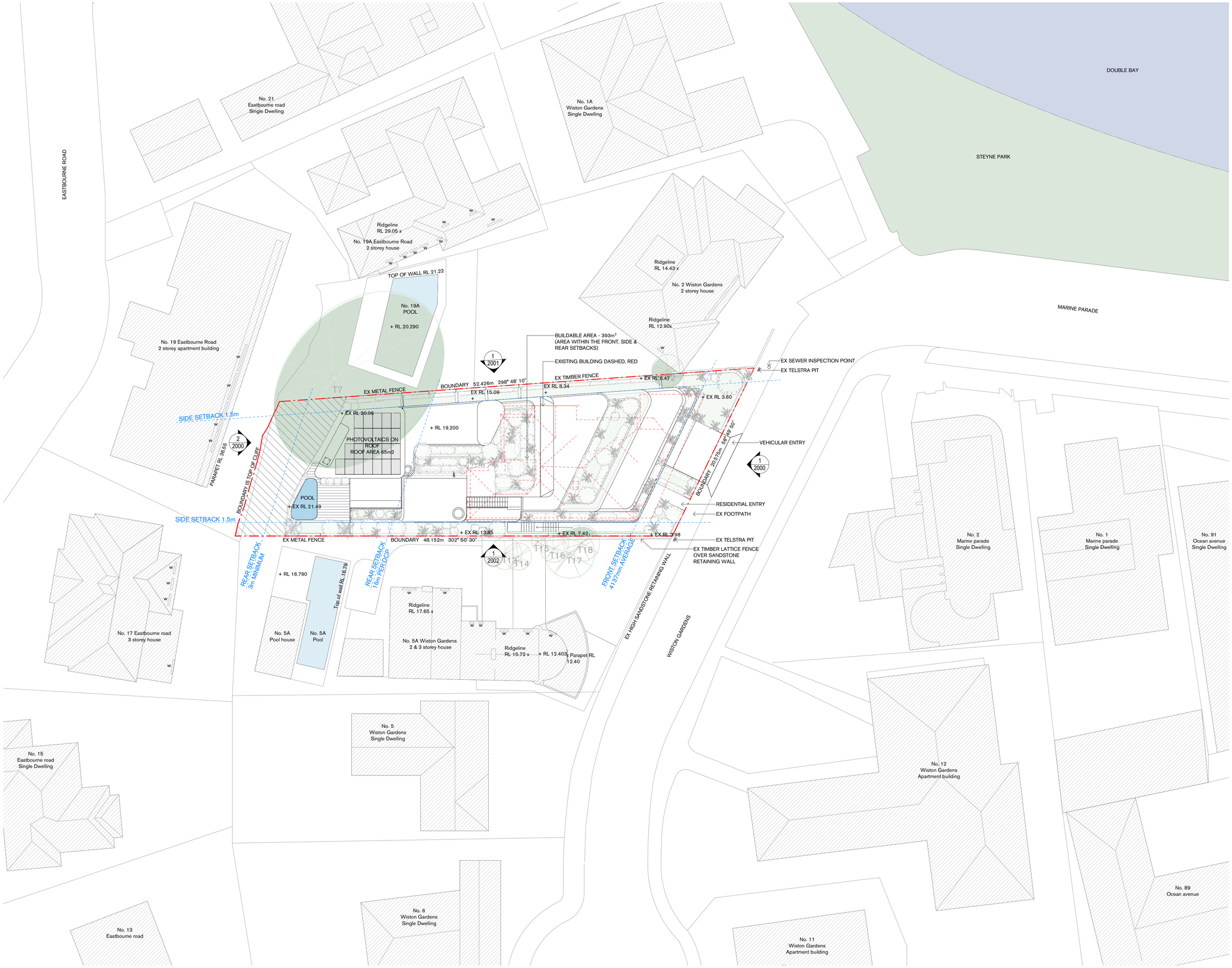
PROJECT
DETAILED SITE INVESTIGATION
3 WISTON GARDENS
DOUBLE BAY, NSW

TITLE
SITE LOCATION

FIGURE No.
2

CONSARA

Appendix A: Detailed Plans for Multi-storey Residential Apartment Building



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Jonathan Evans 6613
Mladen Pmjatovic 7468
Ben Green 7066
Chi Melhem 7754

Notes Regarding "Development Application Drawings"

Minor changes to building form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent.

Refer to arborist Andrew Morton's report for further information regarding the labelled trees.

Site Area: 828m²
Zone: R3 Medium Density Residential
Building Height: 10.5m maximum
Acid Sulfate: Class 5

Rev	Date	For
A	11.03.20	For client review
B	07.04.20	For legal advice
C	14.04.20	For legal advice
D	12.06.20	For consultant information
E	10.07.20	For consultant information
F	29.07.20	For Development Application

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Heritage
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Legend

Existing tree retained

Proposed tree

Proposed planting

Tzannes

Scale 1 : 200 @ A1 (Double @ A3)
0 2 4 6 8 10 m

North

Project
Wiston Gardens Double Bay

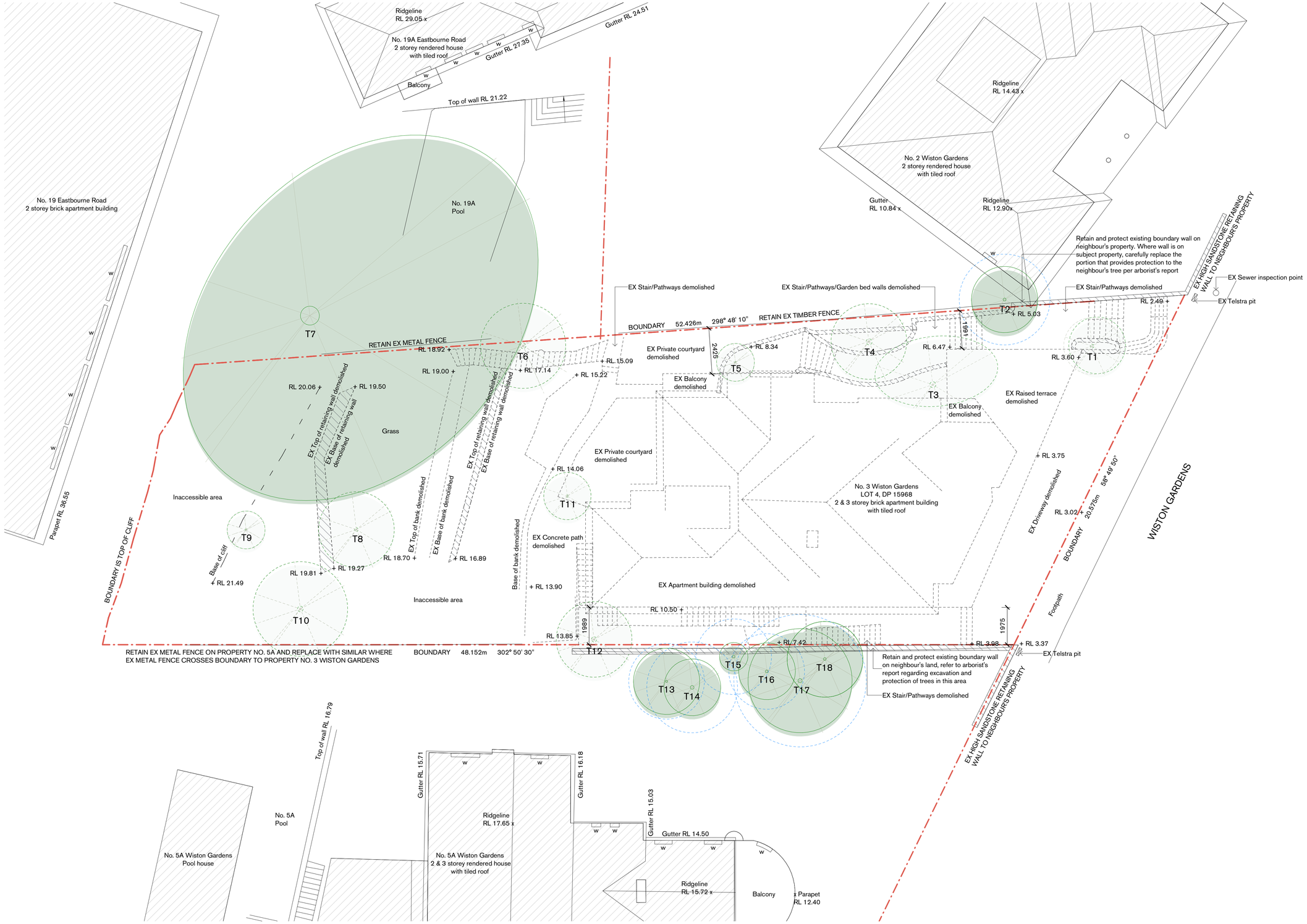
Address
3 Wiston Gardens
Double Bay, NSW 2028

Status
FOR DEVELOPMENT APPLICATION

Drawing
Site and Roof Plan

Date Created	Drawn	Checked
10/03/20	CD	TZ

Project No.	Drawing No.	Revision
19029	0001	F



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B	10.07.20	For consultant information
C	29.07.20	For Development Application

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Legend

Existing tree retained

Existing tree removed

Tzannes

Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000 mm

Project
Wiston Gardens Double Bay

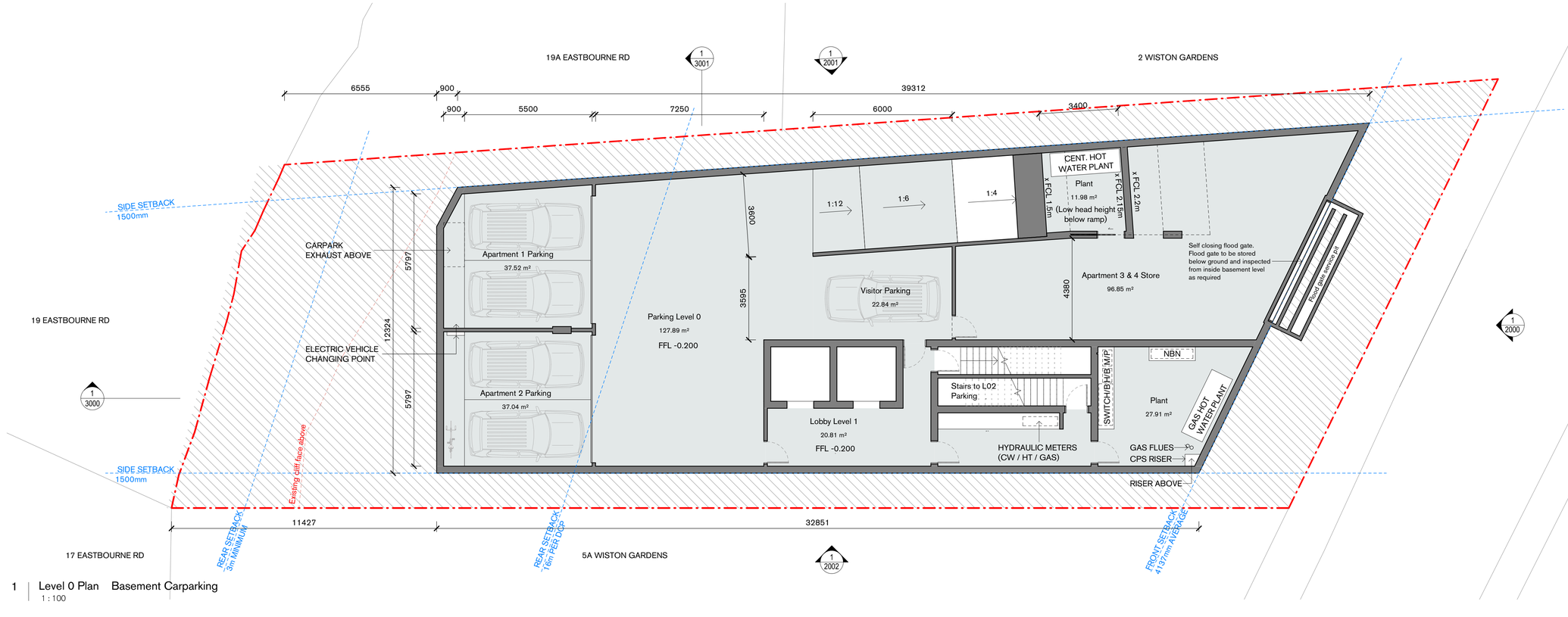
Address
3 Wiston Gardens
Double Bay, NSW 2028

Status
FOR DEVELOPMENT APPLICATION

Drawing
Demolition Plan

Date Created	Drawn	Checked
05/05/20	SR	TZ

Project No.	Drawing No.	Revision
19029	0500	C



1 | Level 0 Plan Basement Carparking
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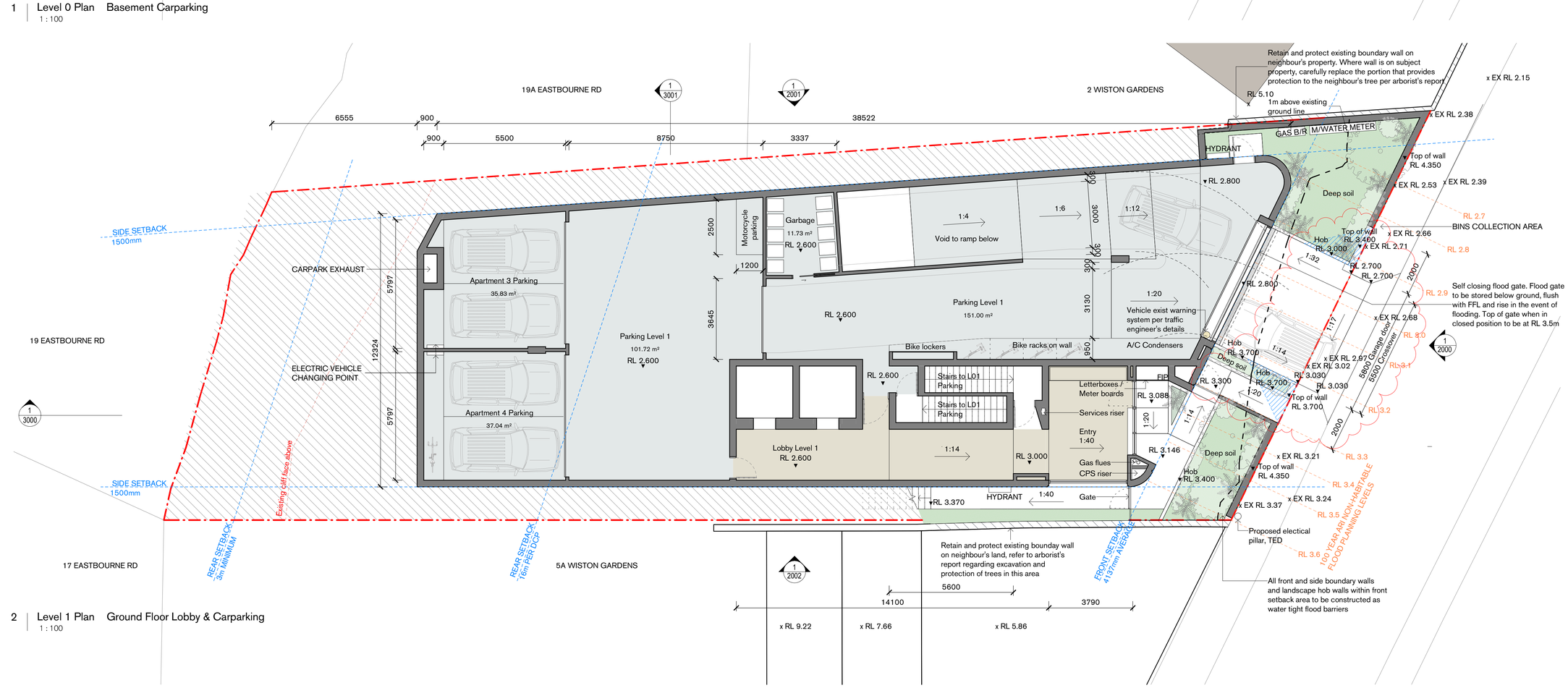

2 | Level 1 Plan Ground Floor Lobby & Carparking
1 : 100

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Notes Regarding "Development Application Drawings"

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Note

Landscaping per landscape architect's report

Rev	Date	For
F	31.07.20	For Development Application
G	19.11.20	Flood Plane Updates
H	23.11.20	Flood Plane Updates
I	24.11.20	Flood Plane Updates
J	02.12.20	Flood Plane Updates
K	12.03.21	For Comment
L	15.03.21	WMC Requested Amendments

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Legend

ALV	Aluminium Louvres
BZ	Bronze Finish Metal
CON	Concrete
GLC	Glass - Clear
MDR	Metal Deck Roof
MSR	Masonry
SST	Sandstone Block

Tzannes

Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000 mm

Project

Wiston Gardens Double Bay

Address

3 Wiston Gardens
Double Bay, NSW 2028

Status

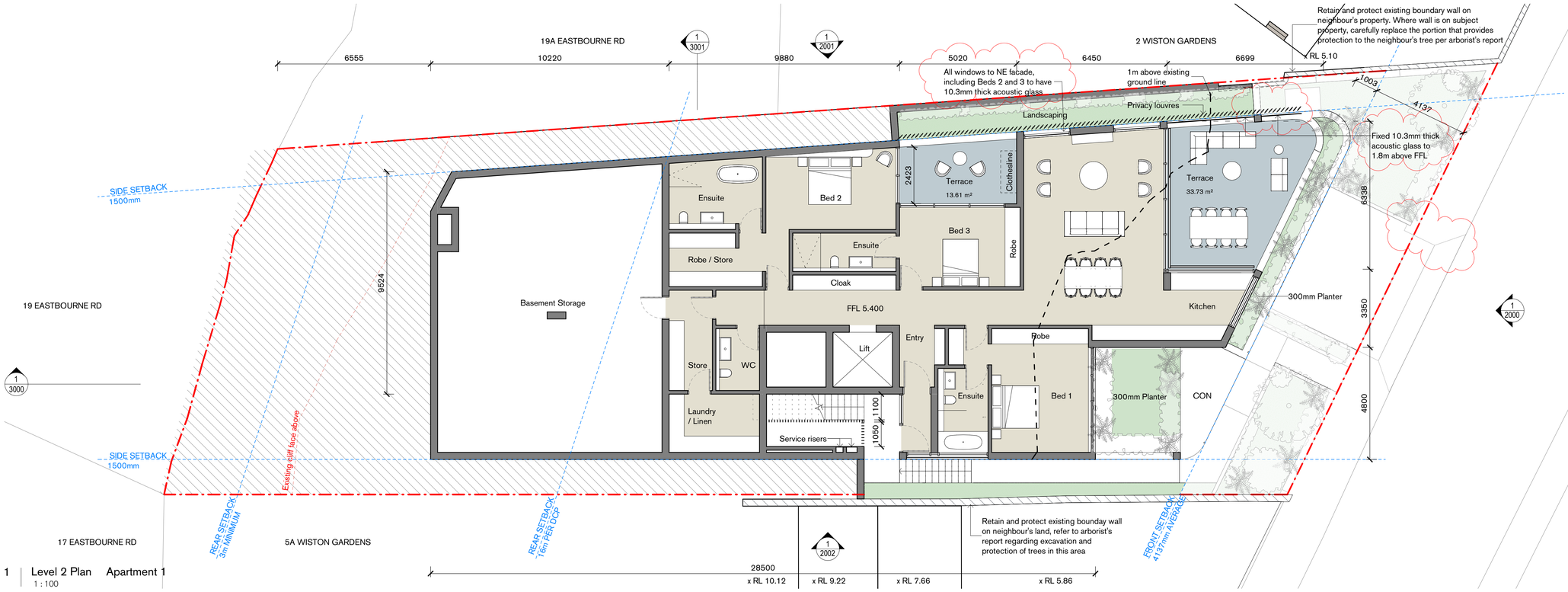
FOR DEVELOPMENT APPLICATION

Drawing

Level 0 and Level 1 Plans

Date Created	Drawn	Checked
13/12/19	CD	TZ

Project No.	Drawing No.	Revision
19029	1000	L



1 | Level 2 Plan Apartment 1
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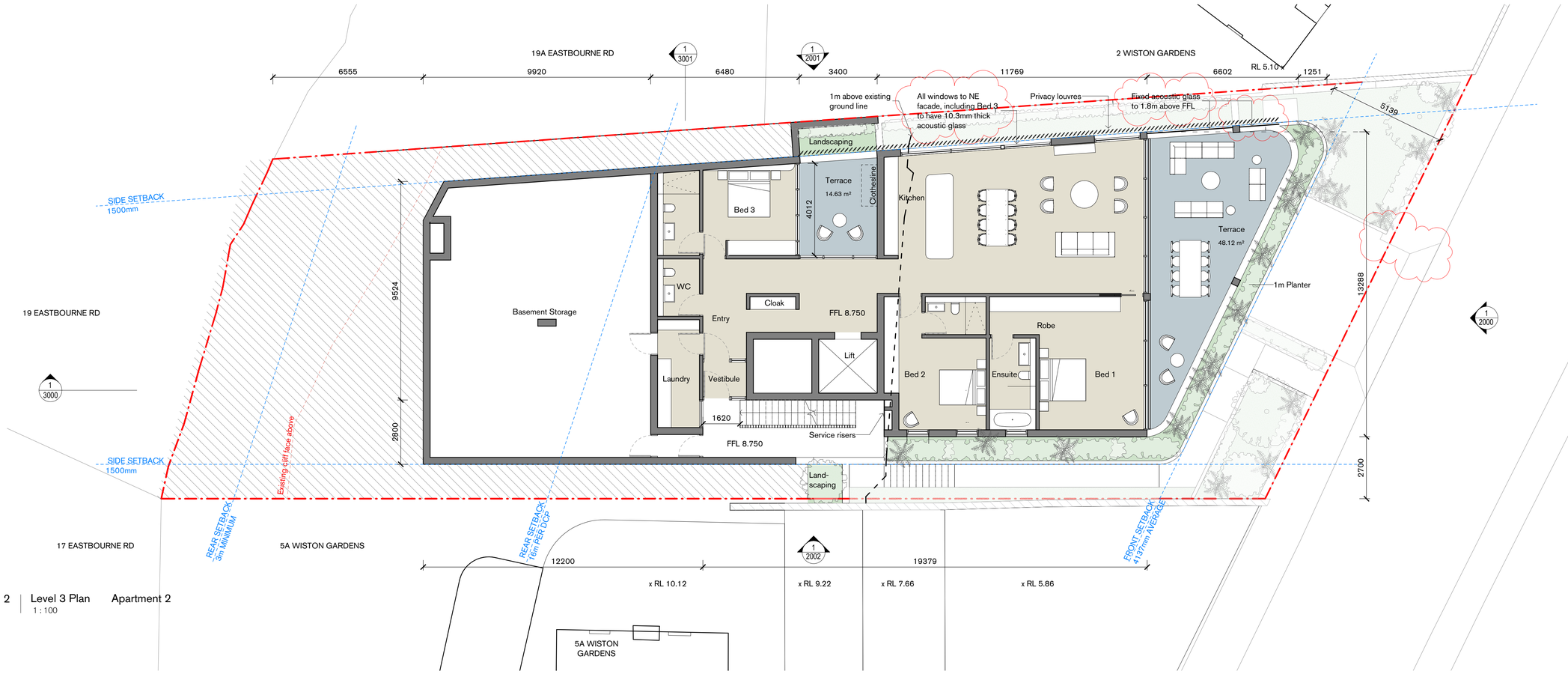

2 | Level 3 Plan Apartment 2
1 : 100

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Notes Regarding "Development Application Drawings"

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Note

Landscaping per landscape architect's report

Rev	Date	For
C	10.07.20	For consultant information
D	29.07.20	For Development Application
E	19.11.20	Flood Plane Updates
F	23.11.20	Flood Plane Updates
G	02.12.20	Flood Plane Updates
H	12.03.21	For Comment
I	15.03.21	WMC Requested Amendments

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Legend

ALV	Aluminium Louvres
BZ	Bronze Finish Metal
CON	Concrete
GLC	Glass - Clear
MDR	Metal Deck Roof
MSR	Masonry
SST	Sandstone Block

Tzannes

Scale **North**

1 : 100 @ A1 (Double @ A3)
0 1000 2000 3000 4000 5000 mm

Project

Wiston Gardens Double Bay

Address

3 Wiston Gardens
Double Bay, NSW 2028

Status

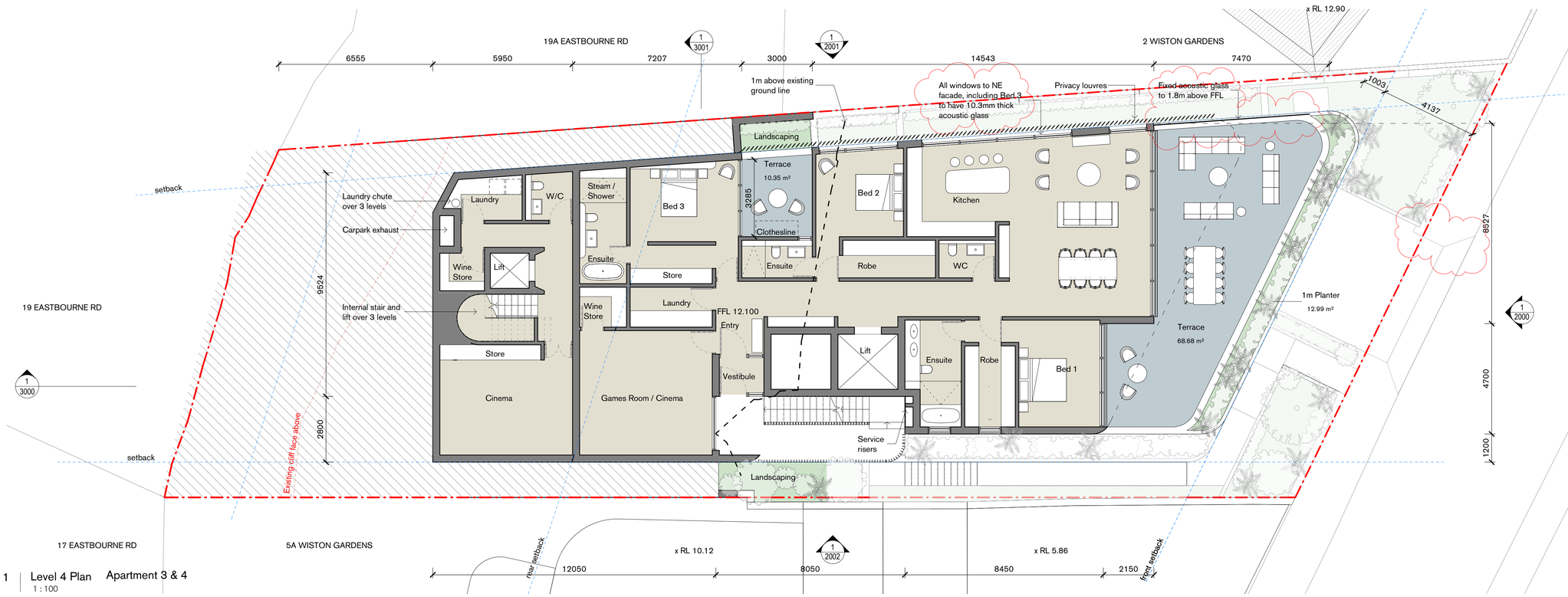
FOR DEVELOPMENT APPLICATION

Drawing

Level 2 and Level 3 Plans

Date Created	Drawn	Checked
13/12/19	CD	TZ

Project No.	Drawing No.	Revision
19029	1001	I



1 | Level 4 Plan Apartment 3 & 4
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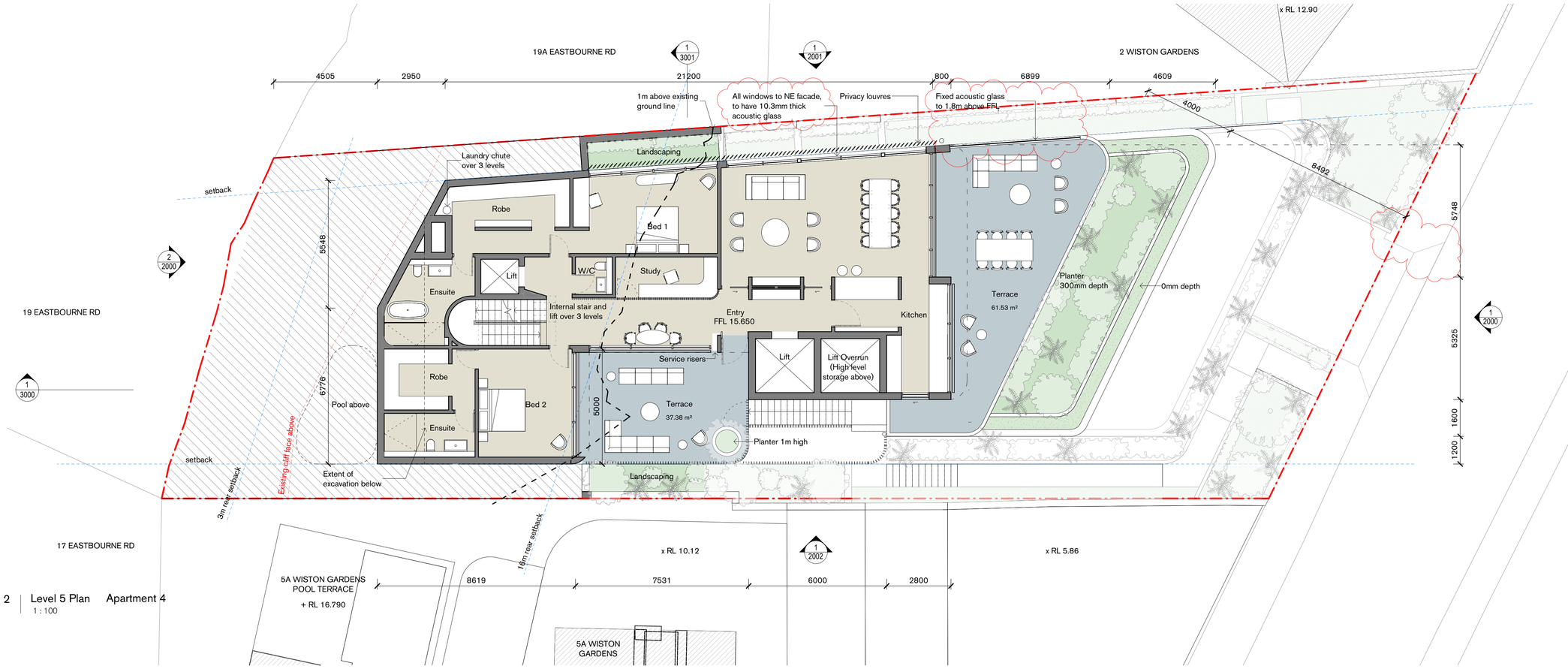

2 | Level 5 Plan Apartment 4
1 : 100

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Note

Landscaping per landscape architect's report

Rev	Date	For
C	08.07.20	For information
D	10.07.20	For consultant information
E	21.07.20	For consultant information
F	29.07.20	For Development Application
G	10.12.20	Flood Plane Updates
H	12.03.21	For Comment
I	15.03.21	WMC Requested Amendments

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CON	Concrete
GLC	Glass - Clear
MDR	Metal Deck Roof
MSR	Masonry
SST	Sandstone Block

Tzannes

Scale 1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000 mm

North

Project

Wiston Gardens Double Bay

Address

3 Wiston Gardens
Double Bay, NSW 2028

Status

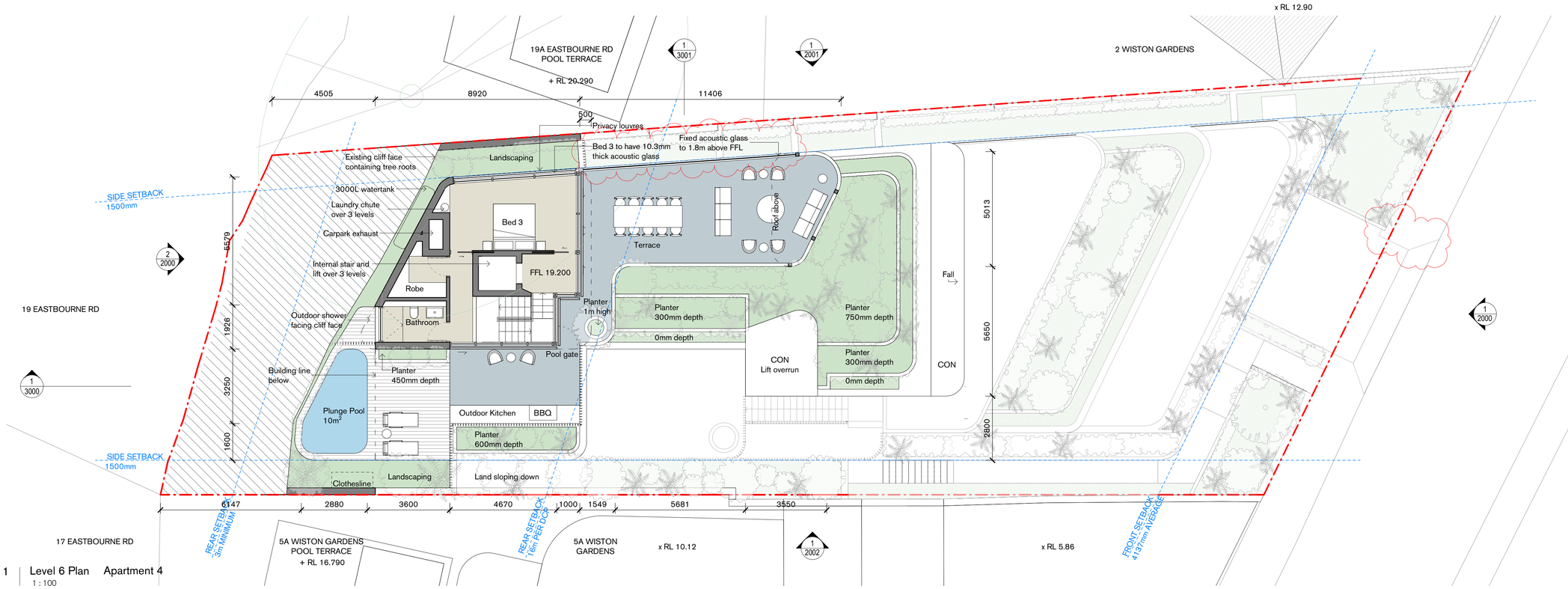
FOR DEVELOPMENT APPLICATION

Drawing

Level 4 and Level 5 Plans

Date Created	Drawn	Checked
18/12/19	CD	TZ

Project No.	Drawing No.	Revision
19029	1002	I



1 | Level 6 Plan Apartment 4
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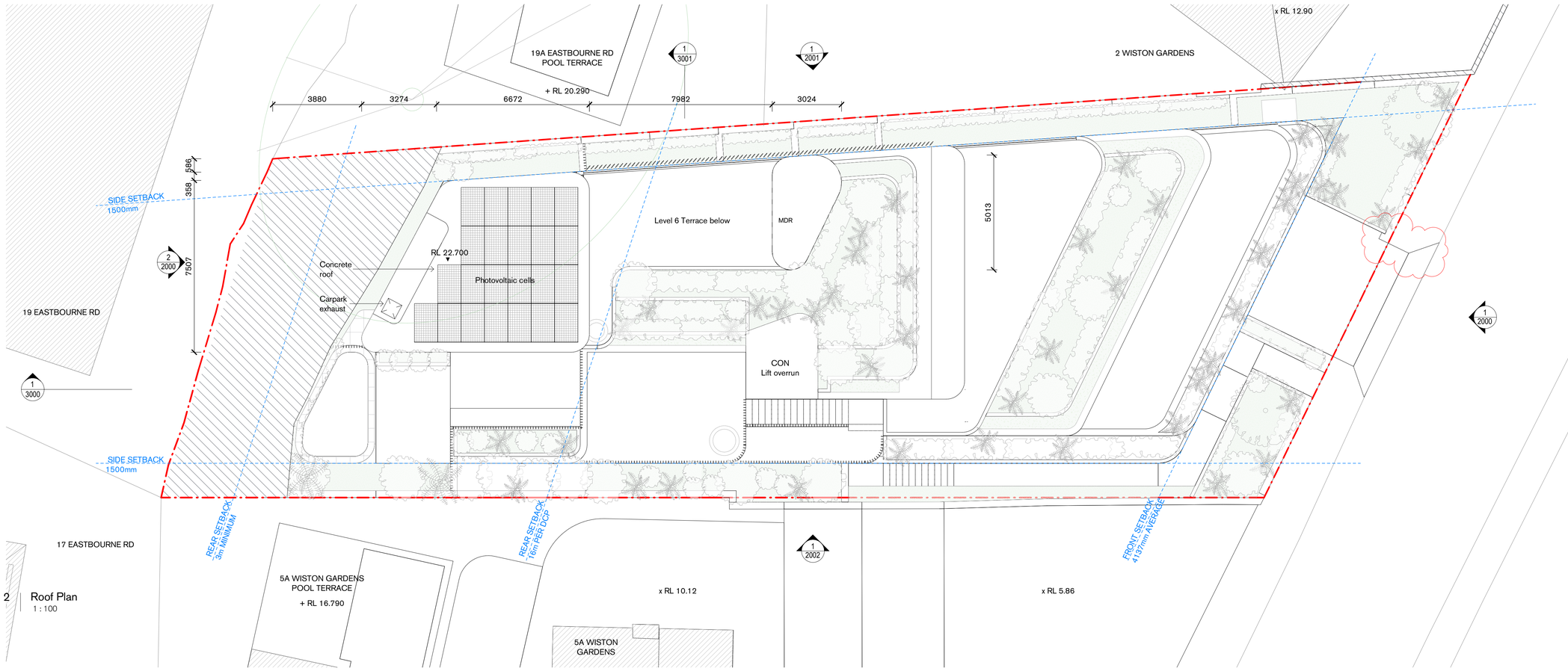

2 | Roof Plan
1 : 100

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Note

Landscaping per report by landscape architect, Oculus

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C	08.07.20	For information
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E	21.07.20	For consultant information
F	29.07.20	For Development Application
G	10.12.20	Flood Plane Updates
H	12.03.21	For Comment
I	15.03.21	WMC Requested Amendments

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MSR	Masonry
SST	Sandstone Block

Tzannes

Scale 1 : 100 @ A1 (Double @ A3)
0 1000 2000 3000 4000 5000 mm

North

Project
Wiston Gardens Double Bay

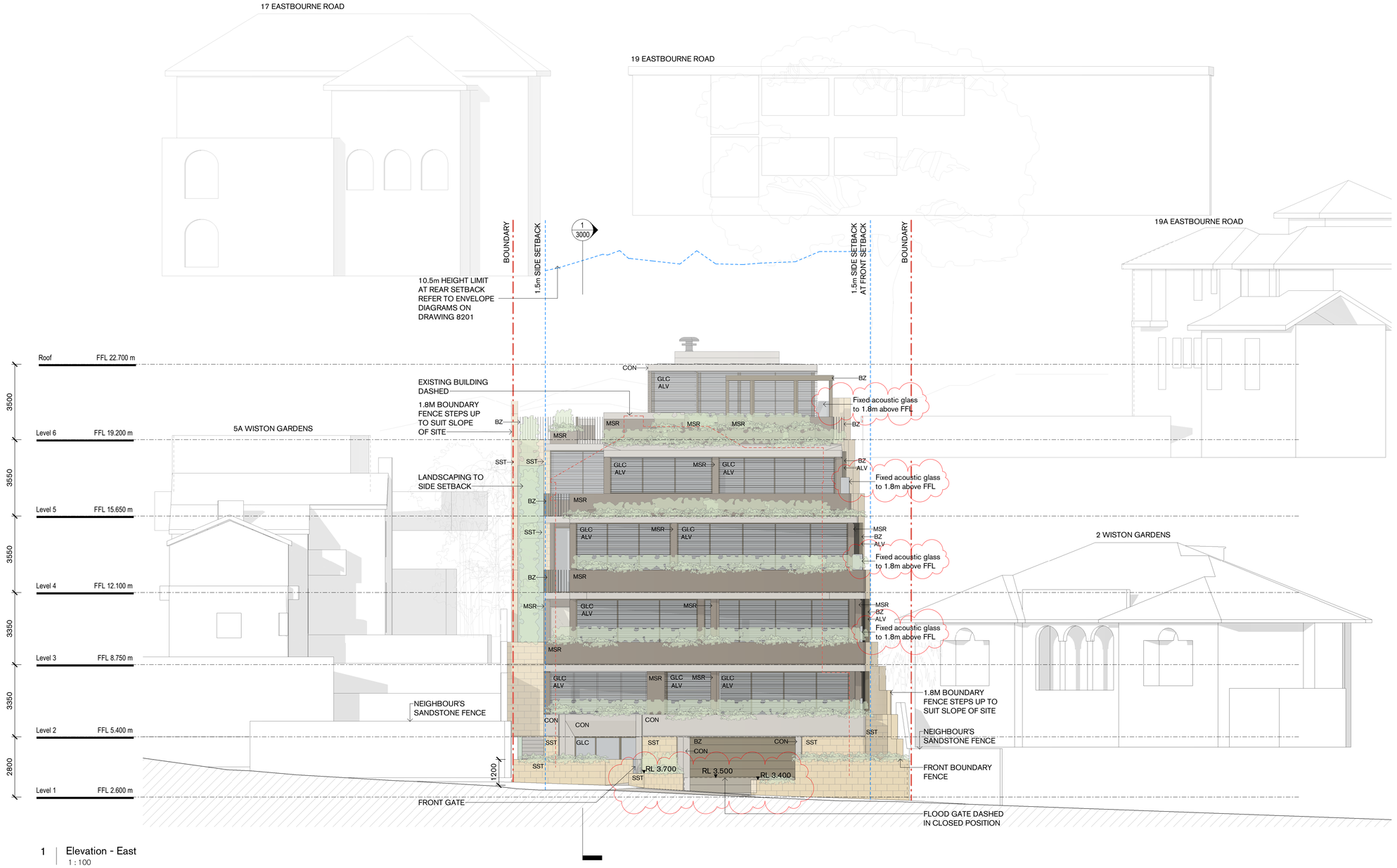
Address
3 Wiston Gardens
Double Bay, NSW 2028

Status
FOR DEVELOPMENT APPLICATION

Drawing
Level 6 and Roof Plans

Date Created	Drawn	Checked
01/08/20	CD	TZ

Project No.	Drawing No.	Revision
19029	1003	I



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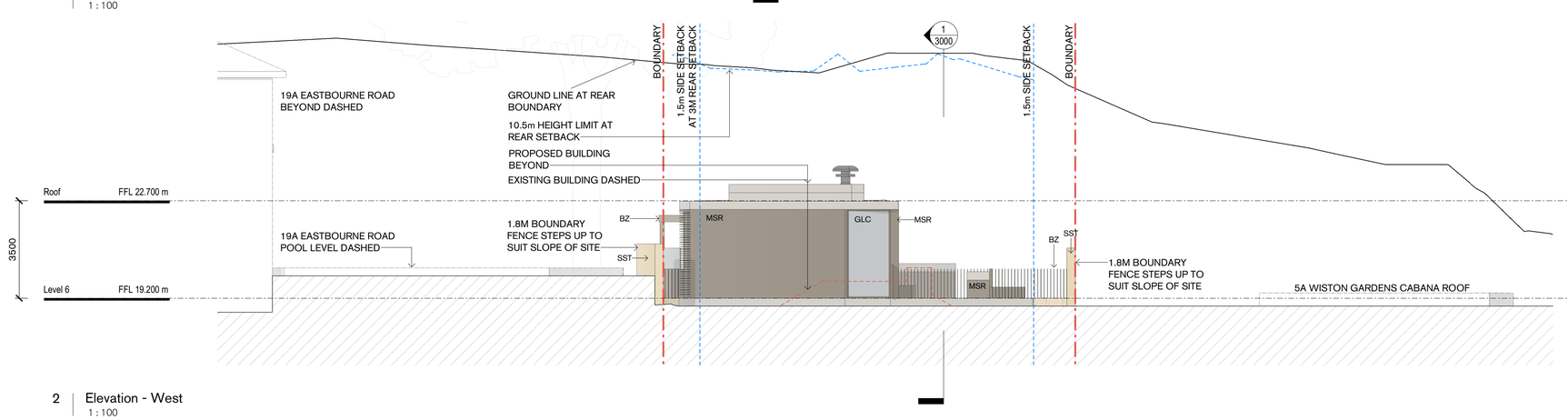

2 | Elevation - West
1 : 100

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Legend

ALV	Aluminium Louvres
BZ	Bronze Finish Metal
CON	Concrete
GLC	Glass - Clear
MDR	Metal Deck Roof
MSR	Masonry
SST	Sandstone Block

Tzannes

Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000 mm

Project
Wiston Gardens Double Bay

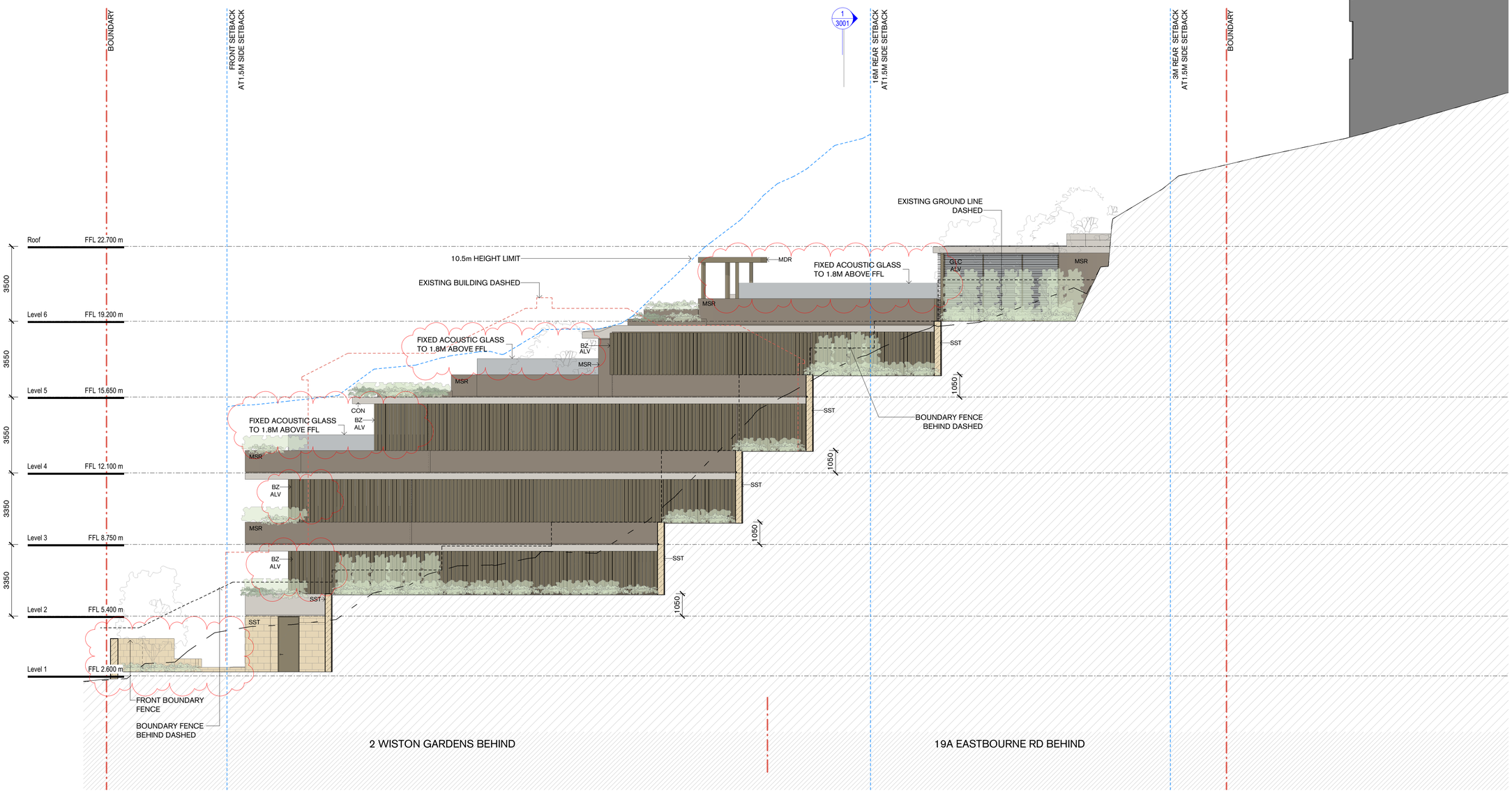
Address
3 Wiston Gardens
Double Bay, NSW 2028

Status
FOR DEVELOPMENT APPLICATION

Drawing
Elevations - East & West

Date Created	Drawn	Checked
20/12/19	RW	TZ

Project No.	Drawing No.	Revision
19029	2000	G



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Mladen Pmjatovic 7488
Ben Green 7066
Chi Melhem 7754

Notes Regarding "Development Application Drawings"

Minor changes to building form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent.

Rev	Date	For
A	12.06.20	For consultant information
B	10.07.20	For consultant information
C	29.07.20	For Development Application
D	04.08.20	For Development Application
E	23.11.20	Flood Plane Updates
F	02.12.20	Flood Plane Updates
G	15.03.21	WMC Requested Amendments

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Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000
mm

Project
Wiston Gardens Double Bay

Address
3 Wiston Gardens
Double Bay, NSW 2028

Status
FOR DEVELOPMENT APPLICATION

Drawing
Elevation - North

Date Created	Drawn	Checked
20/12/19	RW	TZ

Project No.	Drawing No.	Revision
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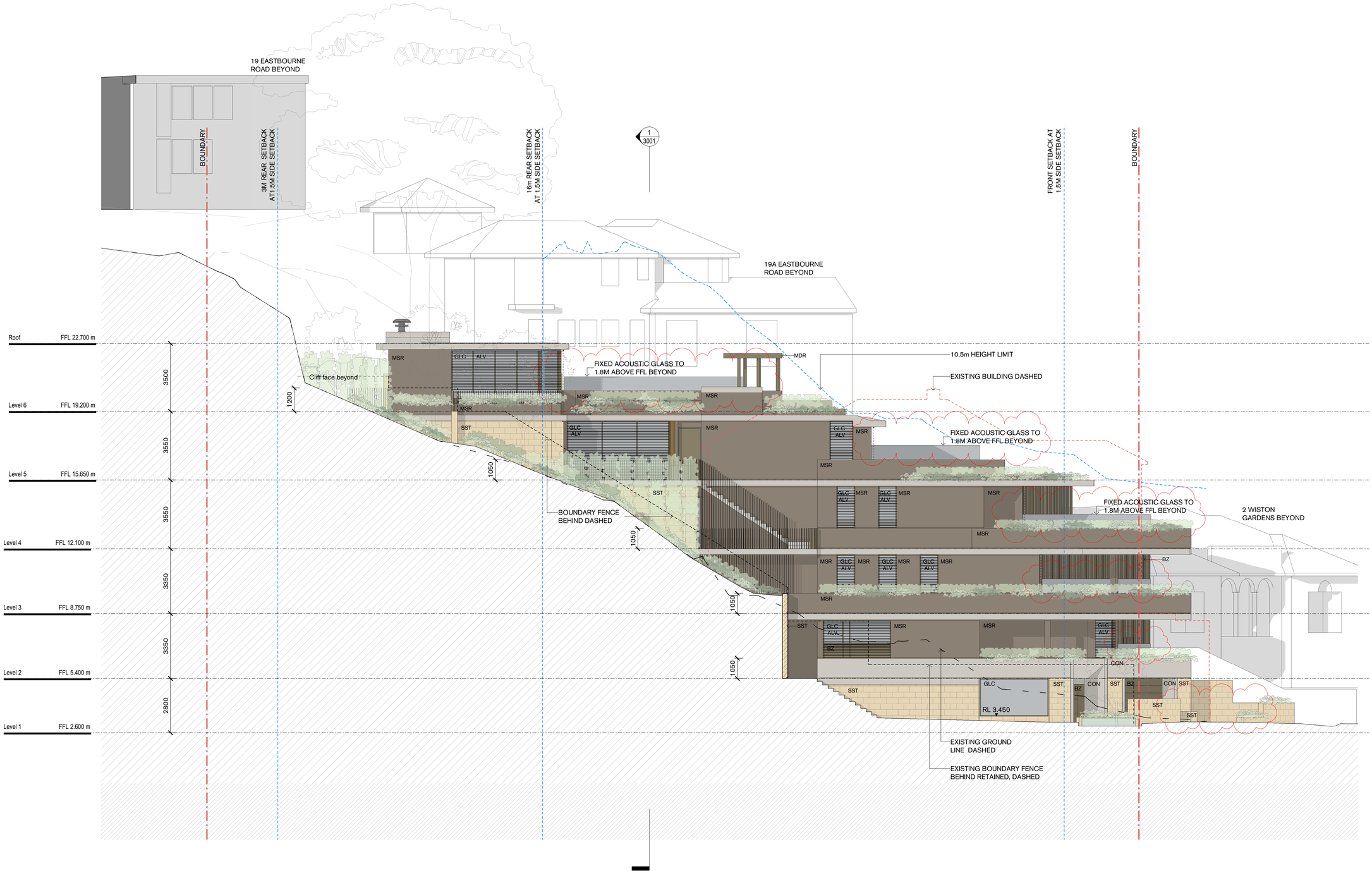

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SST	Sandstone Block

Tzannes

Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000
mm

Project

Wiston Gardens Double Bay

Address

3 Wiston Gardens
Double Bay, NSW 2028

Status

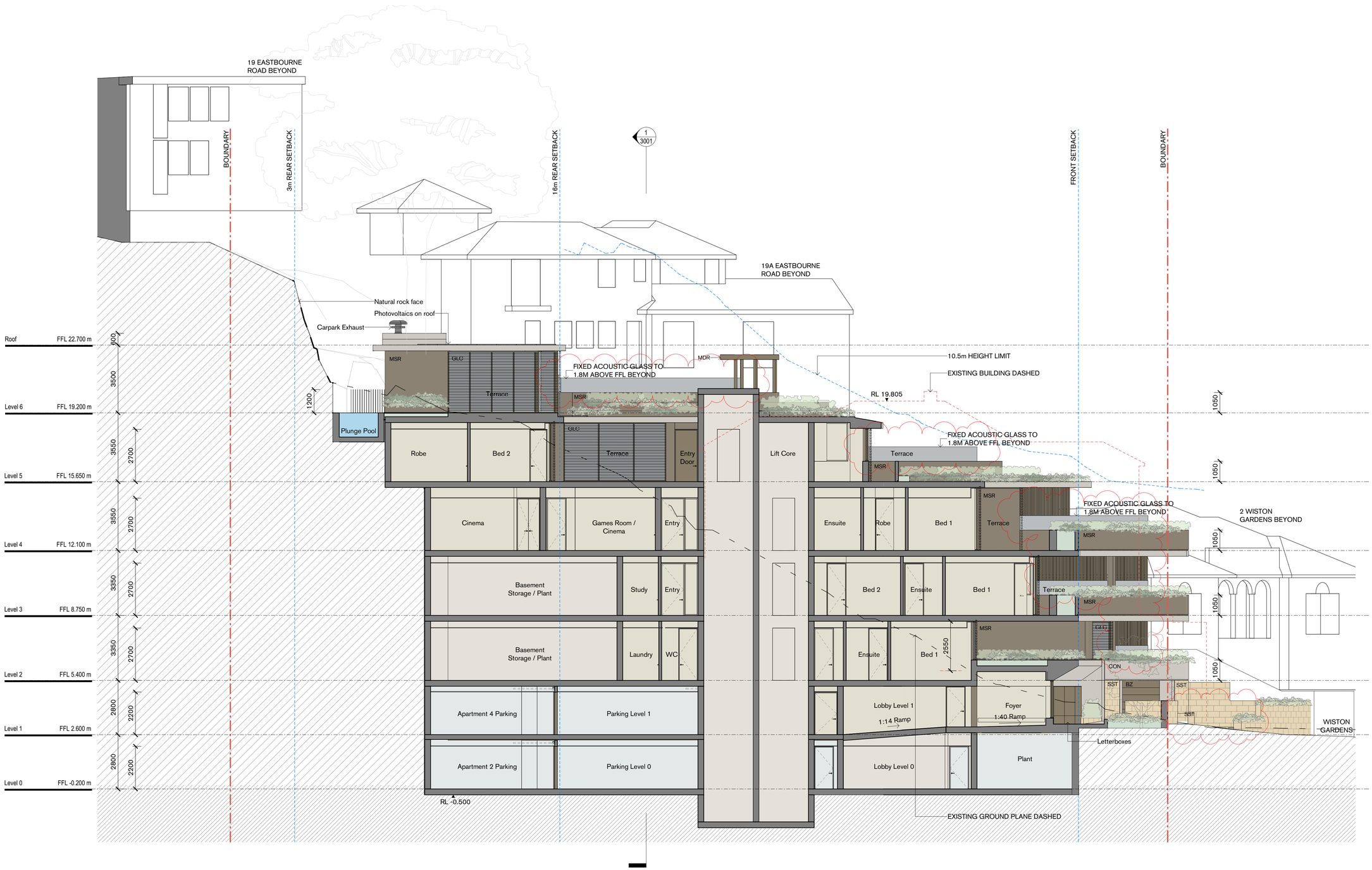
FOR DEVELOPMENT APPLICATION

Drawing

Elevation - South

Date Created	Drawn	Checked
20/12/19	RW	TZ

Project No.	Drawing No.	Revision
19029	2002	G



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Tzannes

Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000 mm

Project

Wiston Gardens Double Bay

Address

3 Wiston Gardens
Double Bay, NSW 2028

Status

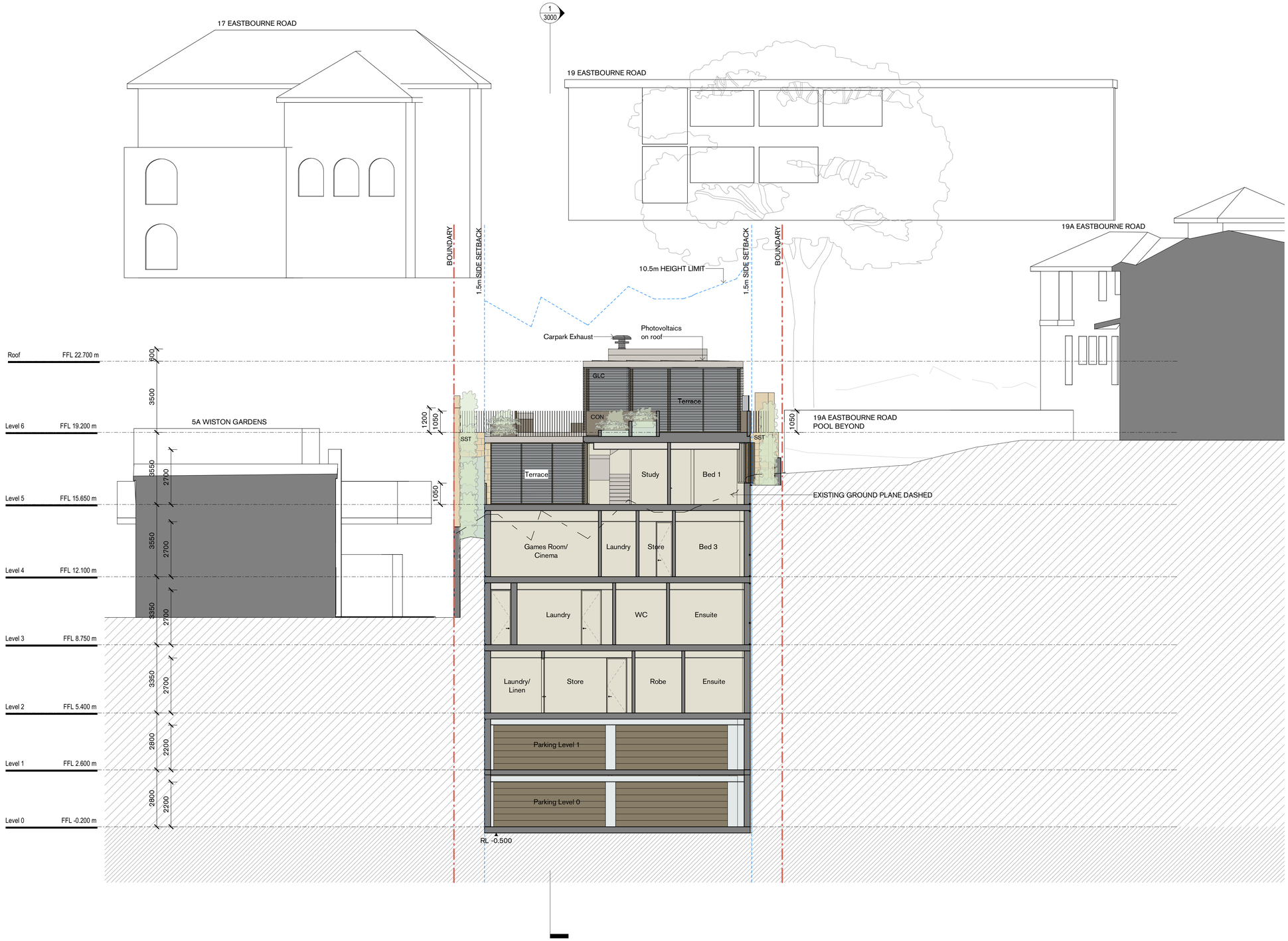
FOR DEVELOPMENT APPLICATION

Drawing

Section 1

Date Created	Drawn	Checked
20/12/19	RW	TZ

Project No.	Drawing No.	Revision
19029	3000	H



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Scale **North**

1 : 100 @ A1 (Double @ A3)

0 1000 2000 3000 4000 5000 mm

Project

Wiston Gardens Double Bay

Address

3 Wiston Gardens
Double Bay, NSW 2028

Status

FOR DEVELOPMENT APPLICATION

Drawing

Section 2

Date Created	Drawn	Checked
18/12/19	RW	TZ

Project No.	Drawing No.	Revision
19029	3001	E

Appendix B: Data Quality Objectives

In determining the type, quantity and quality of data needed to support decisions relating to the characterisation of the sub-surface conditions beneath the lower levels of the Former Torpedo Factory Building, the seven-step DQO approach has been undertaken in accordance with Appendix B of Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC, 2013) (the NEPM). The DQO's are presented below.

Step 1 State the Problem

Merman Investments are proposing the redevelopment of the Site into a medium density residential apartment building. The development comprises a multi-storey building, basement levels for parking and plant rooms and landscaping at the frontage and rear of the building. The Site currently contains a multi-storey residential apartment building that was constructed with no basements at sometime between the 1920s and 1930s.

A steeply terraced sandstone ridge is present across the north-western area of the Site and the ground floor of the building sits at the base of this cliff face which then slopes down to the road. Garages are present at the road level with the frontage of the building located on top of the garages. The building footprint together with the sandstone cliff occupies the majority of the area of the Site. Some minimal garden beds and landscaping areas are present at the northern side and frontage of the current building above the garages and some of the higher sandstone terraces contain some vegetation.

The results of previous investigations identified the presence of shallow fill materials within the landscaped areas present above the garages at the front the Site that contained asbestos containing materials (ACM) and concentrations of polycyclic aromatic hydrocarbons (PAHs) that were greater than the criteria for medium density residential land use. The investigation indicated the potential for these fill materials to extend beneath the existing building to depths of up to 1 to 2 m beneath the building. However, it was noted that as the majority of the Site area is occupied by the terraced sandstone ridge and the current building footprint, areas in which intrusive investigations could be completed were limited and that these physical constraints precluded the opportunity for further investigations to be conducted.

It was concluded that due to the presence of asbestos and PAH contaminated fill materials and that the contamination had not been able to be delineated, the Site is not suitable for residential land use with minimal opportunities for access to soils, however, given the nature of the redevelopment that the Site could be made suitable if remediation and validation works were undertaken. Despite the access constraints on the Site a recommendation was made that a DSI be undertaken prior to the development of a remediation action plan.

This report has been prepared to satisfy the recommendation for the completion of a DSI. However, given that the access on the Site remains unchanged, further intrusive investigations have not been undertaken. Instead, this DSI provides more complete and definitive assessment on the matters raised in the PSI through the completion of a detailed review of the PSI, the development of a detailed conceptual model of the Site, an assessment of adequacy and completeness of all information available for use in the assessment of risk and for the identification of remaining data gaps and uncertainties and demonstration that further intrusive investigations, as recommended by the PSI, are not required in order to determine how suitability of the Site can be achieved as part of the redevelopment on the Site.

This report, together with the PSI, will then be utilised to inform a Remediation Action Plan that will be implemented as part of the works required for the redevelopment of the Site.

Purpose of the Works

The purpose of these works are to provide an assessment of the environmental condition of the Site, including the potential for soil and/or groundwater contamination to be present and its suitability for its current and proposed

ongoing use for medium density residential land use with minimal opportunities for access to soils and recommendations for the requirement for remediation.

Step 2 Identify the Decisions

The decisions to be made based on the results of the works are as follows:

- Are the results of previous investigations able to be relied on up for the purposes of this investigation?
- What are the primary sources of contamination?
- Has the contamination been sufficiently characterised to achieve the objectives of this investigation?
- Is there a potential for the contamination to migrate from the Site?
- Are there data gaps and uncertainties?
- Is there an unacceptable level of uncertainty in relation to the nature and extent of contamination?
- Is the available information sufficiently adequate and complete for an assessment of risk to be made and to enable reliable decisions to be made on future requirements?
- Is further investigation required in order to achieve the objectives of this investigation?

Step 3 Identify Inputs to the Decisions

The inputs required to make the above decisions are as follows:

- Appropriate guidelines endorsed by NSW EPA;
- Proposed Land use;
- Objectives of the works;
- Scope of work that comprises the completion of review and assessment of available information in order to achieve objectives; and
- Relevant assessment criteria.

Step 4 Define the boundaries

The boundaries of the works have been identified as follows:

- Spatial boundaries –the lateral extent of the Site;
- Vertical boundaries –the depth to where sandstone bedrock is encountered;
- Temporal boundaries – the temporal boundary is limited to the data collected during the previous investigations and this work; and
- Constraints within the study boundaries – The following issues present limitations upon the sampling strategy:
    - Access issues due to current building footprint;
    - Unexpected finds during the works.

Step 5 Develop a Decision Rule

The decision rules for the works are as follows:

- If potential for significant or unexpected contamination or unexpected or inconsistent conditions is identified the Merman to be contacted so that an assessment for future works or change in scope is required.

Step 6 Specify Limits on Decision Errors

The minimum acceptable limits on decision errors to be applied in the works and the manner of addressing possible decision errors have been developed based on the Data Quality Indicators (DQIs) of precision, accuracy, representativeness, comparability and completeness and are presented in Appendix C of this report.

The potential for significant decision errors are to be minimised by:

- Completing an assessment of the works to determine whether the decisions set out in Step 3 for these measures have been met;
- Completing a robust QA/QC assessment of the field and analytical data and application of the probability that 95% of data will satisfy the DQIs, therefore a limit on the decision error will be 5% that a conclusive statement may be incorrect;
- Ensuring that, where required and able, an appropriate sampling and analytical density has been applied for the purposes of demonstrating required outcomes; and
- Ensuring that the criteria set for the works are appropriate.
- The potential for significant decision errors are to be minimised by completing a robust QA/QC program and by completing an investigation program that has an appropriate sampling and analytical frequency for the purposes of the works.

Step 7 Develop the Plan

Section 1 of this report sets out the works undertaken in order to demonstrate satisfaction of those objectives.

Appendix C: Data Validation

C1 Quality Assurance and Quality Control Plan

The field and laboratory quality assurance and quality control plan implemented for the works has been designed to achieve pre-determined data quality indicators that demonstrate the precision, accuracy, representativeness, completeness and comparability of the data set and that the data set is of acceptable quality to meet the objectives of the works. It is noted that the field and laboratory data was collected during the completion of the PSI. As such CONSARA has completed a review of the field and laboratory quality assurance and quality control works completed in the PSI and has provided below a summary of the outcomes of this review to confirm that the data has been appropriately validated.

The specific quality assurance and quality control plan adopted for the field and laboratory components of the PSI were developed based on with Appendix B of Schedule B2 of the NEPM and as documented in the PSI are detailed below.

C1.1 Data Quality Indicators

The project DQIs have been established to set acceptance limits on field and laboratory data collected as part of the PSI. For both field and laboratory procedures, acceptance limits are set at different levels for different projects and by the laboratories.

The DQIs are as follows:

DQI	Field	Laboratory	Acceptability Limits
Precision	Sampling methodologies appropriate and complied with. Collection of intra-laboratory duplicate samples	Analysis of: Field intra-laboratory duplicate samples (1 in 10 samples) Laboratory duplicate samples Laboratory prepared trip blanks	 RPD of < 30% RPD of < 50% Non-detect
Accuracy	Sampling methodologies appropriate and complied with. Collection of rinsate blanks	Analysis of: Rinsate blanks (1/day) Method blanks Matrix spikes Matrix spike duplicates Laboratory control samples Surrogate spikes Reference Materials	 Non-detect for CoC Non-detect for CoC 70 to 130% RPD of <50% 70 to 130 % 70 to 130% Varies

DQI	Field	Laboratory	Acceptability Limits
Representativeness	Appropriate media sampled according to appropriate methodologies All media identified sampled.	All samples analysed according to the PSI	All samples analysed according to the laboratory methodologies.
Comparability	Same sampling methodologies used on each day of sampling Experienced sampler Climatic conditions Same types of samples collected	Same analytical methods used (including clean-up) Sample laboratory detection limits (justify/quantify if different) Same laboratories (NATA accredited) Same units	As per NEPC (2013) < nominated criteria where applicable
Completeness	All critical locations and media sampled All samples collected Sampling methodologies appropriate and complied with Experienced sampler Documentation correct	All critical samples analysed and all analytes analysed according to PSI Appropriate methods Appropriate laboratory detection limits Sample documentation complete Sample holding times complied with	As per NEPC (2013) < nominated criteria where applicable As per NEPC (2013)

C1.2 Data Quality Indicators

The overall assessment of the quality of the data obtained during the PSI works is discussed below in terms of the data quality indicators provided above.

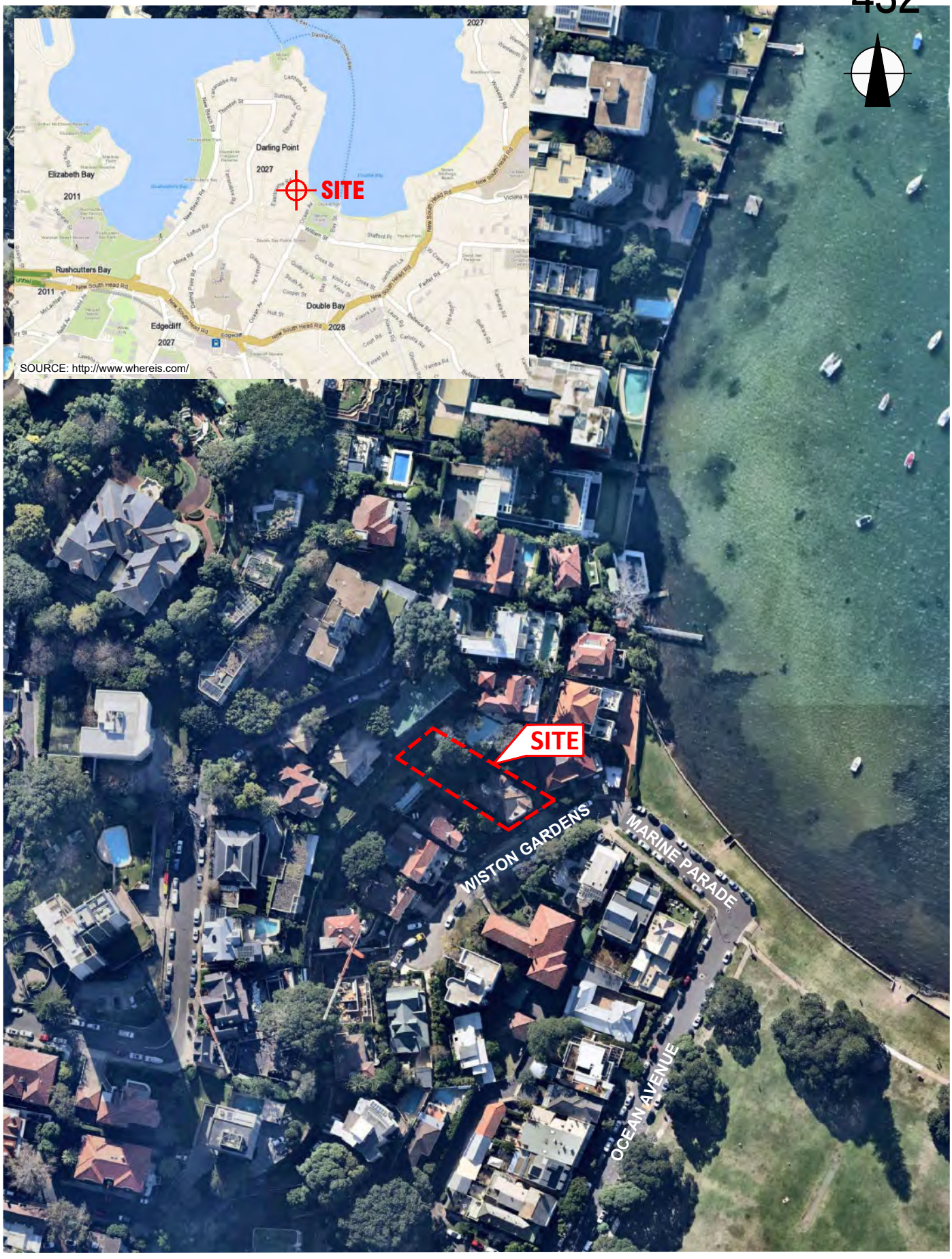
Non-compliances have been documented and discussed in the PSI. The DQIs are as follows:

DQI	Description	Compliance
Precision	Precision is a quantitative measure of the variability (or reproducibility) of data.	Precision or variability of the data was assessed by determining RPDs between the original and duplicate samples analysed. Based on results discussed above, CONSARA considers that the precision of the data presented in the PSI is sufficient for the purposes of the work.
Accuracy	Accuracy is a quantitative measure of the closeness of reported data to the true value.	Accuracy of the data was mainly assessed through review of the laboratory QA/QC results. From the laboratory QA/QC results, CONSARA considers that the accuracy of the data presented in the PSI is sufficient for the purposes of the work

DQI	Description	Compliance
Representativeness	Representativeness is the confidence (expressed qualitatively) that data are representative of each media present on the site.	Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of parameter variations at sampling points or environmental conditions. Sample representativeness is controlled through selecting sampling locations that exemplify site conditions and obtaining suitable samples from these sites. Sample selection and analysis was conducted in order to meet the specific objectives of the PSI. Analysis for the contaminants of concern was selectively conducted on samples collected as indicated in analytical tables. Based on the sampling and analytical regime undertaken in the PSI, the results obtained are considered to be sufficiently representative of the subsurface conditions at the locations tested.
Completeness	Completeness is a measure of the amount of usable data (expressed as %) from a data collection activity.	The completeness of data is defined as the percentage of analytical results that are considered valid. Valid chemical data are values that have been identified as acceptable or acceptable as qualified during the data validation process. The completeness is a comparison of the total number of samples accepted against the total number of samples, calculated as a percentage. The project goal for completeness is 95%. Completeness also includes checking that all entries in the data tables are correct, properly entered, and that any typographical errors are corrected and the data are re-entered properly, as required. Some of the samples collected and analysed did not comply with the stated DQIs. However, the data that did comply with the DQOs and DQIs, is considered to be sufficiently quantitative and complete for the purposes of the work (i.e. >95%)
Comparability	Comparability is the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.	Comparability expresses the confidence with which one data set can be compared with another. In order to assess comparability, field sampling procedures, laboratory sample preparation procedures, analytical procedures, and reporting units must be known and similar to established protocols, as was the case during this investigation. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable, and therefore more comparable, than other data. Each analyte was analysed by the same analytical laboratory using identical methods, and laboratory EQLs were consistent over each laboratory batch. Based on the above, the data obtained throughout the works is considered to be suitably comparable.

Based on the assessment of field and laboratory QA/QC data, the reported field and analytical results in the PSI are considered to be of a quality that can be relied upon for the purposes of the works.

Appendix D: Results of PSI



AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

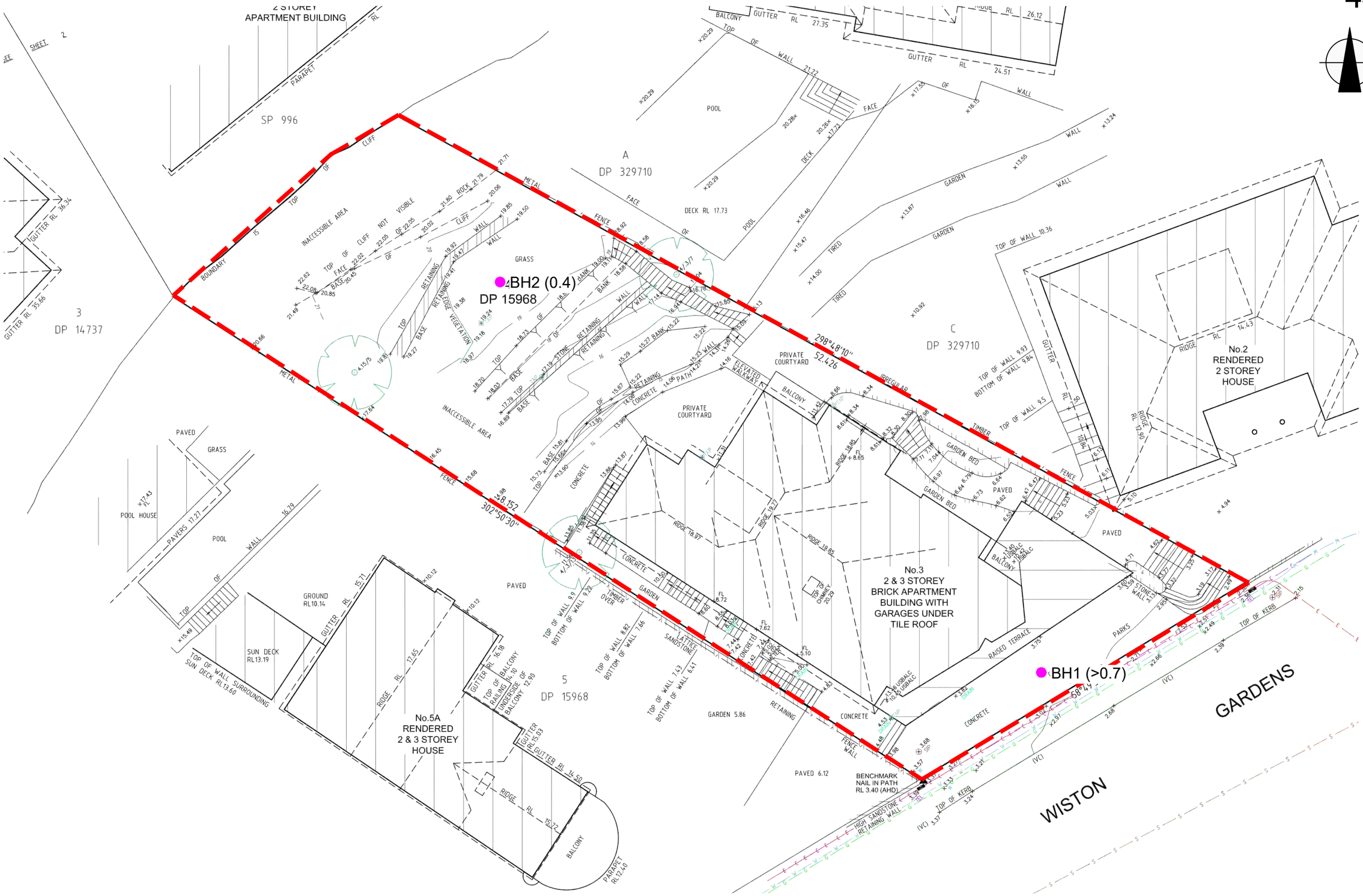
Location: 3 WISTON GARDENS, DOUBLE BAY, NSW

Project No: E33308BT

Figure No: 1

JKEnvironments

PLOT DATE: 14/07/2020 2:32:13 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\33000'S\E33308BT DOUBLE BAY\CAD\E33308BT.DWG



LEGEND

- APPROXIMATE SITE BOUNDARY
- BH(Fill Depth) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

0 2 4 6 8 10
SCALE 1:200 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

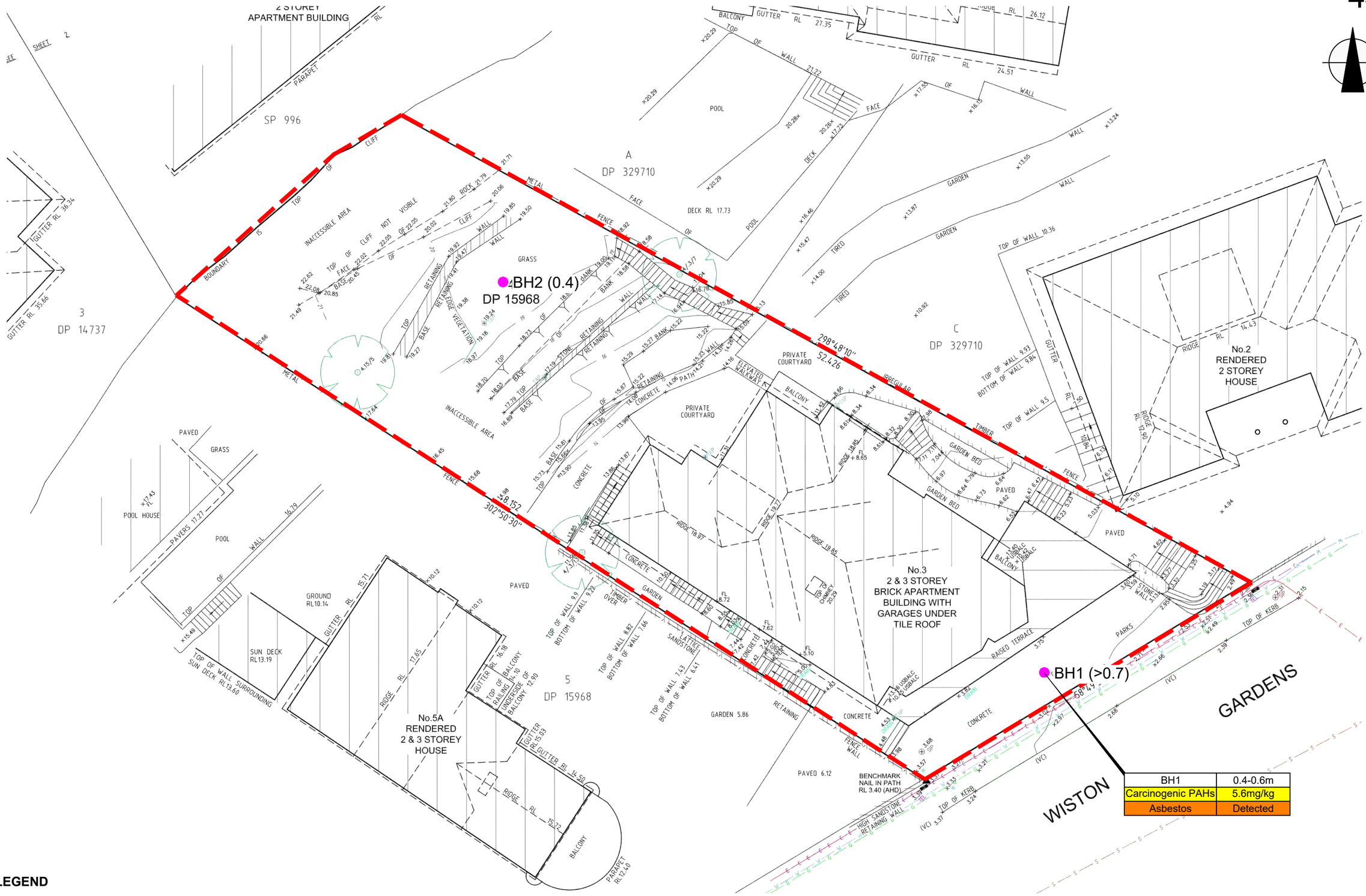
Location: 3 WISTON GARDENS, DOUBLE BAY, NSW

Project No: E33308BT

Figure No: 2

JKEnvironments

PLOT DATE: 17/07/2020 10:37:27 AM DWG FILE: Z:\5 EIS\SC EIS JOBS\33000'S\E33308BT DOUBLE BAY\CAD\E33308BT.DWG



BH1	0.4-0.6m
Carcinogenic PAHs	5.6mg/kg
Asbestos	Detected

LEGEND

- APPROXIMATE SITE BOUNDARY
- BH(Fill Depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- ASBESTOS DETECTED

0 2 4 6 8 10
SCALE 1:200 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **CONTAMINATION LOCATION PLAN**

Location: 3 WISTON GARDENS, DOUBLE BAY, NSW

Project No: E33308BT

Figure No: 3

JKEnvironments

PLOT DATE: 17/07/2020 10:37:45 AM DWG FILE: Z:\5 EIS\5C EIS JOBS\33000'S\E33308BT DOUBLE BAY\CADIE33308BT.DWG

Appendix B: Laboratory Results Summary Tables

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ABC:	Ambient Background Concentration
ACM:	Asbestos Containing Material
ADWG:	AustralianDrinking Water Guidelines
AF:	Asbestos Fines
ANZG	Australian and New Zealand Guidelines
B(a)P:	Benzo(a)pyrene
CEC:	Cation Exchange Capacity
CRC:	Cooperative Research Centre
CT:	Contaminant Threshold
EILs:	Ecological Investigation Levels
ESLs:	Ecological Screening Levels
FA:	Fibrous Asbestos
GIL:	Groundwater Investigation Levels
GSW:	General Solid Waste
HILs:	Health Investigation Levels
HSLs:	Health Screening Levels
HSL-SSA:	Health Screening Level-SiteSpecific Assessment
kg/L	kilograms per litre
NA:	Not Analysed
NC:	Not Calculated
NEPM:	National Environmental Protection Measure
NHMRC:	National Health and Medical Research Council
NL:	Not Limiting
NSL:	No Set Limit
OCP:	Organochlorine Pesticides
OPP:	Organophosphorus Pesticides
PAHs:	Polycyclic Aromatic Hydrocarbons
%w/w:	weight per weight
ppm:	Parts per million
PCBs:	Polychlorinated Biphenyls
PCE:	Perchloroethylene (Tetrachloroethylene or Teterachloroethene)
pH_{KCL} :	pH of filtered 1:20, 1M KCL extract, shaken overnight
pH_{ox} :	pH of filtered 1:20 1M KCl after peroxide digestion
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
RSL:	Regional Screening Levels
RSW:	Restricted Solid Waste
SAC:	Site Assessment Criteria
SCC:	Specific Contaminant Concentration
S_{Cr}:	Chromium reducible sulfur
S_{POS}:	Peroxide oxidisable Sulfur
SSA:	Site Specific Assessment
SSHSLs:	Site Specific Health Screening Levels
TAA:	Total Actual Acidity in 1M KCL extract titrated to pH6.5
TB:	Trip Blank
TCA:	1,1,1 Trichloroethane (methyl chloroform)
TCE:	Trichloroethylene (Trichloroethene)
TCLP:	Toxicity Characteristics Leaching Procedure
TPA:	Total Potential Acidity, 1M KCL peroxide digest
TS:	Trip Spike
TRH:	Total Recoverable Hydrocarbons
TSA:	Total Sulfide Acidity (TPA-TAA)
UCL:	Upper Level Confidence Limit on Mean Valu
USEPA	United States Environmental Protection Agency
VOCC:	Volatile Organic Chlorinated Compounds
WHO:	World Health Organisation

Table Specific Explanations:

HIL Tables:

- The chromium results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
- Carcinogenic PAHs is a toxicity weighted sum of analyte concentrations for a specific list of PAH compounds relative to B(a)P. It is also refered to as the B(a)P Toxic Equivalence Quotient (TEQ).
- Statistical calculations are undertaken using ProUCL (USEPA). Statistical calculation is usually undertaken using data from fill samples.

EIL/ESL Table:

- ABC Values for selected metals have been adopted from the published background concentrations presented in Olszowy et. al., (1995), Trace Element Concentrations in Soils from Rural and Urban New South Wales (the 25th percentile values for old suburbs with high traffic have been quoted).

Waste Classification and TCLP Table:

- Data assessed using the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014).
- The assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion.
- Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde.

QA/QC Table:

- Field blank, Inter and Intra laboratory duplicate results are reported in mg/kg.
- Trip spike results are reported as percentage recovery.
- Field rinsate results are reported in µg/L.

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TABLE S1
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013.
HIL-B: 'Residential with minimal opportunities for soil access; including dwellings with fully/permanently paved yards like high-rise buildings'

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos		
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC)			500	150	500	30000	1200	120	1200	60000	400	4	15	400	500	10	90	600	10	340	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH1	0.13-0.3	Fill: Silty Sandy Gravel	<4	<0.4	**6**	**4**	**19**	<0.1	**3**	**18**	**0.8**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	Not Detected
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	<4	<0.4	**6**	**7**	**18**	<0.1	**3**	**15**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	NA
BH1 (Triplicate)	0.13-0.3	Fill: Silty Sandy Gravel	<4	<0.4	**7**	**5**	**21**	<0.1	**3**	**15**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH1	0.4-0.6	Fill: Silty Sandy Clay	<4	<0.4	**8**	**6**	**27**	**0.2**	<1	**19**	**50**	**5.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0-0.2	Fill: Silty Sand	<4	<0.4	**7**	**15**	**80**	**0.2**	**5**	**83**	**0.58**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	Not Detected
BH2	0.4-0.5	Clayey Silty Sand	**10**	<0.4	**67**	**4**	**11**	<0.1	**1**	**41**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FCF1 - BH1	0.4-0.6	Fragment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
SDUP1	-	Fill: Silty Sand	<4	<0.4	**8**	**14**	**82**	**0.2**	**3**	**75**	**1.2**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	NA
Total Number of Samples			7	7	7	7	7	7	7	7	6	6	4	4	4	4	4	0	4	4	4	3
Maximum Value			10	<PQL	67	15	82	0.2	5	83	50	5.6	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Detected

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**

TABLE S2
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					HSL-A/B:LOW/HIGH DENSITY RESIDENTIAL							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH1	0.13-0.3	Fill: Silty Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.5
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.5
BH1	0.4-0.6	Fill: Silty Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH2	0-0.2	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	3
BH2	0.4-0.5	Clayey Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.4
SDUP1	-	Fill: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
Total Number of Samples					6	6	7	7	7	7	7	6
Maximum Value					<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	3

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the concentration above the SAC is highlighted in grey in the Site Assessment Criteria Table below

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
BH1	0.13-0.3	Fill: Silty Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH1	0.4-0.6	Fill: Silty Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0-0.2	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.4-0.5	Clayey Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP1	-	Fill: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3

TABLE S3
SOIL LABORATORY RESULTS COMPARED TO MANAGEMENT LIMITS
All data in mg/kg unless stated otherwise

			C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
BH1	0.13-0.3	Coarse	<25	<50	<100	<100
BH1 (Duplicate)	0.13-0.3	Coarse	<25	<50	<100	<100
BH1	0.4-0.6	Coarse	<25	<50	**220**	<100
BH2	0-0.2	Coarse	<25	<50	<100	<100
BH2	0.4-0.5	Coarse	<25	<50	<100	<100
SDUP1	-	Coarse	<25	<50	<100	<100
Total Number of Samples			6	6	6	6
Maximum Value			<PQL	<PQL	220	<PQL

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Soil Texture**	C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
BH1	0.13-0.3	Coarse	700	1000	2500	10000
BH1 (Duplicate)	0.13-0.3	Coarse	700	1000	2500	10000
BH1	0.4-0.6	Coarse	700	1000	2500	10000
BH2	0-0.2	Coarse	700	1000	2500	10000
BH2	0.4-0.5	Coarse	700	1000	2500	10000
SDUP1	-	Coarse	700	1000	2500	10000

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TABLE S4
SOIL LABORATORY RESULTS COMPARED T0 DIRECT CONTACT CRITERIA
All data in mg/kg unless stated otherwise

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		4,400	3,300	4,500	6,300	100	14,000	4,500	12,000	1,400	
Site Use		**RESIDENTIAL WITH ACCESSIBLE SOIL- DIRECT SOIL CONTACT**									
Sample Reference	**Sample Depth**										
BH1	0.13-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.5**
BH1 (Duplicate)	0.13-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.5**
BH1	0.4-0.6	<25	<50	**220**	<100	<0.2	<0.5	<1	<3	<1	0
BH2	0-0.2	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**3**
BH2	0.4-0.5	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.4**
SDUP1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
Total Number of Samples		6	6	6	6	6	6	6	6	6	5
Maximum Value		<PQL	<PQL	220	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	3

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

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TABLE S5
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013 EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																	
							AGED HEAVY METALS-EILs						EILs		ESLs							
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	13	28	163	5	122	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																				
BH1	0.13-0.3	Fill: Silty Sandy Gravel	Coarse	NA	NA	NA	<4	**6**	**4**	**19**	**3**	**18**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.09**
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	Coarse	NA	NA	NA	<4	**6**	**7**	**18**	**3**	**15**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH1 (Triplicate)	0.13-0.3	Fill: Silty Sandy Gravel	Coarse	NA	NA	NA	<4	**7**	**5**	**21**	**3**	**15**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH1	0.4-0.6	Fill: Silty Sandy Clay	Coarse	NA	NA	NA	<4	**8**	**6**	**27**	<1	**19**	<1	NA	<25	<50	**220**	<100	<0.2	<0.5	<1	<3	**3.9**
BH2	0-0.2	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**7**	**15**	**80**	**5**	**83**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH2	0.4-0.5	Clayey Silty Sand	Coarse	NA	NA	NA	**10**	**67**	**4**	**11**	**1**	**41**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
SDUP1	-	Fill: Silty Sand	Coarse	NA	NA	NA	<4	**8**	**14**	**82**	**3**	**75**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
Total Number of Samples				0	0	0	7	7	7	7	7	7	7	4	6	6	6	6	7	7	7	7	6
Maximum Value				NA	NA	NA	10	67	15	82	5	83	<PQL	<PQL	<PQL	<PQL	220	<PQL	<PQL	<PQL	<PQL	<PQL	3.9

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
BH1	0.13-0.3	Fill: Silty Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH1 (Triplicate)	0.13-0.3	Fill: Silty Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	--	--	--	--	--	--	--	--	--	--	--
BH1	0.4-0.6	Fill: Silty Sandy Clay	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH2	0-0.2	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH2	0.4-0.5	Clayey Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP1	-	Fill: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20

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TABLE S6
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total	TRH					BTEX COMPOUNDS				
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled	PCBs	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	ASBESTOS FIBRES
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH1	0.13-0.3	Fill: Silty Sandy Gravel	<4	<0.4	**6**	**4**	**19**	<0.1	**3**	**18**	**0.8**	**0.09**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	<4	<0.4	**6**	**7**	**18**	<0.1	**3**	**15**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH1 (Triplicate)	0.13-0.3	Fill: Silty Sandy Gravel	<4	<0.4	**7**	**5**	**21**	<0.1	**3**	**15**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH1	0.4-0.6	Fill: Silty Sandy Clay	<4	<0.4	**8**	**6**	**27**	**0.2**	<1	**19**	**50**	**3.9**	NA	NA	NA	NA	NA	<25	<50	**160**	**120**	**280**	<0.2	<0.5	<1	<3	NA
BH2	0-0.2	Fill: Silty Sand	<4	<0.4	**7**	**15**	**80**	**0.2**	**5**	**83**	**0.58**	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH2	0.4-0.5	Clayey Silty Sand	**10**	<0.4	**67**	**4**	**11**	<0.1	**1**	**41**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
FCF1 - BH1	0.4-0.6	Fragment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
SDUP1	-	Fill: Silty Sand	<4	<0.4	**8**	**14**	**82**	**0.2**	**3**	**75**	**1.2**	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
Total Number of Samples			7	7	7	7	7	7	7	7	6	6	4	4	4	4	4	6	6	6	6	6	6	6	6	6	3
Maximum Value			10	<PQL	67	15	82	0.2	5	83	50	3.9	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	160	120	280	<PQL	<PQL	<PQL	<PQL	Not Detected

Concentration above the CT1 — **VALUE**
Concentration above SCC1 — **VALUE**
Concentration above the SCC2 — **VALUE**
Concentration above PQL — **Bold**

TABLE S7
SOIL LABORATORY TCLP RESULTS
All data in mg/L unless stated otherwise

			Arsenic	Cadmium	Chromium	Lead	Mercury	Nickel	B(a)P
PQL - Envirolab Services			0.05	0.01	0.01	0.03	0.0005	0.02	0.001
TCLP1 - General Solid Waste			5	1	5	5	0.2	2	0.04
TCLP2 - Restricted Solid Waste			20	4	20	20	0.8	8	0.16
TCLP3 - Hazardous Waste			>20	>4	>20	>20	>0.8	>8	>0.16
Sample Reference	**Sample Depth**	**Sample Description**							
BH1	0.13-0.3	Fill: Silty Sandy Gravel	<0.05	<0.01	<0.01	<0.03	<0.0005	<0.02	<0.001
BH1 (Duplicate)	0.13-0.3	Fill: Silty Sandy Gravel	<0.05	<0.01	<0.01	<0.03	<0.0005	<0.02	<0.001
BH2	0-0.2	Fill: Silty Sand	<0.05	<0.01	<0.01	<0.03	<0.0005	<0.02	<0.001
Total Number of samples			3	3	3	3	3	3	3
Maximum Value			<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**
Concentration above PQL	**Bold**

Preliminary (Stage 1) Site Investigation
3 Wiston Gardens, Double bay, NSW
E33334B

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TABLE Q1
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthen	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cen	Benzo(g,h,i)perylene
	PQL Envirolab SYD		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1*	*2*	*1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.05*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1.0*	*2.0*	*1.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH2	0-0.2	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
laboratory	SDUP1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	0.2	0.1	<0.1	<0.1	0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.2	0.2	0.075	0.1	0.15	0.1	nc	nc	0.075
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0%	0%	67%	0%	67%	0%	nc	nc	67%
Field	TB-S1	-	NA	NA	NA	NA	<0.2	<0.5	<1	<2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	29/06/20																									

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH2	0-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	TB-S1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	29/06/20																					

			Azinphos-methyl (Guthi	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4*	*0.4*	*1*	*1*	*1*	*0.1*	*1*	*1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4.0*	*0.4*	*1.0*	*1.0*	*1.0*	*0.1*	*1.0*	*1.0*
Intra	BH2	0-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	7	15	80	0.2	5	83
laboratory	SDUP1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	8	14	82	0.2	3	75
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	7.5	14.5	81	0.2	4	79
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	13%	7%	2%	0%	50%	10%
Field	TB-S1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	29/06/20																						

Result outside of QA/QC acceptance criteria (highlighted)

Appendix D: Borehole Logs

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BOREHOLE LOG

Borehole No. 1
1/1

Client: MERMAN INVESTMENTS PTY LTD

Project: PROPOSED RESIDENTIAL DEVELOPMENT

Location: 3 WISTON GARDENS, DOUBLE BAY, NSW

Job No.: 33308B **Method:** HAND AUGER **R.L. Surface:** ≈ 3.4m

Date: 29/6/20 **Datum:** AHD

Plant Type: - **Logged/Checked by:** S.D./D.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLET-ION	■			■	REFER TO DCP TEST RESULTS	0			CONCRETE: 130mm.t				NO OBSERVED REINFORCEMENT
	■			■				-	FILL: Silty sandy gravel, fine to coarse grained igneous and sandstone gravel, light brown, fine to coarse grained sand, with brick and concrete fragments.	W M w>PL		50 50	APPEARS POORLY TO MODERATELY COMPACTED 0.4-0.6m FCF1
	■			■		0.5			FILL: Silty sand, fine to coarse grained, light brown and light grey, trace of fine to medium grained sandstone gravel.	M			
						1			FILL: Silty sandy clay, low to medium plasticity, light grey and grey, fine to medium grained sand, trace of fine to medium grained sandstone gravel.				HAND AUGER REFUSAL ON OBSTRUCTION IN FILL
									FILL: Silty sand, fine to medium grained, grey, trace of fine to medium grained sandstone gravel.				
						1.5			END OF BOREHOLE AT 0.7m				
						2							
						2.5							
						3							
						3.5							

JKGeotechnics

BOREHOLE LOG

Borehole No. 2
1/1

Client: MERMAN INVESTMENTS PTY LTD

Project: PROPOSED RESIDENTIAL DEVELOPMENT

Location: 3 WISTON GARDENS, DOUBLE BAY, NSW

Job No.: 33308B **Method:** HAND AUGER **R.L. Surface:** ≈ 19.2m

Date: 29/6/20 **Datum:** AHD

Plant Type: - **Logged/Checked by:** S.D./D.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION AND AFTER 1 HR	■			■	REFER TO DCP TEST RESULTS	0			FILL: Silty sand, fine to medium grained, dark grey, trace of clay, fine to medium gained sandstone gravel and ash.	M			GRASS COVER APPEARS POORLY COMPACTED
	■			■		0.5		SM	Clayey silty SAND: fine to medium grained, orange brown.	M	L		RESIDUAL
									END OF BOREHOLE AT 0.6m				HAND AUGER REFUSAL ON INFERRED SANDSTONE
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							