

REMEDIATION ACTION PLAN

185 Fifth Avenue, Austral NSW

prepared for

GM Architects

February 2018

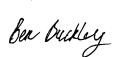


DOCUMENT CONTROL REGISTER

Document Information	
Job Number	E1292-3
Document Number	1
Report Title	Remediation Action Plan
Site Address	185 Fifth Avenue, Austral NSW
Prepared for	GM Architects

Document Review			
Revision Number	Date Issued	Description	Issued By
0	14/02/18	Initial Issue	Ben Buckley

Distribution Register		
Distribution Method	Custodian	Issued to
Electronic	B. Buckley	Benviron Group Office
Electronic	M. Khouri	GM Architects

Authorisation and Release			
	Signature	Name	Date
Prepared		Michael Silk B.Env Sc	14/02/18
Authorised		Benjamin Buckley- Director B.Env Sc., BSc (Forensics)	14/02/18

ABBREVIATIONS

AIP	<i>Australian Institute of Petroleum Ltd</i>	QA/QC	<i>Quality Assurance, Quality Control</i>
ANZECC	<i>Australian and New Zealand Environment and Conservation Council</i>	RAC	<i>Remediation Acceptance Criteria</i>
AST	<i>Aboveground Storage Tank</i>	RAP	<i>Remediation Action Plan</i>
BGL	<i>Below Ground Level</i>	RPD	<i>Relative Percentage Difference</i>
BTEX	<i>Benzene, Toluene, Ethyl benzene and Xylene</i>	SAC	<i>Site Assessment Criteria</i>
COC	<i>Chain of Custody</i>	SVC	<i>Site Validation Criteria</i>
DA	<i>Development Approval</i>	TCLP	<i>Toxicity Characteristics Leaching Procedure</i>
DP	<i>Deposited Plan</i>	TPH	<i>Total Petroleum Hydrocarbons</i>
DQOs	<i>Data Quality Objectives</i>	UCL	<i>Upper Confidence Limit</i>
EPA	<i>Environment Protection Authority</i>	UST	<i>Underground Storage Tank</i>
ESA	<i>Environmental Site Assessment</i>	VHC	<i>Volatile Halogenated Compounds</i>
HIL	<i>Health-Based Soil Investigation Level</i>	VOC	<i>Volatile Organic Compounds</i>
LGA	<i>Local Government Area</i>		
NEHF	<i>National Environmental Health Forum</i>		
NEPC	<i>National Environmental Protection Council</i>		
NHMRC	<i>National Health and Medical Research Council</i>		
OCP	<i>Organochlorine Pesticides</i>		
OPP	<i>Organophosphate Pesticides</i>		
PAH	<i>Polycyclic Aromatic Hydrocarbon</i>		
PCB	<i>Polychlorinated Biphenyl</i>		
PID	<i>Photo Ionisation Detector</i>		
PQL	<i>Practical Quantitation Limit</i>		

TABLE OF CONTENTS

ABBREVIATIONS.....	3
LIST OF FIGURES AND APPENDICES	9
1.0 INTRODUCTION.....	10
2.0 OBJECTIVES, SCOPE & DEVIATIONS.....	11
2.1 OBJECTIVES.....	11
2.2 SCOPE	11
2.3 DEVIATION FROM THIS RAP	12
3.0 BACKGROUND INFORMATION	13
3.1 SITE IDENTIFICATION AND ZONING.....	13
3.2 SITE DESCRIPTION.....	14
3.3 SUMMARY OF SITE HISTORY	14
3.4 PROPOSED DEVELOPMENT	15
3.5 ENVIRONMENTAL INFORMATION	16
3.6 PREVIOUS ENVIRONMENTAL INVESTIGATIONS	18
4.0 REMEDIATION CRITERIA	22
4.1 SOIL.....	22
4.1.1 Health Investigation Levels (HIL).....	22
4.1.2 Health Screening Levels (HSLs)	24
4.1.3 Ecological Investigation Levels (EILs)	25
4.1.4 Ecological Screening Levels (ESLs).....	25
4.1.5 Asbestos.....	27
4.1.6 Export of waste	27
5.0 REMEDIATION STRATEGY	28
5.1 GENERAL.....	28
5.2 NSW EPA PREFERRED HIERARCHY OF OPTIONS FOR SITE REMEDIATION.....	28
5.3 REMEDIATION OPTION REVIEW	29
5.3.1 Available remediation / management technologies.....	29
5.3.2 Excavation and off-site disposal	30

5.3.3	Treatment	30
5.3.4	Managing risks by preventing any direct exposure pathway between contaminated soil and site users (through capping).....	31
5.4	RATIONALE FOR SELECTION OF REMEDIAL STRATEGY	31
5.5	PREFERRED REMEDIATION STRATEGY	37
6.0	REMEDIAL WORKS	39
6.1	REMEDIAL GOALS	39
6.2	REMEDIAL PROGRAM	39
6.3	EXTENT OF REMEDIAL WORKS REQUIRED	41
6.4	REGULATORY REQUIREMENTS SUCH AS LICENSES AND APPROVALS	42
6.5	DISPOSAL OF EXCAVATED CONTAMINATED MATERIAL	42
6.6	CONTINGENCIES DURING REMEDIAL WORKS	42
6.6.1	Contaminated Soils	42
6.6.2	USTs	42
6.6.3	Contaminated Groundwater.....	43
7.0	VALIDATION PLAN (DATA QUALITY OBJECTIVES)	44
7.1	STATE THE PROBLEM.....	44
7.2	IDENTIFY THE ISSUE	44
7.3	IDENTIFY THE INPUTS TO THE DECISION	45
7.4	DEFINE THE STUDY BOUNDARIES.....	45
7.5	DECISION RULES	45
7.6	SPECIFY LIMITS OF DECISION ERROR.....	47
7.7	OPTIMISING THE DESIGN FOR OBTAINING DATA.....	47
8.0	VALIDATION SAQP & METHODOLOGY	49
8.1	SOIL VALIDATION METHODOLOGY	49
8.2	SOIL VALIDATION REPORTING	51
9.0	VALIDATION WORKS.....	52
9.1	OBJECTIVES	52
9.2	WASTE CLASSIFICATION OF THE FILL & HOTSPOTS	54
9.3	VALIDATION OF HOTSPOTS	54
9.4	VALIDATION OF AREAS WHERE FILL HAS BEEN TEMPORARILY STOCKPILED	55
9.5	VALIDATION OF IMPORTED FILL	55

9.6	DURATION OF REMEDIATION AND VALIDATION WORKS	55
10.0	QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)	56
10.1	GENERAL QA/QC.....	56
10.2	SAMPLE CONTAINERS.....	56
10.3	DECONTAMINATION.....	57
10.4	SAMPLE TRACKING, IDENTIFICATION AND HOLDING TIMES.....	57
10.5	SAMPLE TRANSPORT	58
10.6	DATA QUALITY INDICATORS	58
11.0	ENVIRONMENTAL MANAGEMENT PLAN	61
12.0	SITE MANAGEMENT PLAN	62
12.1	GENERAL.....	62
12.2	SITE ACCESS	63
12.3	WORKING HOURS.....	63
12.4	DEMOLITION (INCLUDING ASBESTOS MANAGEMENT)	63
12.5	SURFACE WATER AND SOIL MANAGEMENT	64
12.6	GROUNDWATER MANAGEMENT	65
12.7	TRAFFIC MANAGEMENT	65
12.8	NOISE CONTROL	66
12.9	DUST CONTROL	66
12.10	ODOUR CONTROL.....	66
12.11	WORK HEALTH AND SAFETY PLAN	67
12.12	WASTE / SOIL MANAGEMENT PLAN (IMPORTATION, STOCKPILES, TRACKING & DISPOSAL)	68
12.12.1	<i>Imported Soil</i>	68
12.12.2	<i>Stockpiles</i>	69
12.12.3	<i>Waste Tracking</i>	69
12.12.4	<i>Waste Disposal</i>	70
12.13	COMMUNITY ENGAGEMENT.....	71
13.0	OPERATIONAL CONTROLS	72
13.1	FIRE AND EXPLOSION HAZARD	72
13.2	PUBLIC COMPLAINTS REGISTRY.....	72
13.3	DUTIES OF THE ON-SITE ENVIRONMENTAL SCIENTIST.....	73
13.4	UNEXPECTED OCCURRENCES	74

13.5	NON-COMPLIANCES	74
14.0	CONTINGENCY MANAGEMENT	76
14.1	CONTACT PERSONS	79
14.2	UNEXPECTED FINDS PROTOCOL	80
14.3	USTS.....	81
14.4	GROUNDWATER CONTINGENCY	81
15.0	REGULATORY APPROVALS AND LICENSES	82
15.1	STATE ENVIRONMENTAL PLANNING POLICIES.....	82
15.2	STATE PROTECTION OF THE ENVIRONMENTAL OPERATIONS (UPSS) REGULATION 2014	82
15.3	DUTY TO REPORT	82
15.4	DEVELOPMENT CONSENT AND CONTROL PLANS.....	83
15.5	ASBESTOS REMOVAL REGULATIONS / WORK HEALTH SAFETY REGULATIONS	83
15.5.1	<i>General.....</i>	<i>83</i>
15.5.2	<i>Notification of Asbestos Removal Works</i>	<i>85</i>
15.5.3	<i>Notification of Respirable Asbestos Fibre Levels at more than 0.02 fibres / ml.....</i>	<i>85</i>
15.5.4	<i>Notification of the Emergency Demolition of a Structure or plant involving Asbestos</i>	<i>86</i>
15.6	PROTECTION OF THE ENVIRONMENT OPERATIONS (WASTE) REGULATIONS 2005.....	87
15.7	OTHER LICENCES REQUIRED	89
16.0	CONCLUSION.....	90
17.0	LIMITATIONS	93

LIST OF TABLES

Table 1: Site Identification	13
Table 2: Site Condition and Surrounding Environment Review	16
Table 3: Health Investigation Levels (HIL) Criteria for Soil Contaminants.....	23
Table 4: Health Screening Levels (HSL) Criteria	24
Table 5: Site Derived EIL Criteria.....	25
Table 6: (EIL) and (ESL) Criteria	26
Table 7: Health Screening Levels for Asbestos	27
Table 8: Remediation options	34
Table 9: Summary of Decision Rules.....	46
Table 10: Sampling and Handling.....	49
Table 11: Soil Validation Sampling Program	52
Table 12: QA/QC Frequencies.....	56
Table 13: Data Quality Indicator for the proposed Validation Program	59
Table 14: Contingency Management.....	76
Table 15: Contact Persons	79

LIST OF FIGURES AND APPENDICES

Figure 1	Site Locality
Figure 2	Site Features, Borehole Locations & Exceedance Plan
Appendix A	Unexpected Finds Protocol
Appendix B	Proposed Development Plans & Survey

1.0 INTRODUCTION

Benviron Group (Benviron) was appointed by GM Architects, to prepare a Remediation Action Plan (RAP) for the property located at 185 Fifth Avenue, Austral NSW ("the site"). The site is currently occupied by a rural residential property and is proposed to be redeveloped into four multi-level residential apartment buildings including two level basements, landscaping, road widening & new road.

Two previous reports were identified at the time of writing this report and are listed below:

- Benviron Group (2017), "Preliminary Site Investigation", 185 Fifth Avenue, Austral NSW, Ref: E1292, dated August 2017.
- Benviron Group (2018), "Detailed Site Investigation", 185 Fifth Avenue, Austral NSW, Ref: E1292-2, dated February 2018.

Benviron Group is utilising the above information in the current investigation.

This RAP has been prepared in order to be part of the Development Application (DA) for this site. Work and reporting were conducted in general accordance with the Benviron Group proposal, Benviron Group environmental protocols and with reference to relevant environmental regulatory criteria including the guidelines issued or endorsed by the NSW EPA.

2.0 OBJECTIVES, SCOPE & DEVIATIONS

2.1 Objectives

The primary objective of this RAP is to inform and guide site remediation and validation through the following:

- Summary of the current contamination status of the site;
- Providing a description of the remediation strategy(s) that will effectively manage the environmental concerns identified, in a manner that protects both human health and the environment;
- Provide a preliminary sampling and analytical quality plan to be used for site validation;
- Comply with DA Conditions for Development;

2.2 Scope

The scope is outlined below:

- Establish remediation goals and criteria
- Evaluation of remedial technologies and selection of appropriate remedial strategy(s)
- Facilitate guidance on approvals, licences, contractor WHS Plan & any other site management plans required for the remedial works.
- Develop sampling, analysis and quality plan for additional works, remedial works and proposed validation.

2.3 Deviation from this RAP

It is recommended that an experienced and qualified Environmental Engineer / Scientist be appointed to the project to enable:

- Coordination and implementation of the staged approach to the proposed remediation / validation works;
- Any proposed deviations from the works specified in this RAP are documented and approved as required under OEH 2011 Guidelines for Consultants Reporting on Contaminated Sites;

Completion of remedial works without adequate supervision from a qualified Environmental Engineer / Scientist could leave to project delays and extra costs due to additional requirements imposed by a third party, to confirm the environmental status of site.

Any waste material removed from site without sufficient characterisation and/ or waste classification may lead to regulatory actions.

3.0 BACKGROUND INFORMATION

3.1 Site identification and zoning

The site is identified as follows:

Table 1: Site Identification

Site Identifier	Site Details	
Site Location	185 Fifth Avenue, Austral NSW 2765	
Lot/DP	Lot 1115 in DP2475	
Site Coordinates #	NE corner: Latitude: -33.945508, Longitude: 150.805922 NW corner: Latitude: -33.945381, Longitude: 150.805072 SE corner: Latitude: -33.946836, Longitude: 150.805651 SW corner: Latitude: -33.946716, Longitude: 150.804796	
Parish	Cabramatta	
County	Cumberland	
Nearest Survey Marker	PM178460 131m West	
Site Area ##	12,120.425 m ²	
Local Government Area (LGA)	Liverpool	
Zoning##	R2 – Low Density Residential	
Surrounding Land Uses	<i>North</i>	Rural Residential & Agricultural
	<i>South</i>	Fifth Avenue and rural residential
	<i>East</i>	Rural residential
	<i>West</i>	Rural Residential & Commercial / Agricultural

Notes:

Refer to NSW LPI “Six Maps” <https://maps.six.nsw.gov.au/>

<https://www.planningportal.nsw.gov.au/find-a-property>

3.2 Site description

The site is located at 185 Fifth Avenue, Austral NSW, in the Liverpool City Council municipality.

The site features are reported on **Figure 2 – Site Features, Borehole Locations & Exceedance Plan**.

3.3 Summary of site history

A summary of the site history is outlined below:

- The land title information indicated the property at 185 Fifth Avenue has been owned by private individuals from 1925 to 1998. From 1998 to the current date the property has been continued to be owned by private individuals.
- The land titles have revealed the following concerns in relation to potential land use;
 - Farmer and Market Gardener were listed as personal occupations in 1947 and 1959 respectively.
- The aerial photographs indicate the site had been cleared vacant land and part of a larger agricultural property in 1955. From 1955 to 1970 the site was developed into a new rural residential property with freestanding sheds and agricultural/ farming activities evident. From 1970 to the current date the site has remained a rural residential with no evidence of agricultural activities.

- The surrounding land had been a mixture of vacant uncleared bushland, rural residential, agricultural and vacant cleared land in the 1955 aerial photograph. The land surrounding the site has remained a mixture of rural residential, residential and agricultural to the current date.
- NSW EPA Records reveal that the subject site is not listed.
- The SafeWork NSW records & Section 149 certificates have not been searched, received and/or reviewed as part of this investigation.
- The Council records have flagged some potential concern in relation to land use and/or contamination including the development of multiple buildings onsite and the use of the garage / workshop for home industry use.

3.4 Proposed development

The site is currently occupied by a rural residential property and is proposed to be redeveloped into four multi-level residential apartment buildings including two level basements, landscaping, road widening & new road.

The proposed development is four 5-storey residential buildings (Buildings A, B, C and D) with two levels of basement carpark. The two level basement carpark is joined between buildings A & B and between buildings C & D at basement 1 level. Buildings A & D are located on the higher eastern part of the site where the proposed vehicular entrance from the future road to the basement carpark are situated. The lower basement 2 carpark level (basement 2) is at approximately RL+66.4m AHD for Buildings A & D and at approximately RL +65.6 m AHD for Buildings B & C. The proposed basement wall has a minimum set-back of 6.0m from the northern and southern boundary, and a minimum set-back of 4.7m from the eastern and the western site boundary. The proposed basement floor levels are confirmed to contain car spaces & lift pits.

Refer to **Appendix B** - Proposed Development Plans & Survey

3.5 Environmental Information

A review of the environmental information is outlined in the table below:

Table 2: Site Condition and Surrounding Environment Review

Site Information	Descriptions
Sensitive Receivers	The nearest sensitive human receptors are the current and future users of the site, construction workers during the site redevelopment and the general public. The nearest watercourse is a tributary of Kemps Creek located 83m north west of the site.
Soil Landscape <i>Review of NSW Soil and Land Information website ESPADE.</i>	The Soil Landscape Map viewed on NSW ESPADE indicates that the site is located within the Blacktown landscape area. These soils are considered moderately reactive highly plastic subsoil, low soil fertility with poor soil drainage.
Topography <i>Review of NSW Soil and Land Information website ESPADE.</i>	The topography viewed on NSW ESPADE indicated the following for the Blacktown Landscape: Gently undulating rises on Wianamatta Shale with local relief 10-30 m and slopes generally <5% but up to 10%. Crests and ridges are broad (200-600 m) and rounded with convex upper slopes

Site Information	Descriptions
	grading into concave lower slopes. Rock outcrop is absent. Based on the site inspection it was determined that the site was sloping to the north west at approximately 2-4°.
Geological Profile	The Geological Map of Penrith (Geological Series Sheet 9030, Scale 1:100,000, Edition 1, 1991), published by the Department of Minerals and Energy indicates the residual soils within the site to be underlain by Triassic Age Shale of the Wianamatta Group, comprising shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff.
Salinity Potential Review of DIPNR Salinity Potential in Western Sydney 2002 Risk Map	A review of the Salinity Potential in Western Sydney 2002 Map (DIPNR March 2003) was undertaken for the site. The map indicated the site is located in an area listed with moderate salinity potential.
Presence of Acid Sulphate Soils <i>Review of NSW Department of Land & Water Conservation (DLWC) Acid Sulphate Soil Risk Maps (Edition Two, December 1997, Scale 1:250,000).</i>	A review of the Liverpool map indicated the site has “No Known Occurrence” of acid sulphate soil material expected within the soil profile.

Site Information	Descriptions					
Localised Hydrogeology Review of DPI (Office of Water) Database.	Number	Location from Site	Depth (m BGL)	SWL (m BGL)	Use	Water Bearing Zones
	GW107007	2.7km NE	267.00	4	Test Bore	Shale
	GW112662	2.7km SE	-	-	Monitoring	-
	GW072372	6.0km W	228.0	-	Stock / Domestic	Sandstone
Nearest Surface Water Body	The nearest watercourse is a tributary of Kemps Creek located 83m north west of the site.					
Local Meteorology (Bureau of Meteorology BOM website)	The monthly rainfall of the local surrounding area is represented by the data collected from the BOM rainfall gauge located in Rossmore (South Creek), which is located approximately 3.5km from Austral. The records indicate that the lowest & highest monthly rainfall recorded from 2007 to 2017 in May (date of fieldwork) was 7mm & 105mm.					
Nearest Active Service Station (Google Maps Search)	2.5km south of the site.					

3.6 Previous environmental investigations

Two previous reports were identified at the time of writing this report and are listed below:

- Benviron Group (2017), "Preliminary Site Investigation", 185 Fifth Avenue, Austral NSW, Ref: E1292, dated August 2017.

- Benviron Group (2018), “Detailed Site Investigation”, 185 Fifth Avenue, Austral NSW, Ref: E1292-2, dated February 2018.

Benviron Group 2017 PSI

Benviron Group was appointed by GM Architects to undertake a Preliminary Site Investigation (PSI) for the property situated at 185 Fifth Avenue, Austral NSW. A number of potential areas of environmental concerns were identified at the site, particularly:

- Historical uses including agricultural (farming / market gardening);
- Where pesticides were potentially utilised;
- Carpark areas / driveways where leaks and spills from cars may have occurred;
- degrading building features

The following data gaps were also identified:

- The proposed development plans include landscape areas which are recommended for intrusive investigation to determine site suitability in relation to the proposed development.
- The groundwater quality at the site has not been investigated.
- The SafeWork NSW records & Section 149 certificates have not been searched, received and/or reviewed as part of this investigation.

A summary of the investigation components including the previous site history (farming / market gardening & home industry use for the garage), underground services plans & site inspection; indicates the potential for significant soil and/or groundwater impact was considered medium. In applying the NEPM 2013 Schedule B2 “Guideline on Site

Characterisation”; there is sufficient evidence, uncertainty and/ or suspicion of contamination, therefore further investigation was recommended.

Based on the results of this investigation it was considered that the risks to human health and the environment associated with soil and groundwater contamination at the site are medium in the context of the proposed use of the site. The site ***can be made suitable*** for the proposed development, subject to the following recommendations:

- Preparation of a Detailed Site Investigation (Phase 2 Environmental Site assessment) by a suitably qualified Environmental Consultant.
- Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the “Waste Classification Guidelines, Part 1: Classifying Waste” NSW EPA (2014).
- An Asbestos Clearance Certificate is recommended to be completed once all existing buildings are structures have been demolished.
- All further works may be undertaken during construction certificate stage.

Benviron Group 2018 DSI

Benviron Group was appointed by GM Architects to undertake a Detailed Site Investigation (DSI) for the property situated at 185 Fifth Avenue, Austral NSW.

The investigation revealed the following areas of environmental concern:

- The asbestos detected within BH1 is located in the fill layer to a depth of 0.3m BGL.

- The asbestos detected within BH4 is located in the fill layer to a depth of 0.1m BGL.
- The copper and zinc concentration within BH9 is located in the fill layer to a depth of 0.1m BGL.
- The groundwater monitoring undertaken by Benviron Group has indicated no concerns with Heavy Metals, TRH, BTEXN, PAH, & VOC in relation to the adopted guidelines.

Based on the results of the investigation, the abovementioned locations BH1, BH4 & BH9 require minor remediation in order to render the site suitable for the proposed development.

- It is considered that the site would be deemed suitable for the proposed development subject to the implementation of a Remediation Action Plan (RAP) to manage the abovementioned environmental concerns and data gaps.
- Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).

4.0 REMEDIATION CRITERIA

4.1 Soil

4.1.1 Health Investigation Levels (HIL)

To assess the contamination status of soils at a site, the NSW EPA refers to the document entitled National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) (Amendment 2013).

The site is currently occupied by a rural residential property and is proposed to be redeveloped into four multi-level residential apartment buildings including two level basements, landscaping, road widening & new road.

The site will be assessed against the NEPM exposure scenario 'Residential B' Health Investigation Levels of the above mentioned guidelines and specifically refers to the following:

HIL 'B' Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.

The soil regulatory guidelines are presented in the table below.

Table 3: Health Investigation Levels (HIL) Criteria for Soil Contaminants

 Benviron group simple sustainable solutions	Residential B	Reference
Heavy Metals		
Arsenic	500	NEPM 2013 - Table 1(A)1 HILs
Beryllium	90	NEPM 2013 - Table 1(A)1 HILs
Boron	40000	NEPM 2013 - Table 1(A)1 HILs
Cadmium	150	NEPM 2013 - Table 1(A)1 HILs
Chromium (VI)	500	NEPM 2013 - Table 1(A)1 HILs
Cobalt	600	NEPM 2013 - Table 1(A)1 HILs
Copper	30000	NEPM 2013 - Table 1(A)1 HILs
Lead	1200	NEPM 2013 - Table 1(A)1 HILs
Manganese	14000	NEPM 2013 - Table 1(A)1 HILs
Mercury (Inorganic)	120	NEPM 2013 - Table 1(A)1 HILs
Methyl Mercury	30	NEPM 2013 - Table 1(A)1 HILs
Nickel	1200	NEPM 2013 - Table 1(A)1 HILs
Selenium	1400	NEPM 2013 - Table 1(A)1 HILs
Zinc	60000	NEPM 2013 - Table 1(A)1 HILs
Cyanide (Free)	300	NEPM 2013 - Table 1(A)1 HILs
Polycyclic Aromatic Hydrocarbons (PAHs)		
Carcinogenic PAHs (as Bap TEQ)	4	NEPM 2013 - Table 1(A)1 HILs
Total PAHs	400	NEPM 2013 - Table 1(A)1 HILs
Organochlorine Pesticides		
DDT + DDE + DDD	600	NEPM 2013 - Table 1(A)1 HILs
Aldrin + Dieldrin	10	NEPM 2013 - Table 1(A)1 HILs
Chlordane	90	NEPM 2013 - Table 1(A)1 HILs
Endosulfan	400	NEPM 2013 - Table 1(A)1 HILs
Heptachlor	10	NEPM 2013 - Table 1(A)1 HILs
HCB	15	NEPM 2013 - Table 1(A)1 HILs
Phenols		
Phenols	45000	NEPM 2013 - Table 1(A)1 HILs
Pentachlorophenol	130	NEPM 2013 - Table 1(A)1 HILs
Cresols	4700	NEPM 2013 - Table 1(A)1 HILs
Polychlorinated Biphenyls (PCBs)		
PCBs	1200	NEPM 2013 - Table 1(A)1 HILs
Other Pesticides		
Atrazine	470	NEPM 2013 - Table 1(A)1 HILs
Chlorpyrifos	340	NEPM 2013 - Table 1(A)1 HILs
Bifenthrin	840	NEPM 2013 - Table 1(A)1 HILs
Herbicides		
2,4,5-T	900	NEPM 2013 - Table 1(A)1 HILs
2,4-D	1600	NEPM 2013 - Table 1(A)1 HILs
MCPA	900	NEPM 2013 - Table 1(A)1 HILs
MCPB	900	NEPM 2013 - Table 1(A)1 HILs
Mecoprop	900	NEPM 2013 - Table 1(A)1 HILs
Picloram	6600	NEPM 2013 - Table 1(A)1 HILs
Other Organics		
PDBE (Br1-Br9)	2	NEPM 2013 - Table 1(A)1 HILs

Note - All values are in mg/kg

4.1.2 Health Screening Levels (HSLs)

For selection of the health screening criteria an assessment of the in-situ soil profile should be undertaken. The soil criteria indicates that the upper soil profile is more consistent with SILT & CLAY.

Table 4: Health Screening Levels (HSL) Criteria

 Benviron group simple sustainable solutions	HSL A & HSL B	HSL A & HSL B	HSL A & HSL B	HSL A & HSL B	Soil Saturation Concentration (Csat)	Reference
	0m to <1m	1m to <2m	2m to <4m	4m+		
CLAY						
Toluene	480	NL	NL	NL	630	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	NL	68	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	110	310	NL	NL	330	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	5	NL	NL	NL	10	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.7	1	2	3	430	NEPM 2013 - Table 1(A) 3 HSLs
F1	50	90	150	290	850	NEPM 2013 - Table 1(A) 3 HSLs
F2	280	NL	NL	NL	560	NEPM 2013 - Table 1(A) 3 HSLs
SAND						
Toluene	160	220	310	540	560	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	55	NL	NL	NL	64	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	40	60	95	170	300	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	3	NL	NL	NL	9	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.5	0.5	0.5	0.5	360	NEPM 2013 - Table 1(A) 3 HSLs
F1	45	70	110	200	950	NEPM 2013 - Table 1(A) 3 HSLs
F2	110	240	440	NL	560	NEPM 2013 - Table 1(A) 3 HSLs
SILT						
Toluene	390	NL	NL	NL	640	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	NL	69	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	95	210	NL	NL	350	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	4	NL	NL	NL	10	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.6	0.7	1	2	440	NEPM 2013 - Table 1(A) 3 HSLs
F1	40	65	100	100	910	NEPM 2013 - Table 1(A) 3 HSLs
F2	230	NL	NL	NL	570	NEPM 2013 - Table 1(A) 3 HSLs

Note - All values are in mg/kg

4.1.3 Ecological Investigation Levels (EILs)

Any applicable validation samples in the future will be assessed against the site derived EILs determined from the Benviron Group DSI dated February 2018. A copy of the site derived EILs is provided below.

Table 5: Site Derived EIL Criteria

	EIL Analytes (mg/kg)							
	ARSENIC	CHROMIUM (VI) ^a	COPPER	LEAD	NICKEL	ZINC	NAPHTHALENE	DDT
Site Derived Ecological Investigation Levels (EILs)								
Fill BH15 (0.1-0.2m)	100	420	110	1,100	40	250	170	180
Site Derived Ecological Investigation Levels (EILs)								
Natural BH2 (0.4-0.5m)	100	420	200	1,100	180	410	170	180

Notes: a Chromium VI has been used in lieu of Chromium III

4.1.4 Ecological Screening Levels (ESLs)

Ecological screening levels (ESLs) are presented based on a review of Canadian guidance for petroleum hydrocarbons in soil and application of the Australian methodology (Schedule B5b) to derive Tier 1 ESLs for BTEX, benzo(a)pyrene and F1 and F2 (Warne 2010a, 2010b)

The Canadian Council of the Ministers of the Environment (CCME) has adopted risk-based TPH standards for human health and ecological aspects for various land uses in the *Canada-wide standard for petroleum hydrocarbons (PHC) in soil* (CCME 2008) (CWS PHC). The standards established soil values including ecologically based criteria for sites affected by TPH contamination for coarse- and fine-grained soil types.

Table 6: (EIL) and (ESL) Criteria

	Contaminant Age/Soil Texture	National parks and areas of high conservation value	Urban residential and open public spaces	Commercial and industrial	Reference
Ecological Investigation Levels (EILs)					
Heavy Metals					
Arsenic	Fresh	20	50	80	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	40	100	160	NEPM 2013 - Table 1(B) 1-5 EILs
Chromium (III)	Fresh	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Copper	Fresh	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Lead	Fresh	110	270	440	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	470	1100	1800	NEPM 2013 - Table 1(B) 1-5 EILs
Nickel	Fresh	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Zinc	Fresh	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	Fresh	10	170	370	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	10	170	370	NEPM 2013 - Table 1(B) 1-5 EILs
Organochlorine Pesticides					
DDT	Fresh	3	180	640	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	3	180	640	NEPM 2013 - Table 1(B) 1-5 EILs
Ecological Screening Levels (ESLs) and Management Limits					
F1 (C ₆ -C ₁₀)	Coarse	125*	180*	215*	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F1 (C ₆ -C ₁₀) (Management Limits)	Coarse	-	700	700	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine		800	800	NEPM 2013 - Table 1(B) 6-7 EILs
F2 (>C ₁₀ -C ₁₆)	Coarse	25*	120*	170*	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F2 (>C ₁₀ -C ₁₆) (Management Limits)	Coarse	-	1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine		1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs
F3 (>C ₁₆ -C ₃₄)	Coarse	-	300	1700	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine		1300	2500	NEPM 2013 - Table 1(B) 6-7 EILs
F3 (>C ₁₆ -C ₃₄) (Management Limits)	Coarse	-	2500	3500	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine		3500	5000	NEPM 2013 - Table 1(B) 6-7 EILs
F4 (>C ₃₄ -C ₄₀)	Coarse	-	2800	3300	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine		5600	6600	NEPM 2013 - Table 1(B) 6-7 EILs
F4 (>C ₃₄ -C ₄₀) (Management Limits)	Coarse	-	10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine		10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs
Benzene	Coarse	10	50	75	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	10	65	95	NEPM 2013 - Table 1(B) 6-7 EILs
Toluene	Coarse	10	85	135	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	65	105	135	NEPM 2013 - Table 1(B) 6-7 EILs
Ethylbenzene	Coarse	1.5	70	165	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	40	125	185	NEPM 2013 - Table 1(B) 6-7 EILs
Xylenes	Coarse	10	105	180	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	1.6	45	95	NEPM 2013 - Table 1(B) 6-7 EILs
Benzo(a)pyrene	Coarse	0.7	0.7	0.7	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	0.7	0.7	0.7	NEPM 2013 - Table 1(B) 6-7 EILs

Notes

- Urban residential/public open space is broadly equivalent to the HIL-A, HIL-B and HIL-C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.
- Aged values are applicable to arsenic contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
- Insufficient data was available to calculate aged values for DDT and naphthalene, consequently the values for fresh contamination should be used.
- Insufficient data was available to calculate ACLs for As, DDT and naphthalene. The EIL should be taken directly from Table 1B(5).
- ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.
- '-' indicates that insufficient data was available to derive a value.
- To obtain F1, subtract the sum of BTEX concentrations from C6-C10 fraction and subtract naphthalene from >C10-C16 to obtain F2.
- Management limits are applied after consideration of relevant ESLs and HSLs
- Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

4.1.5 Asbestos

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1. The following health screening levels for asbestos can be seen below:

Table 7: Health Screening Levels for Asbestos

	Health Screening Levels (w/w)			
Form of Asbestos	Residential A	Residential B	Recreational C	Commercial/Industrial D
Bonded ACM	0.01%	0.04%	0.02%	0.05%
FA and AF (Friable Asbestos)	0.001%			
All forms of asbestos	No visible asbestos for surface soil			

4.1.6 Export of waste

Any additional soil material requiring offsite disposal will analysed against the NSW EPA refers to the NSW EPA (2014) *“Waste Classification Guidelines, Part 1: Classifying Waste”*.

5.0 REMEDIATION STRATEGY

5.1 General

All works undertaken during the remediation program must be monitored by a suitably qualified person experienced in the assessment and remediation of contaminated sites. The RAP must be adhered to by all personnel and sub-contractors involved in the remediation program.

5.2 NSW EPA preferred hierarchy of options for site remediation

The NSW EPA has a preferred hierarchy of options for site remediation and/or management which is outlined below:

- If practicable, on-site treatment of the contamination so that it is destroyed and the associated risk is reduced to an acceptable level; and
- Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level.

If the above is not practicable:

- Consolidation and isolation of the soil on-site by containment with a properly designed barrier; and
- Removal of contaminated material to an approved facility followed, if necessary, by replacement with appropriate materials; or

- Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse effect, implementation of an appropriate management strategy.

5.3 Remediation option review

5.3.1 Available remediation / management technologies

There is a range of different remediation technologies that are available for remediation of contaminated sites. Some of these technologies are proven while others have not been successfully implemented, particularly in Australia and / or there is limited local expertise for implementation.

A review of the available soil remediation methods and technologies indicated that the following strategies may be applicable to the remediation of fill material contaminated at concentrations exceeding health-based threshold concentrations:

- Excavation and off-site disposal of contaminated soil to landfill.
- Treatment (on-site or off-site).
- Managing the risks posed by contaminants by preventing any direct exposure pathway between the known and potential contaminated soil and users of the proposed development (through capping).
- Further assessment of phytotoxic and health risks.

5.3.2 Excavation and off-site disposal

This method involves the excavation of contaminated materials and disposal of the materials off-site to a landfill licensed by the NSW EPA.

Excavated soils must be classified before disposal to an appropriate landfill. Depending on the levels of contamination, soil may require pre-treatment (to reduce contaminant levels or immobilise contaminants) prior to off-site disposal to the licensed landfill.

5.3.3 Treatment

There is a range of soil treatment technologies available depending on the type of contaminant including in-situ and ex-situ remediation methods. Most commonly, for contamination, the technologies adopted are ex-situ, requiring excavation of the contaminated material. In-situ remediation technologies generally require a longer timeframe for completion than ex-situ technologies. Most of the treatment technologies that require excavation of the contaminated material could be undertaken on or off-site, subject to obtaining licences.

Some possible treatment methods for heavy metals include soil washing and stabilisation of soil.

5.3.4 Managing risks by preventing any direct exposure pathway between contaminated soil and site users (through capping)

On-site capping is used to isolate areas in the subsurface from the surrounding uncontaminated environment. A physical barrier such as a layer of clean soil, synthetic material liners, asphalt and concrete layers may be installed to cap the contaminated material. A cap is typically used where it is required to remove exposure to the contaminated soils and where the contaminated soils are not mobile or there is no contact with groundwater and / or groundwater is not contaminated.

A site management plan is required with any cap and contain strategy. The site management plan identifies the party responsible for adhering to the plan, and includes commitments for ongoing monitoring and maintenance of the cap as well as control of future excavations, which must be minimised or if required, the appropriate occupational health and safety procedures are adopted and permits acquired before work is carried out.

5.4 Rationale for selection of remedial strategy

Usual considerations in selecting and implementing a remediation strategy for a site include:

- **Proven technology:** the remediation method should have a proven track record of success/failure;
- **Reliability:** this is a measure of the degree of certainty that the remediation method will succeed in meeting the site remediation goals in the short and long term;

- **Regulatory approvals:** the remediation method needs to be endorsed by the relevant regulatory authorities. The difficulty in obtaining regulatory approvals will be largely dependent upon the nature of the remediation method proposed;
- **Cost:** provides an indication as to the likely costs involved in implementing each type of remediation method;
- **Implementation time:** provides an indication as to the likely time frame involved in implementing each type of remediation strategy;
- **Land use restrictions:** if contaminated material is left on-site, the regulatory authority may place restrictions on the land use and/or require notification of the contamination on the property title;
- **Ongoing liabilities (maintenance and monitoring requirements):** a remediation strategy that does not involve the complete removal of all contaminants from the site will necessitate some form of ongoing maintenance and/or monitoring to ensure the longer term integrity of the remediation strategy adopted;
- **Future liability:** any remediation strategy that does not involve the complete removal of all contaminants from the site will result in future liability for the contamination;
- **Local contractor experience:** the success and cost effectiveness of any remediation method will be at least partially dependent upon the experience local contractors have in undertaking the type of remediation works proposed;
- **On-site space requirements:** some remediation techniques (e.g. land farming) require relatively large amounts of space to spread soil and will only be feasible if sufficient land is available;

- **Disruptions to site structures and activities:** remediation of the site is likely to create some disturbance, both to the existing site operations and structures, as well as to underground services which may pass through the remediation area (e.g. any work involving excavation of the contaminated soil mass will involve the removal of any structures located atop the excavation zone);
- **Human health risks during remediation:** the remediation workers, site users and the general public may be exposed to hazards posed by contamination during the remediation (e.g. significant levels of vapours may be released when disturbing soil contaminated with volatile organic compounds); and
- **Availability of appropriate disposal sites (for remediation techniques involving excavation and off-site disposal):** landfill disposal of contaminated soil will only be feasible if a landfill licensed to accept the contaminated soils excavated from the site is available at a reasonable distance from the site.

The table below presents an evaluation of the various options for general remediation projects in Australia based on the above. The table also includes a number of limitations and risks associated with each method.

Table 8: Remediation options

Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and Contain
Cost	Low- Medium	Medium	High	Low
Technical feasibility	Possible for a range of contaminants including those encountered at the site during the investigations	Not possible for heavy metal contaminated material	Not possible for heavy metal contaminated material	Possible for a wide range of contaminants including those encountered at the site
Human Health Risks	Relatively low – excavation and direct offsite disposal will minimise personal contact	Variable – relatively low risk associated with in-situ bioremediation but greater with ex-situ, as soil needs to be excavated	Significant – excavation and handling of contaminated materials will create a volatile contaminant release hazard	Relatively low – only minimal soil disturbance involved

Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and Contain
Reliability	Excellent – system ensures the removal of all contaminated materials	Variable – in-situ bioremediation presents only a low potential to adequately remediate all organic species. Ex-situ is more reliable, due to the more complete mixing of organisms, nutrients and oxygen with the contamination	Moderate – thermal processes have been successfully implemented on most organic contaminant species	Moderate – some potential may exist for contaminant breakthrough if containment wall not properly keyed into bedrock. Care also needs to be taken to prevent preferential gas venting.
Regulatory Approval	Satisfactory – Compliance with Regulatory Authorities. Licensed landfills available for day cover	Satisfactory – on-site treatment is generally the EPA’s preferred strategy for site remediation	May be difficult. May require an EIS	Generally satisfactory – whilst on-site containment is not the EPA’s preferred option, it is often accepted as a feasible option

Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and Contain
Disruption to Site Structures and Activities	Significant – all existing site structures need to be demolished or relocated to allow excavation of contaminated soils	Variable – disturbance relatively minor for in-situ bioremediation, but ex-situ would require existing structures to be demolished or relocated	Significant – all existing site structures need to be demolished or relocated to allow excavation of contaminated soils	Moderate – some disruption likely to proposed underground services
Ongoing Liabilities	Minimal – all heavily contaminated materials removed	Variable – need for ongoing monitoring will be largely dependent upon the success of bioremediation in destroying contaminants	Variable – need for ongoing monitoring will be largely dependent upon the success of thermal desorption in destroying contaminants	Moderate to high – capping system need to be maintained, and ongoing monitoring necessary to ensure the integrity of the cap and cut-off wall
Contractor Experience	Good – relatively simple strategy involving only basic technologies	Very Limited – technology is still developing, and only a limited amount of trials undertaken in Australia	Very Limited – technology is still developing, and only a limited amount of trials undertaken in Australia	Moderate – contractors available with experience in the implementation of cap and contain systems

Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and Contain
Availability of Disposal Sites	Good – landfills available to accept solid waste	Not Applicable	Not Applicable	Not Applicable (assuming all materials excavated to form the cut-off wall are retained on-site)
Implementation Time Frame	Short	Long	Short to Moderate	Short to Moderate

5.5 Preferred remediation strategy

For this site, on- and off-site treatment of contaminants, which are the most preferred remedial strategies of the NSW EPA, were ruled out for the following reasons:

- Materials have to be removed from site so if land farming took place, materials would ultimately be removed; and
- The costs of reuse and treatment for more sensitive sites would be substantially higher than off-site disposal to landfill.

The next most preferred strategy of on-site containment was ruled out for the following reasons:

- The site requires a reduction of soils as excavation is required within the site.

The next most preferred NSW EPA strategy of removal of contaminated material to a licensed landfill and is the selected strategy for the following reasons:

- The costs of off-site disposal to landfill are considerably less than treatment costs.
- The method fits in with the proposed development.

Relative benefits of the “excavate and dispose” strategy are as follows:

- The costs associated with the ‘excavate and dispose’ remediation method are low to medium;
- The ‘excavate and dispose’ remediation method may be implemented only if a relatively small amount of soil is to be removed;
- The ‘excavate and dispose’ remediation method is a proven technology for the type of contaminants identified at the site, likely to be approved by the regulatory bodies;
- The ‘excavate and dispose’ remediation method is dependent upon the cost and availability of suitable landfill disposal sites. These are readily available and cost-effective;
- After completion of the remediation works by the ‘excavate and dispose’ remediation method, the site would continue to be suitable for ongoing commercial use and the proposed residential use, and there would be no ongoing liabilities, and very limited (if any) ongoing maintenance / monitoring required;
- As part of the site development, a net reduction of soils is required thus fitting into this remediation strategy; and
- The timeframe for implementation of the ‘excavate and dispose’ remediation method is relatively short compared to other possible remediation methods.

6.0 REMEDIATION WORKS

6.1 Remediation Goals

The remediation goal is to render the site suitable for the proposed development upon completion of the remediation and validation works. This would be achieved by remediating the asbestos and/or copper & zinc impacted hotspots at BH1 (0.0-0.2), BH4 (0-0.1) & BH9 (0-0.1).

It should be noted that the RAP may need to be revised or addendum provided, subject to the review of the results from the additional investigation.

6.2 Remediation program

Assuming appropriate permits have been granted, the remediation of the site is to take place in the following stages:

Stage One -Site Preparation

- Prepare the site with fences, erosion controls, signage and environmental controls.
- A hazardous materials assessment of the buildings should be undertaken prior to demolition being carried out on site.
- An accredited Asbestos Assessor / Occupational Hygienist is to prepare an Asbestos Removal Control Plan (ARCP) which will outline the requirements for the handling, monitoring and contractor disposal requirements for any Special Waste.
- Demolish site structures (which have development consent) and concrete slabs to make way for remedial works and under slab observations.

Stage Two – Removal of impacted soil locations from previous investigations

Hotspot BH1

- Excavate BH1 ---3m long x 3m wide x 0.5m vertically deep (total= 4.5m³) and dispose of at an EPA licensed landfill that can accept the waste. The material should be classified in accordance with the “Waste Classification Guidelines, Part 1: Classifying Waste” NSW EPA (2014).
- The floors and walls of BH1 will be validated by taking 1 floor sample and 4 wall samples. Recovery of appropriate QA/QC samples.

Hotspot BH4

- Excavate BH4 ---3m long x 3m wide x 0.5m vertically deep (total= 4.5m³) and dispose of at an EPA licensed landfill that can accept the waste. The material should be classified in accordance with the “Waste Classification Guidelines, Part 1: Classifying Waste” NSW EPA (2014).
- The floors and walls of BH4 will be validated by taking 1 floor sample and 4 wall samples. Recovery of appropriate QA/QC samples.

Hotspot BH9

- Excavate BH9 ---3m long x 3m wide x 0.5m vertically deep (total= 4.5m³) and dispose of at an EPA licensed landfill that can accept the waste. The material should be classified in accordance with the “Waste Classification Guidelines, Part 1: Classifying Waste” NSW EPA (2014).
- The floors and walls of BH9 will be validated by taking 1 floor sample and 4 wall samples. Recovery of appropriate QA/QC samples.

Stage Three – Asbestos Clearance

- Following the completion of the remediation and validation, an accredited Asbestos Assessor / Occupational Hygienist should undertake & provide an Asbestos Clearance Certificate.

Stage Four – Validation Report Preparation

- Remediation will occur by managing soil for offsite disposal to landfill for contaminated soils.
- A validation report will be prepared to present the remediation works undertaken and confirm that the objectives of the remediation works have been attained.

The extent of the remediation works would be extended whether additional USTs, associated infrastructure & further contaminated material are identified during remediation works.

6.3 Extent of remediation works required

As described above the preferred remediation strategy for the site is excavation and off-site disposal of the fill materials.

If contaminated material is found during the remediation works, these materials will be chased up and removed.

6.4 Regulatory requirements such as licenses and approvals

Approval from a licensed disposal facility will be required prior to removal of any contaminated material from the site.

6.5 Disposal of excavated contaminated material

The contaminated fill or soil excavated from the site will be disposed of at a licensed landfill facility. If disposal of contaminated liquids is required, this will be undertaken by a licensed contractor. The weighbridge and truck dockets will be retained by the contractor and made available to the principal's environmental representative.

6.6 Contingencies during Remedial Works

6.6.1 Contaminated Soils

Follow the unexpected finds protocol as detailed in Section 15.2 & Appendix A. Works to be suspended until the environmental project manager can further assess impacted soils / materials.

6.6.2 USTs

Although no underground storage tanks were identified any systems to be removed should be appropriately validated and backfilled by experienced contractor. Refer to Section 15.3 for more details.

6.6.3 Contaminated Groundwater

Review of groundwater conditions on site, may warrant further groundwater investigations / remediation and longer term management plans.

Any dewatering may require approval under the Water Management Act 2000.

Remedial measure may include; source removal, natural attenuation, bioremediation, PSH recovery using active pumping, groundwater permeability barrier, in-situ oxidation / stabilisation.

If a groundwater contaminant plume is identified and migrating offsite or increasing in contaminant concentrations the following is required:

- Review contaminant increase and analytes;
- Review remediation alternatives;
- Undertake downgradient monitoring;
- Complete fate / transport modelling if required; and
- Assess the need for further action.

7.0 VALIDATION PLAN (DATA QUALITY OBJECTIVES)

Data quality objectives have been developed for the validation assessment.

7.1 State the problem

The site is proposed to be redeveloped, however, previous investigations identified the following concerns:

- Soil remediation is currently limited to the asbestos and/or copper & zinc impacted hotspots at BH1 (0.0-0.2), BH4 (0-0.1) & BH9 (0-0.1).

7.2 Identify the issue

Based on the decision making process for assessing urban redevelopment sites, the following decisions must be made:

- Are there any unacceptable risks to likely future onsite receptors from soil?
- Are there any impacts of chemical mixtures?
- Are there any aesthetic issues?
- Is there any evidence of, or potential for, migration of contaminants from the site?
- Is a site management strategy required?
- Is the site suitable for the proposed residential land use?

The following decision is also required to assess the remediation works as a whole:

- Have the excess materials, if any, removed from site been disposed to a landfill lawfully licenced to receive such material?

7.3 Identify the inputs to the decision

The inputs to the decisions are:

- Physical observations, including visual and olfactory results during site activities;
- The results of previous investigations (Sections 3.6);
- Soil analytical data from any imported fill;
- Soil analytical data for waste classification purposes for materials requiring off-site disposal; and
- Waste disposal documentation for excess materials disposed off-site

7.4 Define the study boundaries

The study boundary is defined as follows:

- The lateral extent of the study boundary is defined by the site boundaries as shown in Figure 1 - Site Locality & Figure 2 - Site Features, Borehole Locations & Exceedances Location Plan; and
- The vertical extent of the soil removal is at least 0.5m (BH1, BH4 & BH9) BGL up to clean underlying material;

7.5 Decision Rules

The following outlines the decision rules for the project:

Table 9: Summary of Decision Rules

Decisions	Decision Rule
Are there any unacceptable risks to likely future onsite receptors from soil or groundwater?	If there is the decision is <i>Yes</i> then control measures are required to manage the risk. Otherwise the decision is <i>No</i>
Are there any chemical mixtures?	Are there more than one group of contaminants presents which increase the risk of harm? If there is the decision is <i>Yes</i> Otherwise the decision is <i>No</i>
Any aesthetic issues?	If there are any soil discolouration and/or unacceptable odours the decision is <i>Yes</i> Otherwise the decision is <i>No</i>
Is there any evidence of, or potential for, migration of contaminants from the site?	Evidence and/or potential will be outlined and the decision is <i>Yes</i> Otherwise the decision is <i>No</i>
Site Management Strategy required?	Was the answer to any of the above decisions <i>Yes</i> ? If <i>yes</i> , a site management strategy is required. If <i>no</i> , a site management strategy is not required. The requirement for site management can typically be precluded by remediation of the areas of environmental impact that causes a site decision to be <i>yes</i> .
Is the site suitable for the proposed residential land use	Soil, soil vapour and groundwater data will be compared to the remediation criteria outlined in Section 4. Statistics may be undertaken where appropriate. If the material is suitable the decision is <i>Yes</i> Otherwise the decision is <i>No</i>
Have the excess materials, if any, removed from site been disposed to a landfill lawfully licenced to receive such material?	Fill/soil analytical data will be compared against adopted criteria. Statistical analysis of the data in accordance with relevant guidance documents will be undertaken, where appropriate, to facilitate the decisions (as detailed above).

	Documentation from the operation receiving the material including the dates, tonnage and classification of the accepted material will be required to facilitate the decision. If the statistical criteria stated above are satisfied, the decision is <i>Yes</i>, and if receipts are provided recording the disposal of material to an off-site licensed facility, the decision is <i>Yes</i>. If the material fail the criteria, and no disposal receipts are provided, the answer is <i>No</i>.
--	--

7.6 Specify Limits of Decision Error

This step is to state the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data.

Data collected and generated during this project must be considered appropriate to allow decisions to be made with confidence. Specific limits for this project have been applied in accordance with the appropriate guidance documents from the NSW EPA, NEPM 2013, appropriate indicators of data quality (DQIs used to assess quality assurance / quality control) and standard operating Benviron Group procedures for field sampling and handling.

7.7 Optimising the Design for Obtaining Data

This step enables decision maker's to identify a resource-effective field investigation sampling design that generates data that are expected to satisfy the site manager's decision performance criteria, as specified in the preceding steps of the DQO Process. The output of this step is the sampling design that will guide development of the field

sampling and analysis plan. This step provides a general description of the activities necessary to generate and select data collection designs that satisfy decision performance criteria.

Validation data is required to be collected to verify:

- The effectiveness of the remediation works;
- Any contaminated soils retained on-site have been appropriately contained and managed;
- Any material imported to backfill excavations are suitable for the proposed site use; and
- Document the condition of the site as being suitable for the proposed future use.

The proposed validation soil sampling program is outlined in Section 10.

8.0 VALIDATION SAQP & METHODOLOGY

Remediation of the impacted area will be considered validated following the achievement of the two validation objectives;

- Validation of the remedial excavations will continue to the extent of the impacts and resulting samples are within the adopted criteria.
- In the event of backfilling, validation of the imported fill materials used is required to confirm the suitability for the intended land use.

8.1 Soil Validation Methodology

Soil sampling and handling is outlined in the table below:

Table 10: Sampling and Handling

Action	Outline
Sample collection	Soil validation sampling will be collected directly from exposed surface of excavation, or from the material scraped from the excavator bucket. Data shall be recorded in accordance with COC requirements
Sampling, handling, transport and tracking	Validation soil samples to be transferred directly into appropriately labelled clean laboratory supplied containers. Validation soil samples to be transferred into chilled eskies for sample preservation. All equipment used in the sampling program was decontaminated prior to use and between samples to prevent

	cross contamination. Decontamination of equipment involved the following procedures: -Cleaning equipment in potable water to remove gross contamination; -Cleaning in a solution of Decon 90; -Rinsing in clean demineralised water then wiping with clean lint free cloths; A Chain of Custody to be completed and forwarded to the laboratory to ensure sample tracking.
Sampling Frequency	<u>Remedial Hotspot Excavation (Validation Sampling):</u> 1 sample per 100m², with one sample per 10 lineal metres along each wall (with a minimum of one sample per excavation wall) <u>Stockpile sampling:</u> Small Volumes (<200m³)- 1 sample every 25m³ Large Volumes (>200m³) as per Table 3 of the Victoria Sampling Guidelines June 2009 (IWRG702)
Laboratory Quality Assurance and Quality Control	The contracted laboratory to conduct in-house QA/QC procedures involving by not limiting to: Blanks, spike recoveries, laboratory duplicates & analysis.
Assessment of DQOs	Provide analysis of the QA/QC samples and procedures & provide assessment of the overall data quality.

8.2 Soil Validation Reporting

All fieldwork, chemical analysis, discussions, conclusions and recommendations will be provided in the final validation report for the site. The validation report will be prepared in accordance with the NSW EPA 2011 Guidelines for Consultants Reporting on Contaminated Sites and NSW DEC (2017) Guidelines for the NSW Site Auditor Scheme and will confirm the site is suitable for the proposed development. Waste tracking documentation and disposal details will be provided in the validation report.

9.0 VALIDATION WORKS

9.1 Objectives

The objective of the validation program is to ensure that at completion of the remediation works, the site is suitable for continued use and the proposed redevelopment.

Table 11: Soil Validation Sampling Program

Item	Sampling Frequency	Analytes
Validation of hotspots BH1, BH4 & BH9.	1 floor sample, 4 wall samples (per hotspot) 1 inter-laboratory duplicate 1 intra-laboratory duplicate	Heavy metals & Asbestos %w/w

Backfill Material (if required)	Certified VENM or 1 sample per 100m ³	HM, TPH, BTEX, PAH, OCP, PCB, Phenol, Cyanide & Asbestos. Additional COPC may need to be included in the testing suite depending on the source site.
	Certified ENM as per NSW EPA Resource Recovery Order 2014	HM, TPH, BTEX, PAH, EC, PH & Foreign Materials & Asbestos
Unexpected Finds	<u>Excavation Floor</u> 1 sample every 25m ³ , with a minimum of 3 samples <u>Excavation Wall</u> 1 sample every 5m (from each distinct horizon / material type)	Dependent on the location, type and characteristic of the unexpected find.

9.2 Waste classification of the fill & hotspots

As part of future site works, any soil to be removed from site will be classified in accordance with the “Waste Classification Guidelines, Part 1: Classifying Waste” NSW EPA (2014).

Remaining Fill and Hotspots

The fill has already been sampled as part of the previous works and these samples will be included within the sampling density for characterisation. Further samples will be recovered either in-situ or from stockpiles. Any excavated fill will be temporarily stockpiled on a heavy duty plastic sheet or a sealed surface such as concrete, and covered with an impermeable plastic sheet to prevent rain infiltration.

9.3 Validation of hotspots

Following removal of soils from the hotspots BH1, BH4 & BH9 photographic records of the floor and wall of the excavation will be taken for reference in the Validation Report.

Sample will be taken from the floor and walls of each of the listed hotspots areas as per Table 11. Soil validation samples will be collected and analysed for Heavy Metals & Asbestos %w/w.

Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

9.4 Validation of areas where fill has been temporarily stockpiled

The excavated contaminated fill will be temporarily stockpiled on a plastic sheet and covered with an impermeable plastic sheet to prevent rain infiltration. In order to confirm that cross-contamination of the soil underneath has not occurred during stockpiling; testing of the soils underneath stockpiles will be required after disposal of the stockpile off-site (where necessary).

9.5 Validation of imported fill

If importation of fill is required it must be certified VENM material and will also be tested in accordance with the requirements of the NSW EPA waste classification guidelines (including testing for asbestos) at a rate of 1 sample per 100 m³. Certified ENM material is also acceptable and will be tested in accordance with the NSW EPA Resource Recovery Order 2014 for ENM. VENM and/or ENM will also be visually assessed for fibro sheeting and samples analysed for asbestos if detected.

9.6 Duration of remediation and validation works

Based on the proposed scope of the remediation and validation works, it is expected that the works should be completed within approximately four weeks following receipt of the regulatory approvals. This timeframe does not include reporting which should be completed approximately three to five weeks after completion of the remediation and validation works.

10.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The quality assurance/quality control (QA/QC) program aims at ensuring that the data collected is sufficiently accurate, precise and reproducible to be used for the purpose of the validation report. QA/QC should be in accordance with the NEMP 2013 and with the Australian Standard AS4482.1-2005.

10.1 General QA/QC

The frequency required for each field quality assurance / quality control (QA/QC) sample is presented in the table below.

Table 12: QA/QC Frequencies

	Intra Lab	Inter Lab	Rinsate	Spikes	Blanks
Sampling Frequency	1 in 20	1 in 20	1/day	1/day	1/day

During the contamination assessment the integrity of data collected is considered vital. With the assessment of the site, a number of measures were taken to ensure the quality of the data. These are as follows:

10.2 Sample Containers

Soil samples to be collected remediation work are to be placed immediately into laboratory prepared glass jars with Teflon lid inserts. Standard identification labels are

to be used for each individual container and labelled according to depth, date, sampling team and media collected.

10.3 Decontamination

All equipment used in the proposed sampling program are to be decontaminated prior to use and between samples to prevent cross contamination. Decontamination of equipment involved the following procedures:

- Cleaning equipment in potable water to remove gross contamination;
- Cleaning in a solution of Decon 90;
- Rinsing in clean demineralised water then wiping with clean lint free cloths;

Benviron Group adopts a sampling gradient of lowest to highest potential contamination to minimise the impact of cross contamination. This gradient is determined from the historical review and the on-site inspection that was carried out prior to sampling.

10.4 Sample Tracking, Identification and Holding Times

All samples are to be forwarded to NATA Accredited laboratories under recognised chain of custodies with clear identification outlining the date, location, sampler and sample ID. All samples are required to comply with the laboratories respective holding times. The sample tracking system is considered adequate for the purposes of sample collection.

10.5 Sample Transport

All samples are to be packed into an esky with ice from the time of collection. A trip blank and trip spike are collected where appropriate. Samples were kept below 4°C at all times, soil samples submitted for asbestos analysis are not required to be kept below 4°C.

10.6 Data Quality Indicators

The pre-determined data quality indicators for the validation program are discussed below in relation to precision, accuracy, representativeness, comparability and completeness and are summarised in the table below:

Table 13: Data Quality Indicator for the proposed Validation Program

Data Quality Indicator	Frequency	DQI Indicator
Completeness		
Data from critical samples is considered valid	All samples	All samples
Satisfactory frequency / result for QC samples	All samples	95%
Field documentation completed	All samples	All samples
Boreholes logs & COCs completed and holding times complied with.	All samples	All samples
Comparability		
Standard operating procedures used	All samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Same analytical methods used	All samples	All samples
Limit of reporting appropriate and consistent	All samples	All samples
Representativeness		
Sampling appropriate for media and analytes	All samples	All samples
Samples adequately preserved	All samples	All samples

Data Quality Indicator	Frequency	DQI Indicator
Precision		
SOPs appropriate and complied with in relation to field duplicates	All samples	All samples
RPDs of the field duplicates within control limits	1/20 samples	<50% RPD
RPDs of the laboratory duplicates within control limits	All samples	All samples
Accuracy		
SOPs appropriate and complied with in relation to field blanks	All samples	All samples
Rinsate Blanks, trip blanks & laboratory blanks free of contaminants	Laboratory blanks (LB) = 1 per batch Rinsate Blanks (RB) = 1 / day Trip Blank (TB)= 1/day	LB = <LOR RB= <LOR TB= <LOR
Surrogate spikes within control limits	All organic analytes	70-130%
Laboratory control spikes within control limits	Yes	Yes
Matrix Spike recoveries within control limits	1 /20 samples	70-130%
Trip spike recoveries within control limits	1/day	>70%

11.0 ENVIRONMENTAL MANAGEMENT PLAN

A site specific Construction Environmental Management Plan (CEMP) should be prepared for the construction phase for the proposed development. The CEMP should set out the requirements for environmental management during the works including:

- Management structure and responsibilities;
- Approval and licensing requirements;
- Environmental induction and training;
- Emergency contacts;
- Environmental incident response;
- Implementation of the plan;
- Community consultation process; and
- Monitoring required during the works and the process for review of the CEMP, if required.

12.0 SITE MANAGEMENT PLAN

Adherence to the SMP will be monitored by an on-site Environmental Scientist who will be present during all critical remediation / validations works. The Site Management Plan (SMP) for the remediation will address:

- Site access;
- Working hours;
- Stormwater and soil management;
- Traffic management;
- Noise, dust and odour control; and
- Work health and safety.

Each of the issues to be addressed in the site management plan is briefly discussed in the following sections.

12.1 General

The remediation and validation works must be undertaken in accordance with applicable statutory requirements. The site manager/foreman of the remediation contractor should have a thorough understanding of the contents of the RAP, corresponding Site Management Plan (SMP), Work Health & Safety Plan (WHS) and should ensure that each employee or sub-contractor is familiarised with the requirements of these plans.

The remediation and validation works will be undertaken under the monitoring of the principal's environmental representative, who will be represented on-site by a field environmental scientist.

12.2 Site access

The contractor will ensure that adequate barriers have been placed around the site to prevent access of unauthorised personnel to areas where contaminated material is exposed. The contractor will also place adequate warning signs around the site.

12.3 Working hours

The working hours for the remediation / validation works will be between 7.00am to 5.00pm Mondays to Fridays and 7.00am to 1.00pm on Saturdays. No work will be carried out on Sundays and public holidays.

12.4 Demolition (including Asbestos Management)

Demolition works are to be completed in accordance with NSW WorkCover Standards and Codes of Practice. Any asbestos identified within the building materials should be managed in accordance with the NSW WorkCover Codes of Practice and Australian Standards.

12.5 Surface water and soil management

The contractor will put in place adequate stormwater runoff, run-on and sediment control measures for the remedial works. These requirements are outlined in Schedule B (9) of the (*site contamination*) NEPM (2013).

These include stockpiling excavated soil in a manner that will prevent contamination from being transported off-site by stormwater, and include the following measures:

- Divert stormwater runoff outside the site so that it does not flow through the site;
- Control drainage on the site by intercepting and redirecting runoff in a controlled manner;
- Stormwater collected at the site in trenches and sumps should be appropriately managed; and
- Silt stop fences should be erected at locations where stormwater may flow outside the site.

The presence of sediment in surface water or runoff must be minimised by the use of sediment controls such as diversion drains, hay bales and silt fencing.

Soils that require stockpiling must be managed in such a manner that these materials remain well contained and easily identifiable and that the effects of wind and rain have minimal impact on their integrity. Subsequently, if adverse weather conditions are anticipated, or if the stockpile is to remain on-site for an extended period, stockpiles must be protected and covered. Stockpile records must be maintained to track the re-use of soils at the site (if any).

Any plant or equipment that comes into contact with soils must be inspected prior to leaving the site, and cleaned as necessary.

12.6 Groundwater management

If groundwater is encountered during excavation works, the groundwater is to be directed to and collected in trenches and sumps. No discharge of groundwater will occur without approval of appropriate regulatory bodies.

12.7 Traffic management

The management of the material leaving the site will be under the monitoring of the principal's environmental representative, who will record the details of these materials.

Vehicular movement is to be conducted in accordance with Council requirements. The contractor will install a vehicle wheel washing or shaking facility and will manage all vehicles as indicated by the principal's environmental representative (Benviron Group) to minimise tracking of any materials onto public roads. The wheels of the vehicles will be washed and brushed prior to leaving the site. Loads leaving the site should be maintained moist and must be covered to prevent materials from the site being spilled or left on public or private roadway or adjacent areas. Particular care should be taken if UST or any unexpected material have been encountered and are to be removed from the site.

12.8 Noise Control

The contractor should keep noise levels to a minimum and levels should not exceed limits indicated in AS 2436 1981. Noise levels must also comply with Council and NSW EPA requirements. It is expected that the equipment to be used in the remediation works will not generate noise levels above these requirements.

12.9 Dust control

Works must comply with the requirements listed in Schedule B (9) of the NEPM (2013), Council and the NSW EPA. The generation of dust should be kept to a minimum. Stockpiled contaminated material should be bunded and covered. Water sprays may be used to minimise dust. Water used for this purpose should not be allowed to flow off-site through the stormwater system, sewer, or any other way.

12.10 Odour control

The level of odours generated during remedial activities must be monitored and local Council and NSW EPA requirements must be complied with. Due to the nature of contamination, odours may be encountered. It is noted however that it is expected only small volumes of fill will be excavated at one time and this should minimise the generation of significant odours.

Should odorous compounds be encountered, the remediation contractor should take measures to mitigate them and to prevent their migration outside the site boundaries. This may involve placing the odorous materials as soon as possible in a bunded area,

covered with plastic membrane, and spraying with an odour suppressant approved by the environmental consultant.

12.11 Work Health and Safety Plan

As personnel on-site may be exposed to potentially toxic or hazardous compounds, the Contractor will prepare a site-specific Work Health and Safety Plan (WHS) prior to commencement of remediation and validation work in accordance with relevant legislation. The WHS will identify hazards, assess the risks posed by the hazards and recommend measures to control the hazards. This should include detailed descriptions of vehicle decontamination, protective clothing, equipment and appropriate safety controls that will be adopted during remediation and validation works carried out at the site.

If odours are detected at areas around the site PID measurements will be collected by the on-site Environmental Scientist. If PID readings >30 ppm are recorded breathing masks should be worn by workers in the vicinity of the odour and >300 ppm odour suppressants as well as controlled excavations should be applied.

Personnel working on the site are required to read, understand and apply the requirements of the WHS. All staff working on the site must be inducted by an authorised induction trainer and must sign the relevant induction form.

12.12 Waste / Soil Management Plan (Importation, stockpiles, tracking & disposal)

12.12.1 Imported Soil

Importation of any soil, rock or aggregate is required to meet the following requirements:

- They must be legally able to be imported onto the site in accordance with the Protection of the Environment Operations (Waste) Regulation 2014 and any required consent approvals;
- The soils must meet the remediation criteria for the site (refer to Section 4);
- The soils must be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) or other materials legally able to be imported onto the site based on a Resource Recovery Exemptions. Where available VENM should be imported in preference to ENM. Soils must be assessed in accordance with the EPA requirements;
- Prior to importation appropriate documentation needs to be provided to, and approved by, the Environmental Consultant and the materials must be inspected at the source site to confirm that there are no signs of contamination;
- The material must be inspected during importation by the Contractor, and any materials not meeting the description given in the provided documentation or displaying signs of contamination will be rejected.

12.12.2 Stockpiles

Stockpiles should be managed to minimise the risk of dust generation, erosion and leaching. The measures required to achieve this should include:

- Restrict the height of stockpiles to reduce dust generation;
- Construct erosion, sediment and runoff control measures;
- Cover stockpiles of contaminated soils to be left on site for more than 24 hours, or if windy conditions are expected;
- Manage the potential for leaching

12.12.3 Waste Tracking

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act. All licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification, and with the appropriate approvals obtained from the EPA, if required. Details of all soils removed from the site (**including VENM**) shall be documented by the Contractor with copies of weighbridge slips, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the contractor.

A site log shall be maintained by the Contractor to track disposed loads against on-site origin. Transport of spoil shall be via a clearly delineated, pre-defined haul route. The proposed waste transport route will be notified to the local Council and truck dispatch

shall be logged and recorded by the Contractor for each load leaving the site. A record of the truck dispatch will be provided to the contractor.

12.12.4 Waste Disposal

All off-site disposal of wastes, where appropriate, will be undertaken in accordance with the POEO Act.

Any soil and rock to be removed from the site will be classified in accordance with either:

- The NSW EPA Waste Classification Guidelines 2014; or
- A General or Specific Exemption under the Protection of the Environment Operations (Waste) Regulation 2014.

No soils should leave the site without a formal waste classification.

All materials excavated and removed from the site shall be disposed in accordance with the POEO Act to a facility/site legally able to accept the material. Copies of all necessary approvals from the receiving site shall be given to the contractor prior to any contaminated material being removed from the site.

A record of the disposal of materials will be maintained. Copies of all consignment notes for the transport, receipt, landfill receipts and disposal of all materials (**including VENM**) will be maintained as part of the site log and made available to the Environmental Consultant for inspection and reporting purposes upon request.

12.13 Community Engagement

Community engagement should be carried out in accordance with Schedule B (8) of NEPM (2013). Prior to the start of any remediation works at the site, every owner and occupier of any land located either wholly or partly within 100m of the boundary of the premises should be notified at least 30 days in advance.

13.0 OPERATIONAL CONTROLS

13.1 Fire and explosion hazard

Explosive atmospheres may be present where any petroleum products or other potentially flammable or explosive substance is encountered / used, including machinery. Therefore, the contractor will put into place measures to prevent fires and explosions, which include:

- pumping and degassing of tanks prior to removal;
- preventing access to the site by unauthorised persons;
- forbidding smoking or using naked flame at the site;
- cutting of concrete to be carried out under a blanket of water in proximity to any underground storage tanks;
- approved fire extinguishers to be maintained in proximity to excavations;
- ensuring that no free product or fuel used for refuelling equipment enters a confined space or drainage/sewer system; and
- using only certified flameproof equipment in proximity to locations where free petroleum fuel is present or is expected to be present.

13.2 Public complaints registry

Given the nature of the remediation and validation works, it is considered that a community relations plan is not required.

13.3 Duties of the on-site environmental scientist

The duties of the on-site environmental scientist include:

- ensure adherence to the Remediation Action Plan, the Work Health and Safety Plan and other plans applicable to the site;
- monitor the excavation of contaminated material undertaken at the site;
- ensure environmental compliance of contractors;
- monitoring with a PID the areas adjacent to open excavated pits at least three times throughout the day, and at additional times if strong or unusual odours or if unusual substances are encountered during the excavations part of the remediation works;
- inspection of the integrity of the sediment controls placed around the site;
- inspection at approximately two hourly intervals of the roadway in the vicinity of the site used by the vehicles leaving the site to ensure that no significant amounts of materials have been tracked off-site by vehicles;
- immediately report actual or potential non-compliances to the principal's environmental representative who will report those to appropriate regulatory bodies ;
- note weather conditions, approximate temperature, direction and velocity of the wind, and rainfall at the commencement of work, at about midday and at the end of the day;
- collect samples for validation or other purposes as required by the principal's environmental representative;
- maintain a site diary which will record the following information:
 - date
 - weather conditions
 - presence of odours at the site and at the site boundaries

- PID measurements
- details of materials excavated during the remediation works, and details of actions taken if unexpected materials are encountered
- details of accidents, near misses or incidents, which may have resulted in injury, and the actions taken to prevent their recurrence
- details of environmental issues, which may result in environmental incidents and measures taken to correct them
- details of visitors to the site or other matters relating to environmental or health issues

13.4 Unexpected occurrences

If during remediation works, significant odours and/or evidence of gross contamination not previously detected are encountered, or any other significant unexpected occurrence, site works should cease in that area, at least temporarily, and immediate action taken to abate the odours or prevent / manage cross-contamination occurring. If required, the administering authority will be notified in writing within two working days of significant unexpected occurrence and informed of the remediation actions implemented.

13.5 Non-compliances

If the on-site environmental scientist suspects that some works carried out at the site do not comply with the requirements of the RAP, the WHS or other plans applicable to the site, this should be reported immediately to the principal's environmental representative. If the principal's environmental representative cannot be contacted or if immediate action is required, the on-site environmental scientist has authority to stop

the work or request appropriate action to be taken. This is particularly the case under the following circumstances:

- injury to person due to exposure to materials excavated from the site;
- spillage of materials at the site or on areas adjacent to the site; and
- other events that the environmental scientist believes could give rise to unacceptable risk to human health or to adverse impact to the site or to areas adjacent to the site.

14.0 CONTINGENCY MANAGEMENT

The conditions that may be encountered when excavating are uncertain. As unknown and variable subsurface conditions impose a degree of uncertainty for the project a set of anticipated conditions has been assumed in developing the excavation plan. However, because field conditions vary, flexibility has been built into the excavation plan to adapt to differing conditions.

Table 14: Contingency Management

Anticipated Problem	Corrective Action By Contractor
Asbestos cement sheeting, lagging, pipping etc.	Stop excavations if there is the potential for people to inhale airborne asbestos fibres. Contact Benviron Group immediately to assess whether the material is asbestos. Cover the area with plastic and suppress dust by wetting down if needed. Place a warning sign at the entrance to the site where asbestos removal or site remediation is taking place. Adhere to WHS regulations and follow the unexpected finds protocol outlined in 15.2 & Appendix A.
Discovery of USTs	Stop excavations, contact Benviron Group immediately. Follow the unexpected finds protocol and UST finds protocol outlined in section 15.2 & 15.3 & Appendix A.
Chemical spill / exposure	Stop work, refer to Occupational Health, Safety and Rehabilitation Plan and immediately contact Benviron Group.
Excessive rain	Maintain access roads, cover high-traffic areas with gravel; or cover working areas/stockpiles with plastic during off-shifts; or shut down operations until runoff is more manageable. Inspect & maintain sediment control pond & filter fences.
Unmanageable mud in excavation zone	Improve drainage collection system; add geotextile/gravel in problem areas; or strip off mud/slurry materials; or excavate from the top of the fill.

Excessive drainage	Minimise active/contaminated work area; or improve diversion clean run-on; or maintain sufficient on-site wastewater storage capacity; or mobilise additional storage and/or treatment systems as needed.
Excessive dust	Use water sprays or biodegradable dust sprays, or cease dust-generating activity until better dust control can be achieved, or apply interim capping systems.
Sediment pond water for discharge – analytical results exceed site response levels	Perform in-situ treatment, e.g. flocculants dosing, until response levels are met. Alternatively arrange off-site disposal by a licensed Contractor.
Excessively wet materials	Stockpile and dewater on-site; or add absorbents.
Equipment failures	Maintain spare equipment or parts; or maintain alternate rental options; or shut down affected operations until repairs are made.
Release of fuel/oil from machinery	Remove source, use absorbent booms to remove oil and make any repairs as required.
Silt fence fails	Stop work and repair fence to specifications.
Excessive noise	Identify source and review noise attenuation equipment and as necessary provide silencers on noisy equipment.

Excessive odours / vapours	If excessive organic odours / vapours are generated, stop works and monitor for volatiles at the site boundaries using PID and upgrade PPE if necessary. Implement control measures including respirators for on-site workers, wetting down excavated material, use of odour and volatile suppressing agents to eliminate or reduce odours as required and/or cover odorous material if practicable. Benviron Group notes that no nuisance odours shall be detected at any site boundary as part of the remedial works. If odours/vapours are detected then it is recommended, as part of the CEMP & community consultation procedure, that the project manager, client and remediation contractor: 1. Notify the owners / occupiers of the adjoining premises in writing regarding the potential odour issues. Include contact details for any concerns in relation to the odour emissions during remediation. 2. Temporarily pause site works to allow excessive odour to subside whilst implementing the control measures. 3. Record logs for volatile emissions and odours.
Excavation extends below water table into natural materials which are assessed and confirmed to comprise potential acid sulphate soils (PASS).	Implement Acid Sulphate Soils management plan. This will include on-site treatment of the soils in the excavation area. Treatment would likely involve lime addition at a rate to be calculated using methods specified in the ASS Manual (1998).
Unearthing drummed material	Isolate and contact Superintendent. Arrange temporary storage in a secure part of the remediation site (to be nominated).
Identification of cultural or building heritage items	Stop work and notify project manager. Follow the unexpected finds protocol as detailed in section 15.2 & Appendix A.

Complaint Management	Notify client, project managers, and environmental consultant following complaint. Report complaint as per internal procedures, implement control measures to address complaint and notify complainant of the results of the remedial actions.
----------------------	--

In addition to the above listed contingencies, the following steps may need to be undertaken should non-spadeable sludge's or buried drums be discovered during the remediation works:

- upgrade of personal protective equipment (PPE), for workers within the active work zone, in accordance with the site Occupational Health, Safety and Rehabilitation Plan;
- segregation and bunding of discovered material;
- use of odour suppressants (where appropriate);
- cover the discovered material with plastic sheeting;
- appropriate sampling and analysis to assess potential contaminants; and
- appropriate off-site disposal of the materials following receipt of analytical results and any associated regulatory approvals required.

14.1 Contact Persons

Table 15: Contact Persons

Responsible Party	Details
Principal Environmental Representative	Benviron Group PO Box 4405, East Gosford NSW 2250 Benjamin Buckley
Project Manager and Client	GM Architects 185 Fifth Avenue, Austral NSW

14.2 Unexpected Finds Protocol

The sampling strategy for each “unexpected find” shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, at concentrations which pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the following minimum requirements:

- Excavation Floor
 - o 1 sample every 25m³, with a minimum of three samples recovered.
 - o Samples should be analysed for the chemicals of concern.
- Excavation Wall
 - o 1 sample every 5m (from each distinct horizon / material type)
 - o Samples should be analysed for the chemicals of concern.

All additional works should be documented by the use of field notes, site photographs, site plans and reporting.

Refer to **Appendix A** for a copy of the Unexpected Finds Protocol.

14.3 USTs

Any unexpected UST's found within the site should be removed in accordance with NSW WorkCover & UPSS Regulation 2014 requirements, and AS4897-2008: The design, installation and operation of underground petroleum storage systems. In the event of conflict between the guidance documents, the latter shall prevail. Due to the volatile nature of petroleum storage tanks, it is recommended that the USTs be excavated and disposed of by an experienced contractor and with an environmental representative present.

Following the removal of any USTs and associated visibly stained or odorous soils, in samples should be collected from the walls and floor of the tank-pits/hotspots and submitted to a NATA accredited laboratory for analysis. The targeted analytes should be, but not be limited to, heavy metals, TPH, BTEX & PAH.

The minimum sampling protocols to be used for unexpected UST areas include:

- 3 samples per backfill UST sands per UST pit;
- 1 sample per tank line;
- 1 sample per vent pipe area;
- 1 sample per spill box (currently not present but may be found);
- 2 base samples and 8 wall (2 samples per wall face) of each tank pit

14.4 Groundwater Contingency

If groundwater contamination is observed during the remediation process, it is recommended to assess the potential impact on the proposed development.

15.0 REGULATORY APPROVALS AND LICENSES

15.1 State Environmental Planning Policies

State Environmental Planning Policy No 55 (SEPP 55) – Remediation of Land sets the regulatory framework for contaminated land and remediation works in NSW. SEPP 55 defines the regulations for Category 1 and Category 2 remediation works. The remedial works to be undertaken at the site constitute Category 2 works (as defined in SEPP 55). Appropriate permissions for remediation should be obtained prior to commencement.

15.2 State Protection of the Environmental Operations (UPSS) Regulation 2014

UPSS Regulation requires if a storage system is decommissioned, a report for the storage system must be served on the relevant authority within 60 days of decommissioning or remediation is completed. The report must be prepared by a duly qualified person in accordance with EPA guidelines, and must describe the processes used to decommission the storage system and assess contamination at the storage site.

15.3 Duty to Report

Under Section 60 of the Contaminated Land Management Act 1997, the owner of the land is required to notify contamination in circumstances as indicated in the NSW EPA (2015) *Guidelines on Duty to Report Contamination under the Contaminated Land Management Act 1997*.

Sites that are significantly impacted by soil, groundwater and ground gases are likely to require notification to the NSW EPA under section 60 of the CLM Act. A decision process

for use by site owners or responsible persons considering reporting contamination under section 60 is provided in Appendix 1 (Figure 1) of the aforementioned guidelines.

15.4 Development Consent and Control Plans

All works should be in accordance with the Liverpool City Council Development Control Plans and any development consent issued by Liverpool City Council for the development.

15.5 Asbestos Removal Regulations / Work Health Safety Regulations

15.5.1 General

The removal and disposal of asbestos will be managed in accordance with the Work Health and Safety Act (2011) and Work Health and Safety Regulation (2011), "How to Safely Remove Asbestos: Code of Practice (WorkCover 2016), the, NSW WorkCover Guidelines and the NSW EPA Waste Classification Guidelines.

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1.

The WHS Regulations require a person conducting a business or undertaking who commissions the removal of asbestos at the workplace must also ensure asbestos removal work is carried out only by a licensed asbestos removalist who is appropriately licensed to carry out the work, unless specified in the WHS Regulations that a licence is not required.

If asbestos is non-friable, is more than 10m² and has been determined that it should be removed, it must be removed by a licensed asbestos removalist as soon as reasonably practicable. Where it is not reasonably practicable to remove it, control measures must be put in place to eliminate any exposure, so far as is reasonably practicable, or to minimise exposure so far as is reasonably practicable, but always ensuring the exposure standard is not exceeded.

Class A License can remove any amount or quantity of asbestos or ACM, including:

- any amount of friable asbestos or ACM
- any amount of ACD
- any amount of non-friable asbestos or ACM

Class B Licence can remove:

- any amount of non-friable asbestos or ACM
 - o Note: A Class B licence is required for removal of more than 10 m² of non-friable asbestos or ACM but the licence holder can also remove up to 10 m² of non-friable asbestos or ACM)
- ACD associated with the removal of non-friable asbestos or ACM
 - o Note: A Class B licence is required for removal of ACD associated with the removal of more than 10 m² of non-friable asbestos or ACM but the licence holder can also remove ACD associated with removal of up to 10m² of non-friable asbestos or ACM

15.5.2 Notification of Asbestos Removal Works

WorkCover must be notified five days before licensed asbestos removal work is commenced.

Asbestos removalists licensed in NSW can lodge the notification electronically using WorkCover's Asbestos and demolition online notification system or complete the form.

Interstate asbestos removalists who hold an asbestos removal licence issued under another Work Health and Safety Regulation must lodge the notification by completing the notification form.

15.5.3 Notification of Respirable Asbestos Fibre Levels at more than 0.02 fibres / ml

WorkCover must be notified within 5 days when the respirable asbestos fibre levels exceed 0.02 fibres/ml in the removal area.

NSW licensed asbestos removalists and interstate asbestos removalists who hold an asbestos removal licence issued under a work health and safety regulation must lodge the notification by completing the notification form.

15.5.4 Notification of the Emergency Demolition of a Structure or plant involving Asbestos

Notification of the demolition or refurbishment of a structure or plant is required for the following:

- that was constructed or installed before 31 December 2003;
- is located in either a workplace or a residential premises where an emergency has occurred;
- the structure or plant must be demolished; and
- asbestos is fixed or installed in the structure or plant before the emergency has occurred.

Demolition or refurbishment does not include minor or routine maintenance work or other minor work.

An emergency is defined if:

- a structure or plant is structurally unsound
- collapse of the structure or plant is imminent.

The person with management or control of the workplace or, if in residential premises, the licensed asbestos removalist must notify WorkCover by completing the notification form.

Interstate asbestos removalists who hold an asbestos removal licence issued under another work health and safety regulation must also notify WorkCover if the work is located in NSW.

Completed notification forms can be lodged by:

- fax to (02) 9281 7486
- email to adu@workcover.nsw.gov.au
- delivery to, Level 10, Centennial Plaza, Building C, 300 Elizabeth Street, Sydney or any WorkCover office
- post to the Asbestos Demolition Unit, WorkCover NSW, PO Box 1476, Strawberry Hills NSW 2012.

Asbestos notifications are free and the asbestos and demolition hotline number is (02) 8260 5885.

15.6 Protection of the Environment Operations (Waste) Regulations 2005

The regulations make requirements relating to non-licensed waste activities and waste transporting.

Section 42 of the Regulation stipulates special transportation, re-use or recycling requirements relating to asbestos waste and must be complied with regardless whether the activity is licensed.

The requirements for the transportation of asbestos waste include:

- bonded asbestos material must be securely packaged at all times,
- friable asbestos material must be kept in a sealed container,
- asbestos-contaminated soils must be wetted down,
- all asbestos waste must be transported in a covered, leak-proof vehicle.

The requirements relating to the off-site disposal of asbestos waste are as follows:

- asbestos waste in any form must be disposed of only at a landfill site that may lawfully receive the waste,
- when asbestos waste is delivered to a landfill site, the occupier of the landfill site must be informed by the person delivering the waste that the waste contains asbestos,
- when unloading and disposing of asbestos waste at a landfill site, the waste must be unloaded and disposed of in such a manner as to prevent the generation of dust or the stirring up of dust,
- asbestos waste disposed of at a landfill site must be covered with virgin excavated natural material or other material as approved in the facility's environment protection licence.

Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It also stipulates that vehicles used to transport waste must be covered when loaded.

15.7 Other licences required

Transporters of contaminated waste are required to be licensed to transport contaminated waste to licensed landfills. Landfills are required to be licensed for the category of waste they are scheduled to receive.

Waste classification documentation and waste dockets from the receiving landfill should be kept on file for site validation purposes.

If water is discharged as part of any dewatering activities, the relevant discharge consents must be obtained.

The appointed site contractor should prepare appropriate Construction Environmental Management Plans CEMP, work health safety plans & other plans required by the Council DA and DCPs. Where asbestos removal is required, the contractor must be appropriately licensed to carry out the designated works.

16.0 CONCLUSION

It is considered that the site will be suitable for the proposed redevelopment into four multi-level residential apartment buildings including two level basements, landscaping, road widening & new roads, subject to the implementation of remediation and validation works in accordance with this RAP.

REFERENCES

- Australian and New Zealand Environment and Conservation Council (ANZECC) (1996) – *Drinking Water Guidelines*.
- Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) – *Guidelines for Fresh and Marine Waters*.
- Department of Urban Affairs and Planning – EPA (1998) “*Managing Land Contamination – Planning Guidelines – SEPP 55 – Remediation of Land*”.
- Benviron Group (2017), “Preliminary Site Investigation”, 185 Fifth Avenue, Austral NSW, Ref: E1292, dated August 2017.
- Benviron Group (2018), “Detailed Site Investigation”, 185 Fifth Avenue, Austral NSW, Ref: E1292-2, dated February 2018.
- National Environmental Protection Council (NEPC) (1999) – *National Environmental Protection (Assessment of Site Contamination) Measure. Amendment 2013*
- NSW EPA (2014) “*Technical Note: Investigation of Service Station Sites*”.
- NSW EPA (2009) “*Guidelines on Significant Risk of Harm from contaminated land and the duty to report*”.
- NSW OEH “Guidelines for Consultants Reporting on Contaminated Sites” (2011). NSW Environment Protection Authority, Sydney.
- NSW DEC, “Guidelines for the Assessment and Management of Groundwater Contamination” (March 2007).
- NSW EPA “Guidelines for the NSW Site Auditor Scheme” (2017, 3rd edition). NSW Environment Protection Authority, Sydney.
- NSW EPA (2014) – “Waste Classification Guidelines, Part 1: Classifying Waste”;

- NSW EPA “Guidelines for Consultants Reporting on Contaminated Sites” (2011). NSW Environment Protection Authority, Sydney.
- NSW EPA (2014) “Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997”;
- NSW EPA “Sampling Design Guidelines” (1995). NSW Environment Protection Authority, Sydney.

17.0 LIMITATIONS

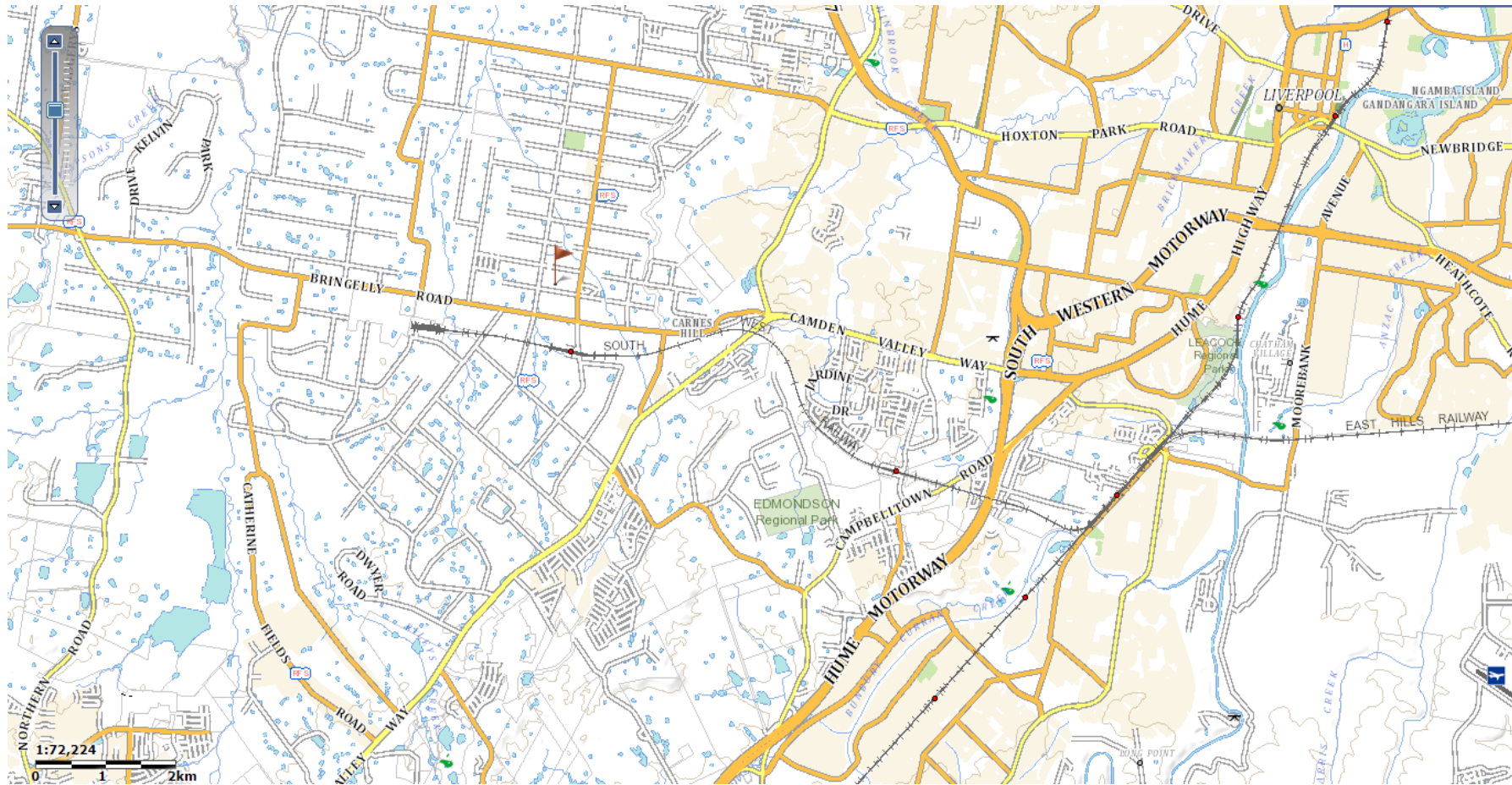
Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions are judgements, which are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions.

FIGURE 1 SITE LOCALITY



Key

Site Location



DRAWN
RL

FIGURE
1

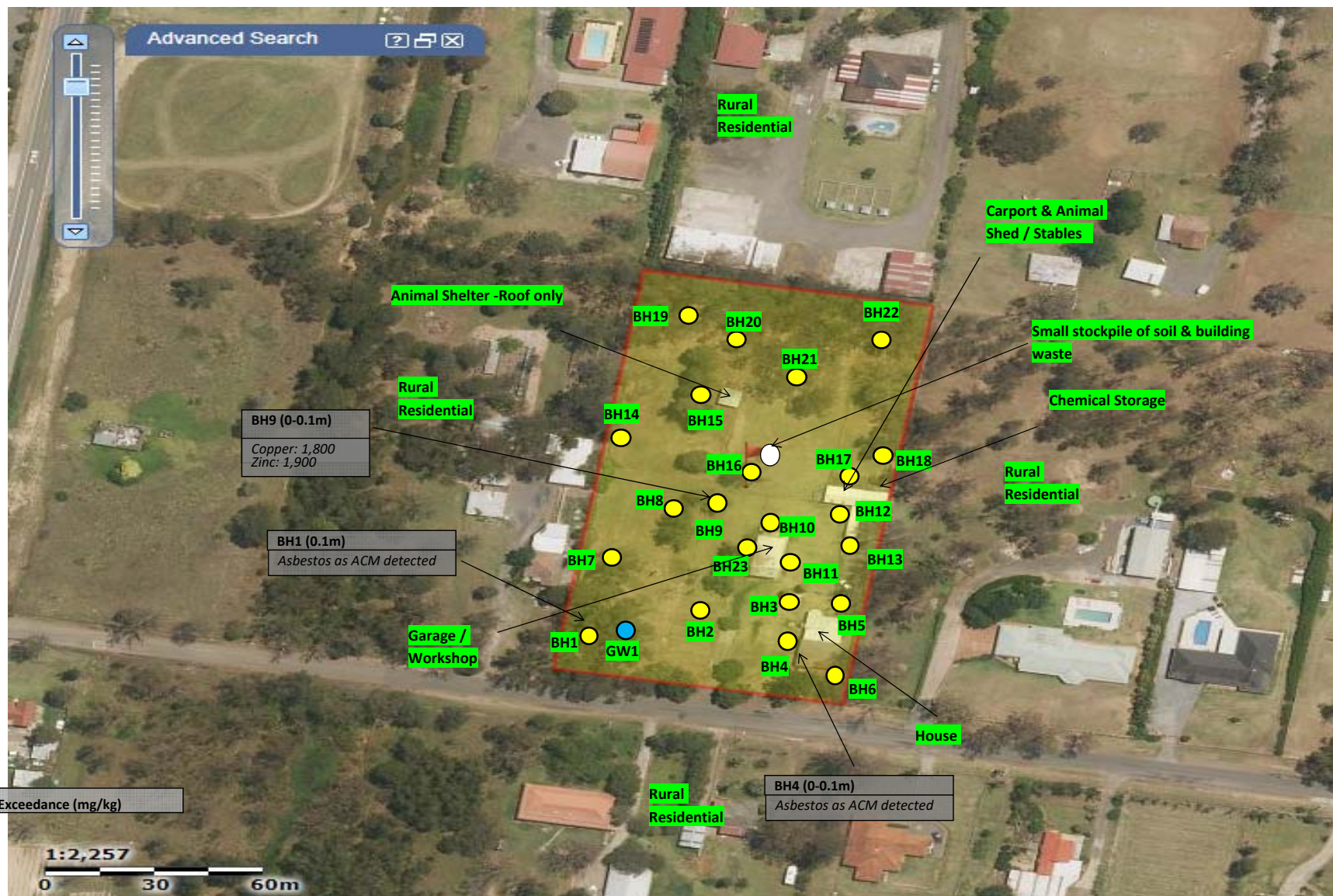
Job #
E1292-3

SITE LOCALITY

Ref: NSW LPI Six Maps

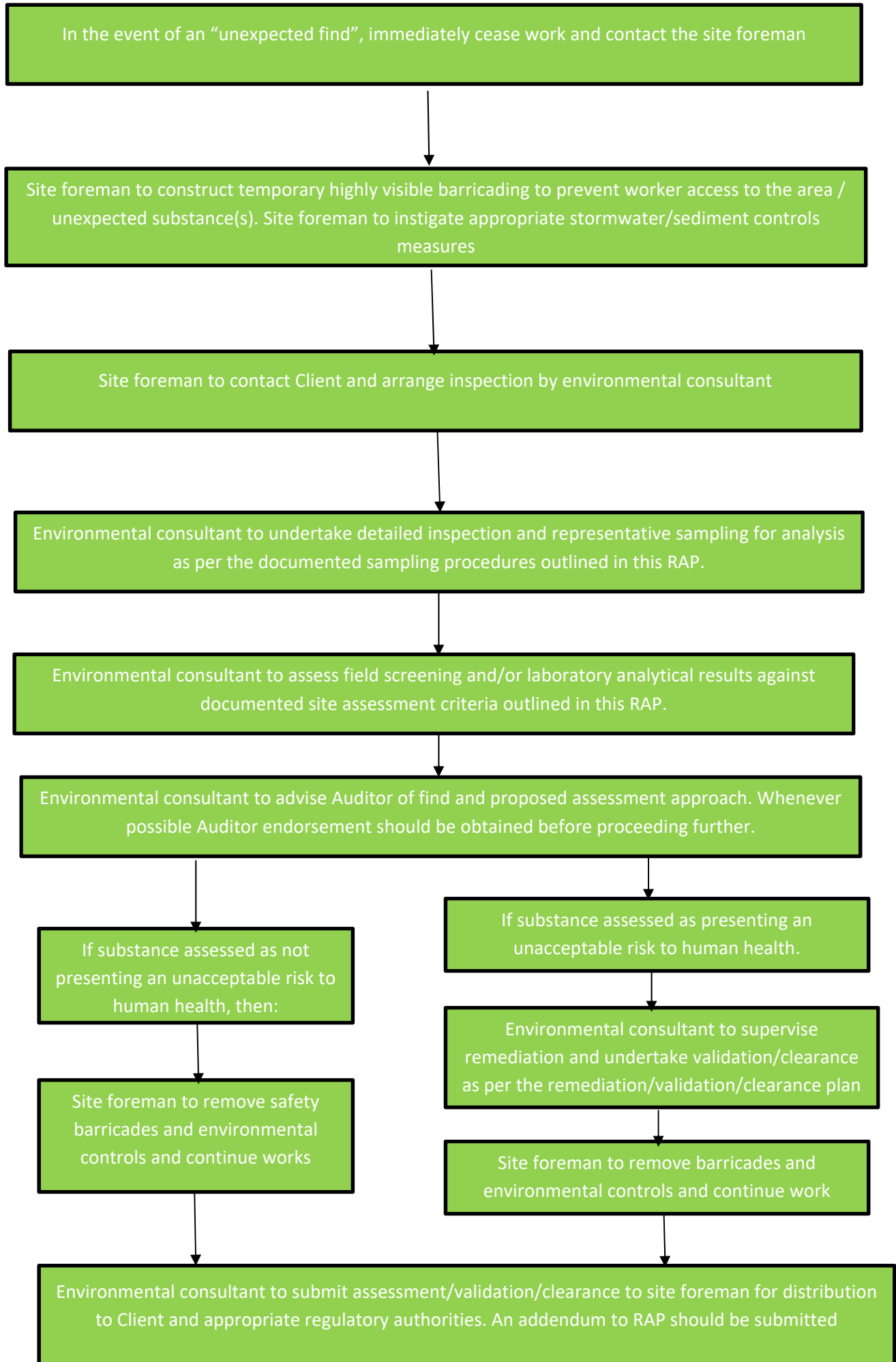
185 Fifth Avenue, Austral

**FIGURE 2: SITE FEATURES, BOREHOLE LOCATIONS & EXCEEDANCE
PLAN**

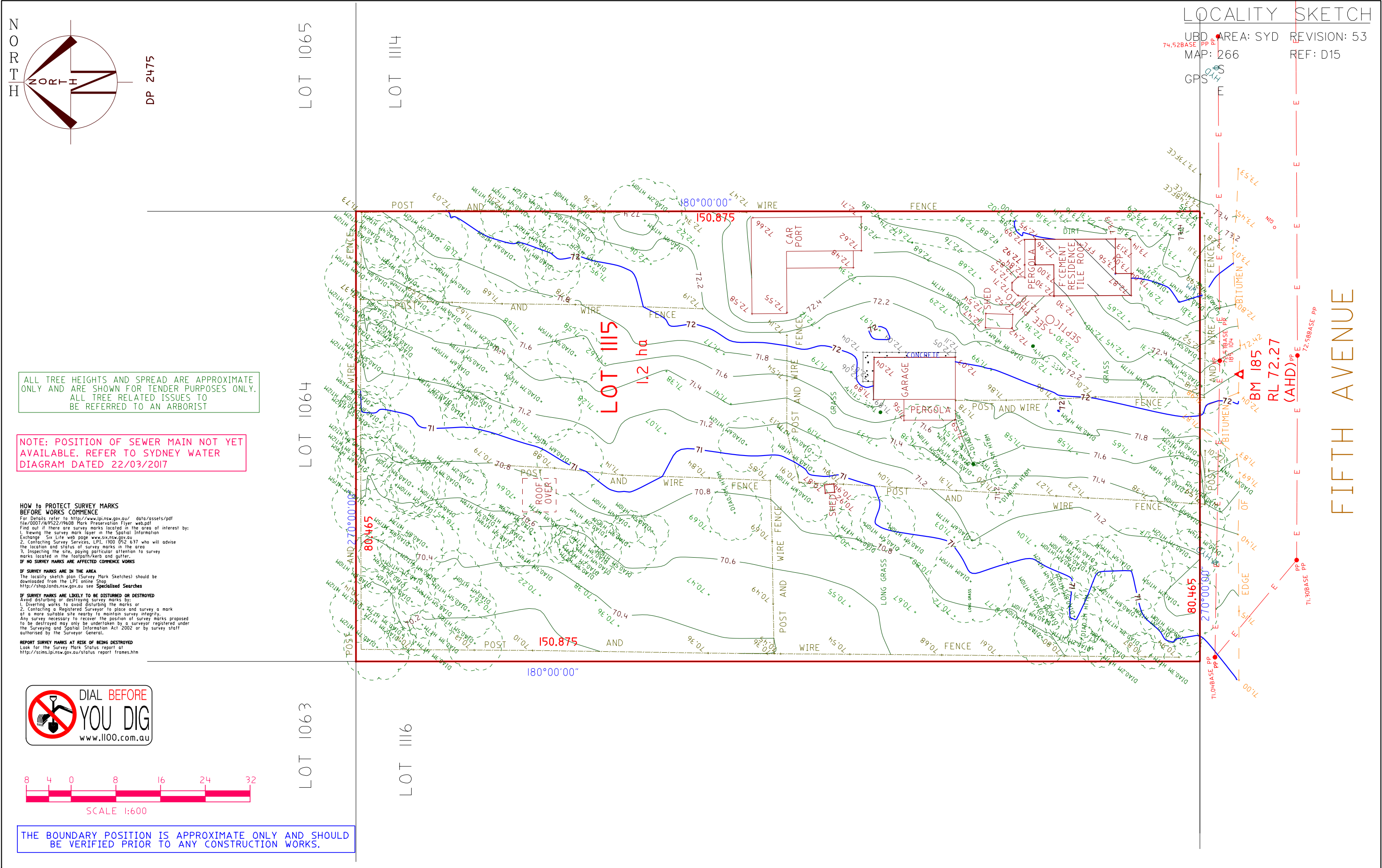


Key Site Location Groundwater Locations Soil Locations		DRAWN RL FIGURE 2 Job # E1292-3	Site Features, Borehole Locations & Exceedance Plan Ref: NSW LPI Six Maps 185 Fifth Avenue, Austral NSW
--	---	--	--

APPENDIX A: UNEXPECTED FINDS PROTOCOL

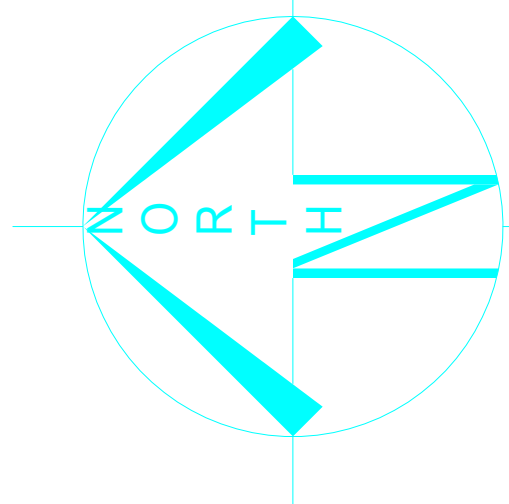


APPENDIX B: PROPOSED DEVELOPMENT PLANS & SURVEY



COPYRIGHT COPYRIGHT OF THIS PLAN AND IN THE ACCOMPANYING CAD FILE(S) WHERE APPLICABLE VESTS WITH ASPECT DEVELOPMENT & SURVEY PTY LTD. THE PLAN AND CAD FILE SHALL ONLY BE USED BY THE ADDRESSED CLIENT FOR THE PURPOSE FOR WHICH THE SURVEY WAS CARRIED OUT.		GENERAL NOTES A) THIS SURVEY IS SPECIFICALLY FOR CONTOUR PURPOSES ONLY. THE BOUNDARIES OF THE SUBJECT PROPERTY HAVE NOT BEEN INVESTIGATED AND THE POSITION SHOWN IS APPROXIMATE ONLY. B) AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY. C) SERVICES SHOWN HAVE BEEN DERIVED FROM VISUAL EVIDENCE APPARENT AT THE TIME OF SURVEY. THE RELEVANT SERVICE AUTHORITY SHALL BE CONTACTED TO VERIFY THE EXISTENCE AND POSITION OF ALL SERVICES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION OR EXCAVATION. D) CONTOURS ARE INDICATIVE OF SURFACE TOPOGRAPHY ONLY. SURVEYED SPOT LEVELS ARE THE ONLY VALUES TO BE RELIED ON FOR REDUCED LEVELS ON PARTICULAR FEATURES.		SYMBOLS & ABBREVIATIONS: <table><tr><td></td><td>GP</td><td>GULLY PIT</td><td></td><td>-E-</td><td>OVERHEAD ELEC LINE</td></tr><tr><td></td><td>HYD</td><td>HYDRANT</td><td></td><td>-S-</td><td>SEWER LINE</td></tr><tr><td></td><td>SIP</td><td>SURFACE INLET PIT</td><td></td><td>GM</td><td>GAS METER</td></tr><tr><td></td><td>SIC</td><td>SEWER INSPECTION COVER</td><td></td><td>LP</td><td>LIGHT POLE</td></tr><tr><td></td><td>SMH</td><td>SEWER MANHOLE</td><td></td><td>EC</td><td>ELECTRICITY CONDUIT</td></tr><tr><td></td><td>W/M</td><td>WATER METER</td><td></td><td>ECT</td><td>ELEC & TELE CONDUIT</td></tr><tr><td></td><td>EL</td><td>ELECTRICITY BOX</td><td></td><td>TC</td><td>TELECOM CONDUIT</td></tr><tr><td></td><td>TP</td><td>TELECOMMUNICATIONS PIT</td><td></td><td>WC</td><td>WATER CONDUIT</td></tr><tr><td></td><td>VC</td><td>VEHICLE CROSSING</td><td></td><td>INV</td><td>INVERT</td></tr><tr><td></td><td>SV</td><td>STOP VALVE</td><td></td><td>KO</td><td>KERB OUTLET</td></tr><tr><td></td><td>SWMH</td><td>STORMWATER MANHOLE</td><td></td><td>TK</td><td>TOP OF KERB</td></tr></table>			GP	GULLY PIT		-E-	OVERHEAD ELEC LINE		HYD	HYDRANT		-S-	SEWER LINE		SIP	SURFACE INLET PIT		GM	GAS METER		SIC	SEWER INSPECTION COVER		LP	LIGHT POLE		SMH	SEWER MANHOLE		EC	ELECTRICITY CONDUIT		W/M	WATER METER		ECT	ELEC & TELE CONDUIT		EL	ELECTRICITY BOX		TC	TELECOM CONDUIT		TP	TELECOMMUNICATIONS PIT		WC	WATER CONDUIT		VC	VEHICLE CROSSING		INV	INVERT		SV	STOP VALVE		KO	KERB OUTLET		SWMH	STORMWATER MANHOLE		TK	TOP OF KERB	ASPECT DEVELOPMENT & SURVEY PTY LTD CONSULTING REGISTERED SURVEYORS ABN 60 078 649 000 SUITE 1 103 VANESSA STREET KINGSGROVE NSW 2208 PHONE (02) 9554 8388 FAX (02) 9554 8588 PO BOX 161 KINGSGROVE NSW 1480 DX 11392 HURSTVILLE		PROJECT OUR REFERENCE 6/1038845/216964 LOT 1115 DP 2475 SECTION DATUM AHD SOURCE SCIMS 22/03/17 ORIGIN OF LEVELS PM 44229 REDUCED LEVEL 74.951 SURVEYED AC DATE 25/03/2017 DRAWN NP DATE 29/03/2017 SCALE 1: 600 A3 SHEET		CLIENT: GMARCHITECTS REF: REF: ADDRESS: 185 FIFTH AVENUE SUBURB AUSTRAL	
	GP	GULLY PIT		-E-	OVERHEAD ELEC LINE																																																																								
	HYD	HYDRANT		-S-	SEWER LINE																																																																								
	SIP	SURFACE INLET PIT		GM	GAS METER																																																																								
	SIC	SEWER INSPECTION COVER		LP	LIGHT POLE																																																																								
	SMH	SEWER MANHOLE		EC	ELECTRICITY CONDUIT																																																																								
	W/M	WATER METER		ECT	ELEC & TELE CONDUIT																																																																								
	EL	ELECTRICITY BOX		TC	TELECOM CONDUIT																																																																								
	TP	TELECOMMUNICATIONS PIT		WC	WATER CONDUIT																																																																								
	VC	VEHICLE CROSSING		INV	INVERT																																																																								
	SV	STOP VALVE		KO	KERB OUTLET																																																																								
	SWMH	STORMWATER MANHOLE		TK	TOP OF KERB																																																																								

NORTH



DP 2475

LOT 1065

LOT 1114

LOT 1064

LOT 1063

LOT 1116

ALL TREE HEIGHTS AND SPREAD ARE APPROXIMATE ONLY AND ARE SHOWN FOR TENDER PURPOSES ONLY.
ALL TREE RELATED ISSUES TO BE REFERRED TO AN ARBORIST

NOTE: POSITION OF SEWER MAIN NOT YET AVAILABLE. REFER TO SYDNEY WATER DIAGRAM DATED 22/03/2017

HOW TO PROTECT SURVEY MARKS
BEFORE WORKS COMMENCE
The locality sketch plan (Survey Mark Sketches) should be downloaded from the LPI online Shop
Find out if there are survey marks located in the area of interest by
1. Viewing the survey mark layer in the Spatial Information Exchange 'Six Life' web page www.six.nsw.gov.au
2. Contacting Survey Services, LPI, 1300 052 637 who will advise the location and status of survey marks in the area
3. Inspecting the site, paying particular attention to survey marks
PROTECT SURVEY MARKS BEFORE COMMENCE WORKS

IF SURVEY MARKS ARE IN THE AREA
The locality sketch plan (Survey Mark Sketches) should be downloaded from the LPI online Shop
<http://shop.lands.nsw.gov.au> see Specialised Searches

IF SURVEY MARKS ARE LIKELY TO BE DISTURBED OR DESTROYED
Avoid disturbing or destroying survey marks by
1. Diverting works to avoid disturbing the marks or
2. Contacting a Registered Surveyor to place and survey a mark at a more suitable site nearby to maintain survey integrity
Any survey necessary to recover the position of survey marks proposed to be destroyed may only be undertaken by a surveyor registered under the Surveying and Spatial Information Act 2002 or by survey staff authorised by the Surveyor General.

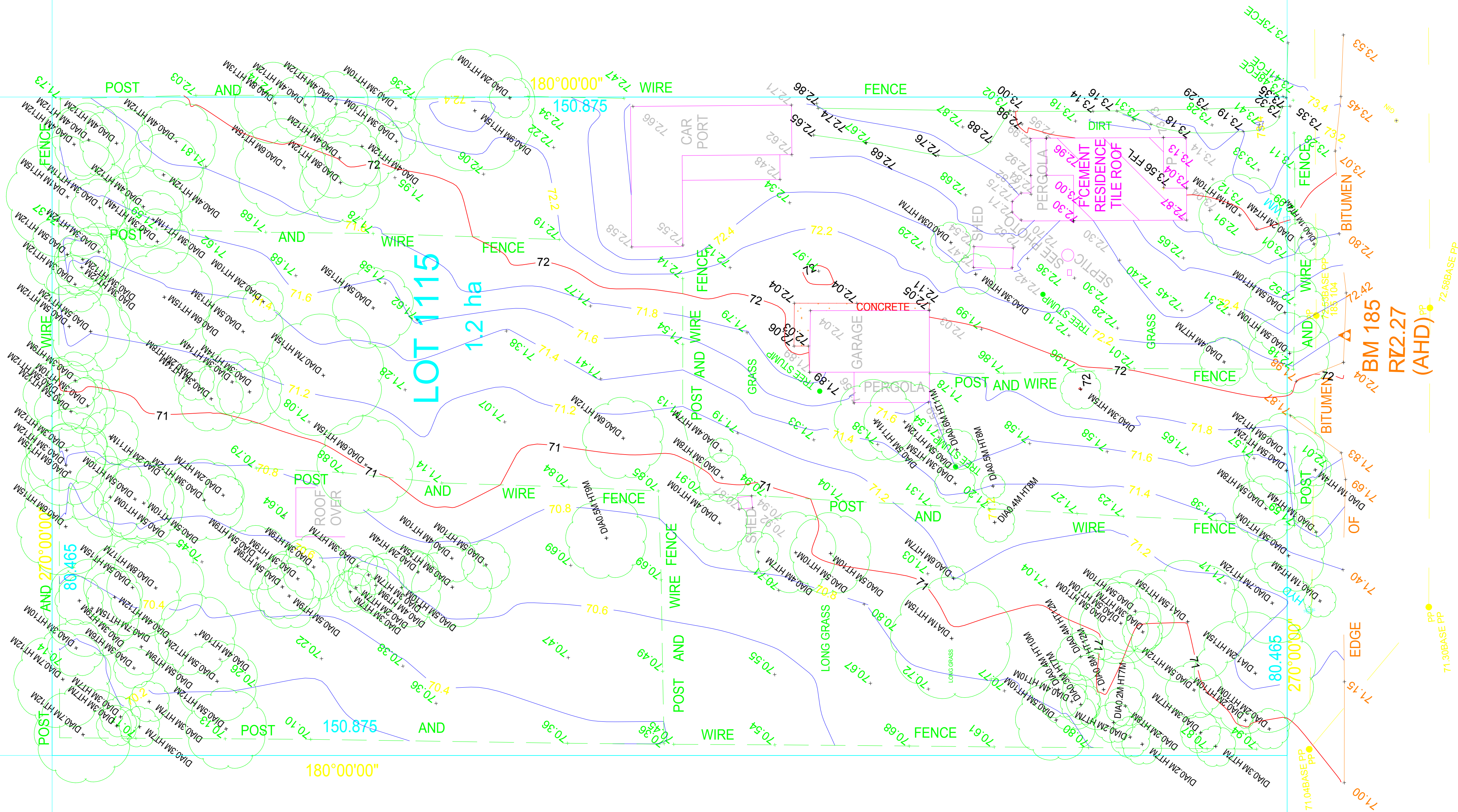
REPORT SURVEY MARKS AT RISK OF BEING DESTROYED
Look for the Survey Mark Status report at
http://scims.lpi.nsw.gov.au/status/report_frames.htm



THE BOUNDARY POSITION IS APPROXIMATE ONLY AND SHOULD BE VERIFIED PRIOR TO ANY CONSTRUCTION WORKS.

LOCALITY SKETCH

UBD AREA: SYD
MAP: 266
GPS
REVISION: 53
REF: D15



FIFTH AVENUE

COPYRIGHT

COPYRIGHT OF THIS PLAN AND IN THE ACCOMPANYING CAD FILE(S) WHERE APPLICABLE VESTS WITH ASPECT DEVELOPMENT & SURVEY PTY LTD.

THE PLAN AND CAD FILE SHALL ONLY BE USED BY THE ADDRESSED CLIENT FOR THE PURPOSE FOR WHICH THE SURVEY WAS CARRIED OUT.

GENERAL NOTES

- A) THIS SURVEY IS SPECIFICALLY FOR CONTOUR PURPOSES ONLY. THE BOUNDARIES OF THE SUBJECT PROPERTY HAVE NOT BEEN INVESTIGATED AND THE POSITION SHOWN IS APPROXIMATE ONLY
B) AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY
C) SERVICES SHOWN HAVE BEEN DERIVED FROM VISUAL EVIDENCE APPARENT AT THE TIME OF SURVEY. THE RELEVANT SERVICE AUTHORITY SHALL BE CONTACTED TO VERIFY THE EXISTENCE AND POSITION OF ALL SERVICES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION OR EXCAVATION
D) CONTOURS ARE INDICATIVE OF SURFACE TOPOGRAPHY ONLY. SURVEYED SPOT LEVELS ARE THE ONLY VALUES TO BE RELIED ON FOR REDUCED LEVELS ON PARTICULAR FEATURES.

SYMBOLS & ABBREVIATIONS:

GP	GULLY PIT	E-1	OVERHEAD ELEC LINE
HYD	HYDRANT	S-	SEWER LINE
SIP	SURFACE INLET PIT	GM	GAS METER
SIC	SEWER INSPECTION COVER	LP	LIGHT POLE
SMH	SEWER MANHOLE	EC	ELECTRICITY CONDUIT
W/M	WATER METER	ETC	ELECTRIC & TELE CONDUIT
EL	ELECTRICITY BOX	TC	TELECOM CONDUIT
TP	TELECOMMUNICATIONS PIT	WC	WATER CONDUIT
VC	VEHICLE CROSSING	INV	INVERT
SV	STOP VALVE	KO	KERB OUTLET
SWMH	STORMWATER MANHOLE	TK	TOP OF KERB

ASPECT DEVELOPMENT & SURVEY PTY LTD CONSULTING REGISTERED SURVEYORS

ABN 60 078 649 000

SUITE 1
103 VANESSA STREET
KINGSGROVE NSW 2208
PHONE (02) 9554 8388
FAX (02) 9554 8588

PO BOX 161
KINGSGROVE NSW 1480
DX 11392
HURSTVILLE

PROJECT

OUR REFERENCE 6/1038845/216964

LOT 1115 DP 2475 SECTION

DATUM AHD SOURCE SCIMS 22/03/17

ORIGIN OF LEVELS PM 44229 REDUCED LEVEL 74.951

SURVEYED AC DATE 25/03/2017

DRAWN NP DATE 29/03/2017

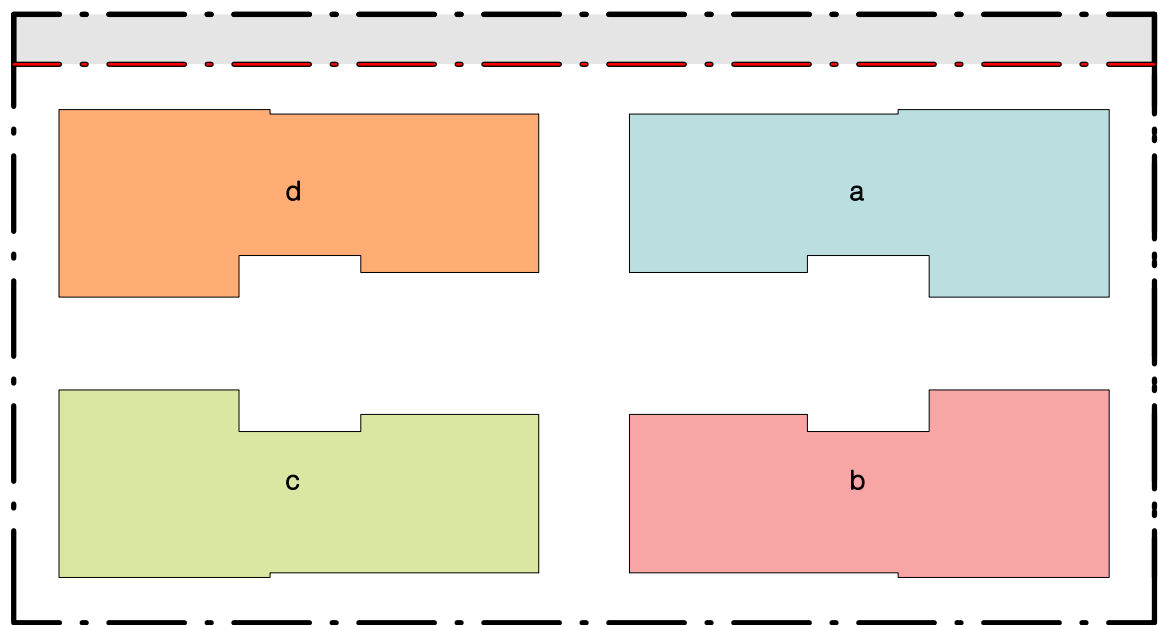
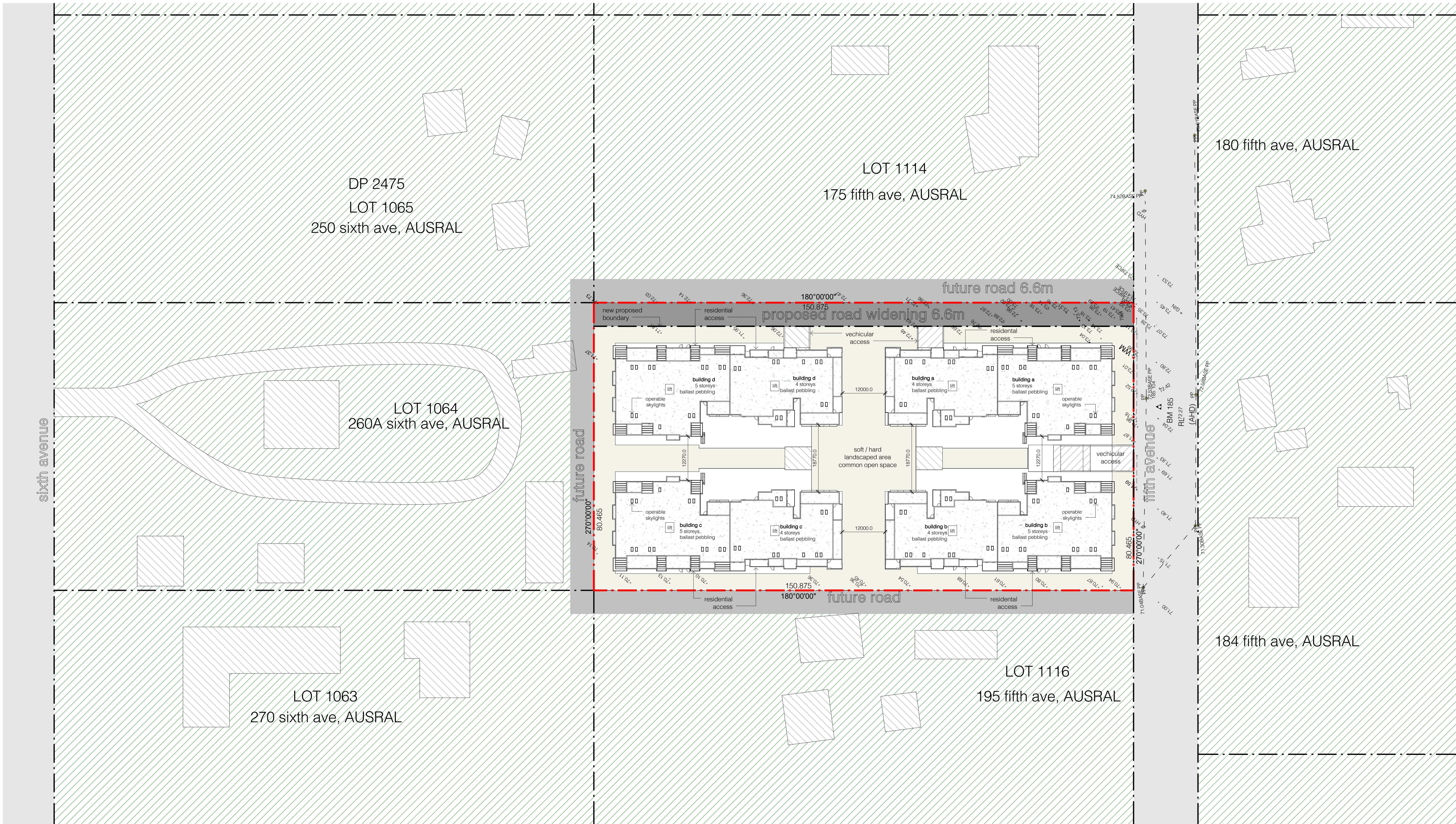
SCALE 1: 600 A3 SHEET

CLIENT: GMARCHITECTS

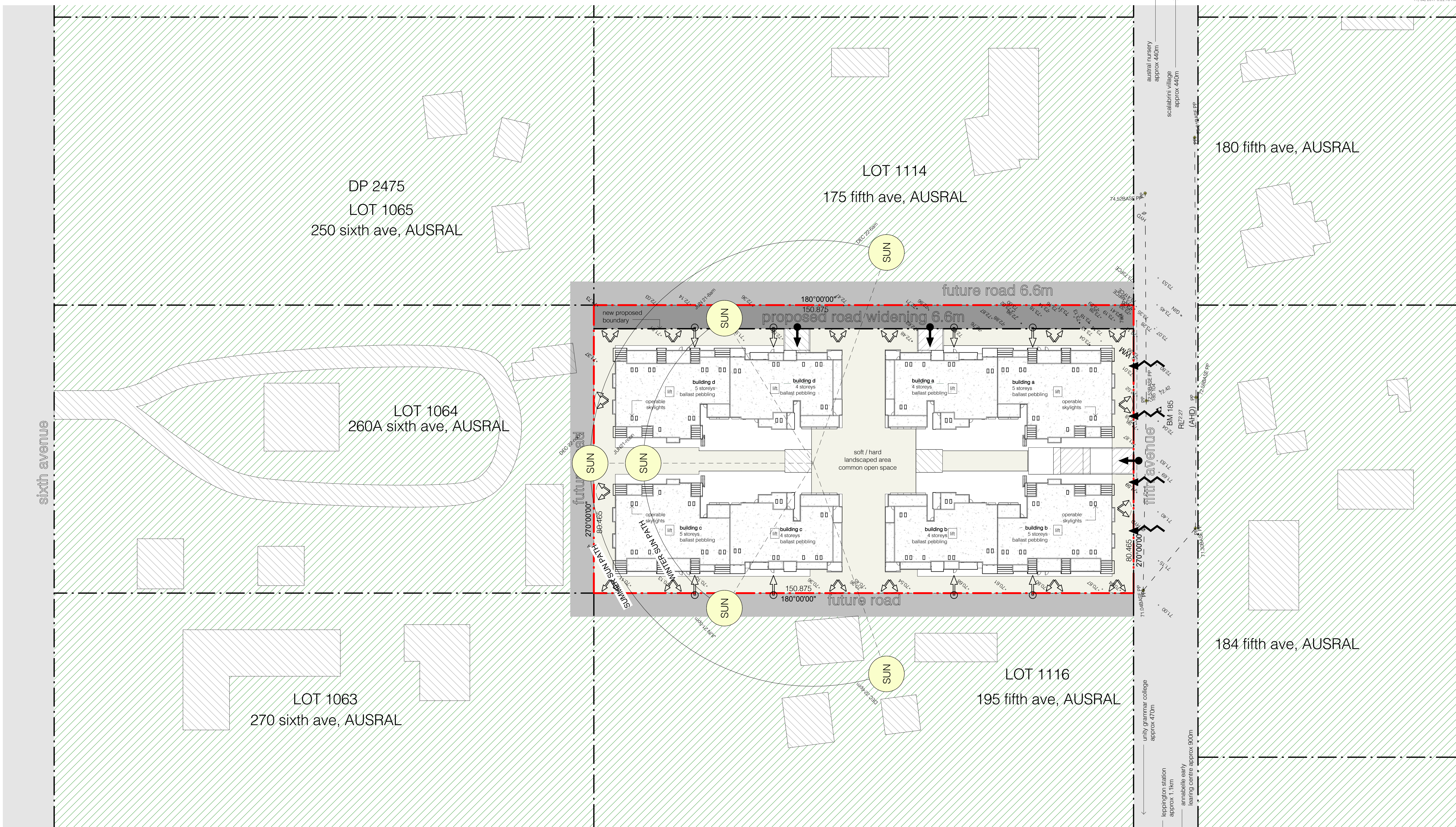
REF:

REF:

ADDRESS: 185 FIFTH AVENUE
SUBURB AUSTRAL



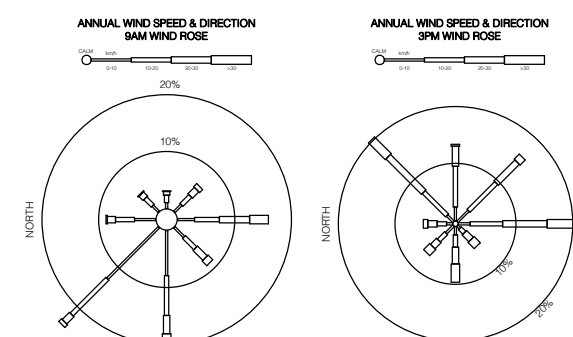
building key
1:1000



legend

- proposed vehicular access point
- site boundary
- noise source
- proposed pedestrian access point
- key views

site analysis

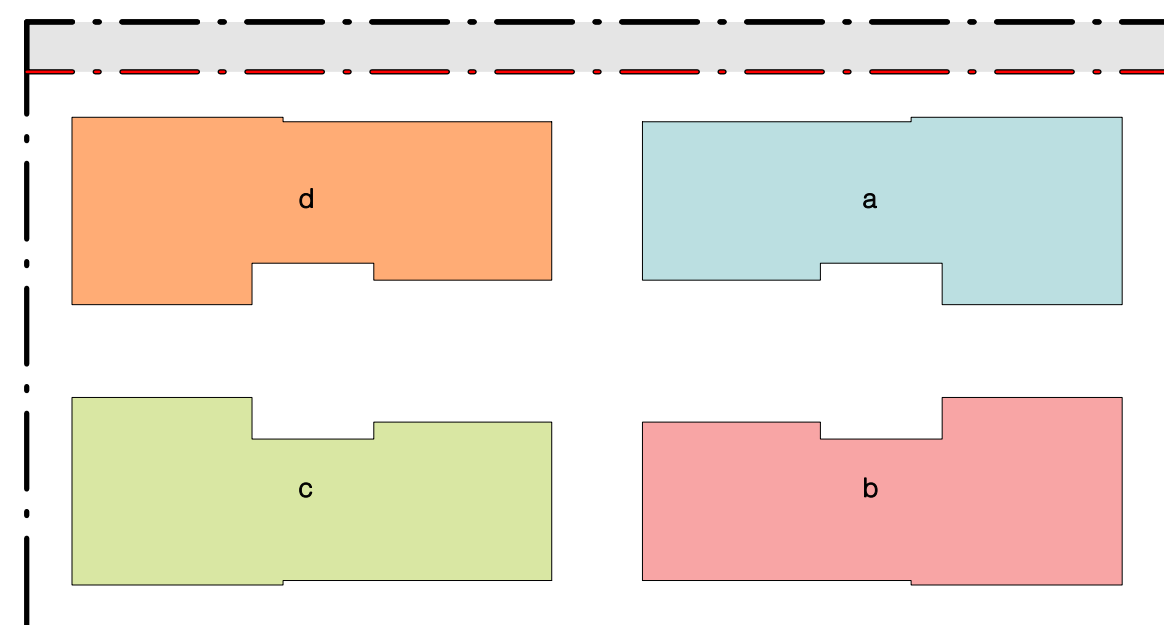


future road

future road 6.6m
proposed road widening 6.6m

fifth avenue

future road

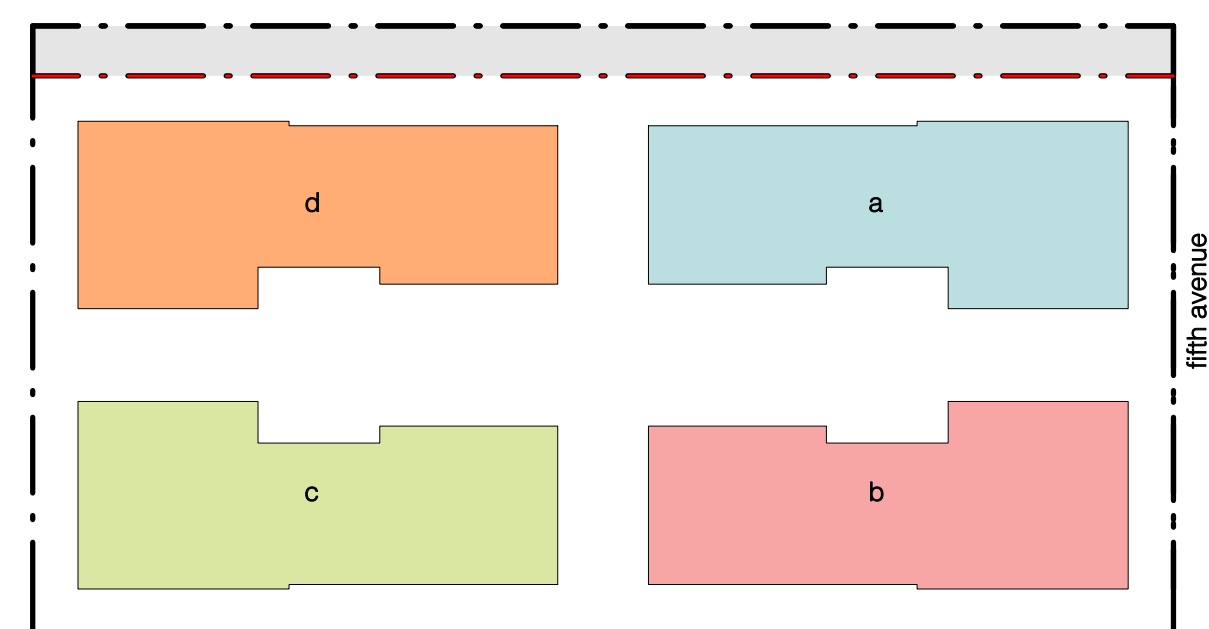
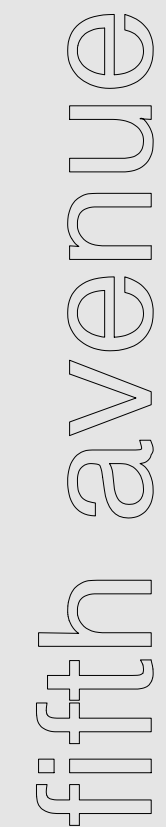


building key
1:1000

basement 1
185 fifth avenue, austral
residential apartments + basements
development application
gm architects
3/30a parkside rd, homebush west NSW 2140
info@gmarchitects.com.au

α200

Issue	Date	Description
1	11/04/2017	Issue for development application



DP 2475
LOT 1065

LOT 1114

future road 6.6m

proposed road widening 6.6m

future road
LOT 1064

270°00'00"

80.465

LOT 1063

ground floor plan
1:200

future road

LOT 1116

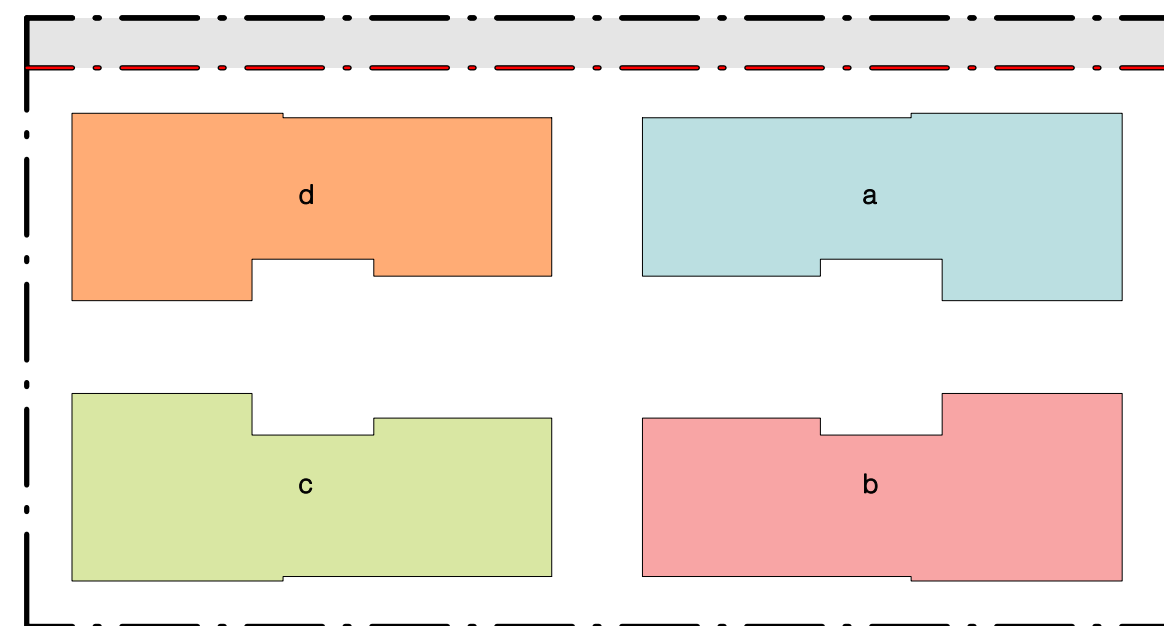
PP 72.53BASE PP
185.104

fifth avenue

80.465

270°00'00"

PP 71.04BASE PP



ground floor

building key
1:1,000

- b1 - bedroom 1
- b2 - bedroom 2
- b3 - bedroom 3
- liv - living room
- din - dining
- kit - kitchen
- bath - bath
- st - storage
- ens - ensuite
- wir - walk-in-robe
- ldy - laundry

σ202

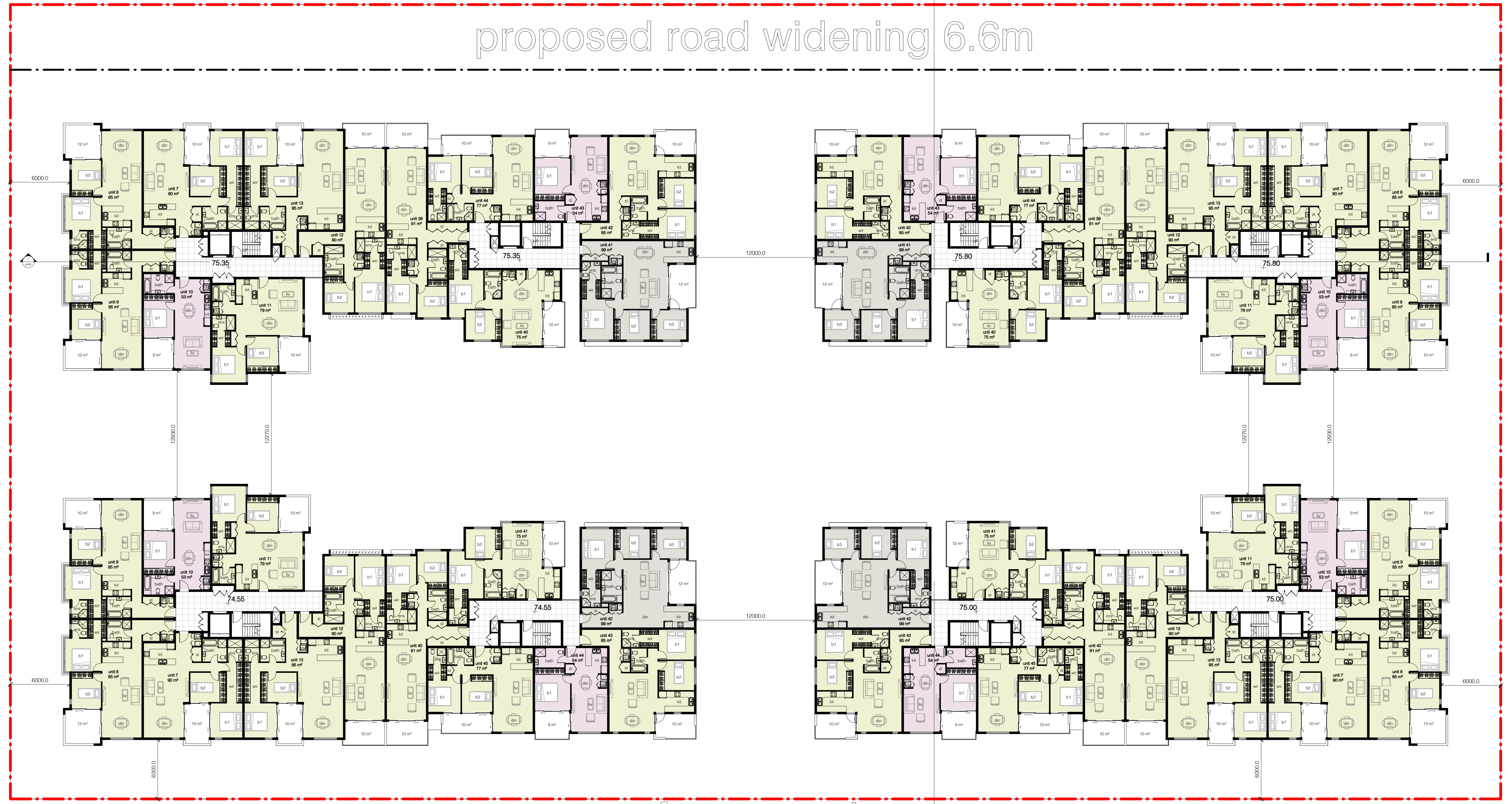
future road

future road 6.6m

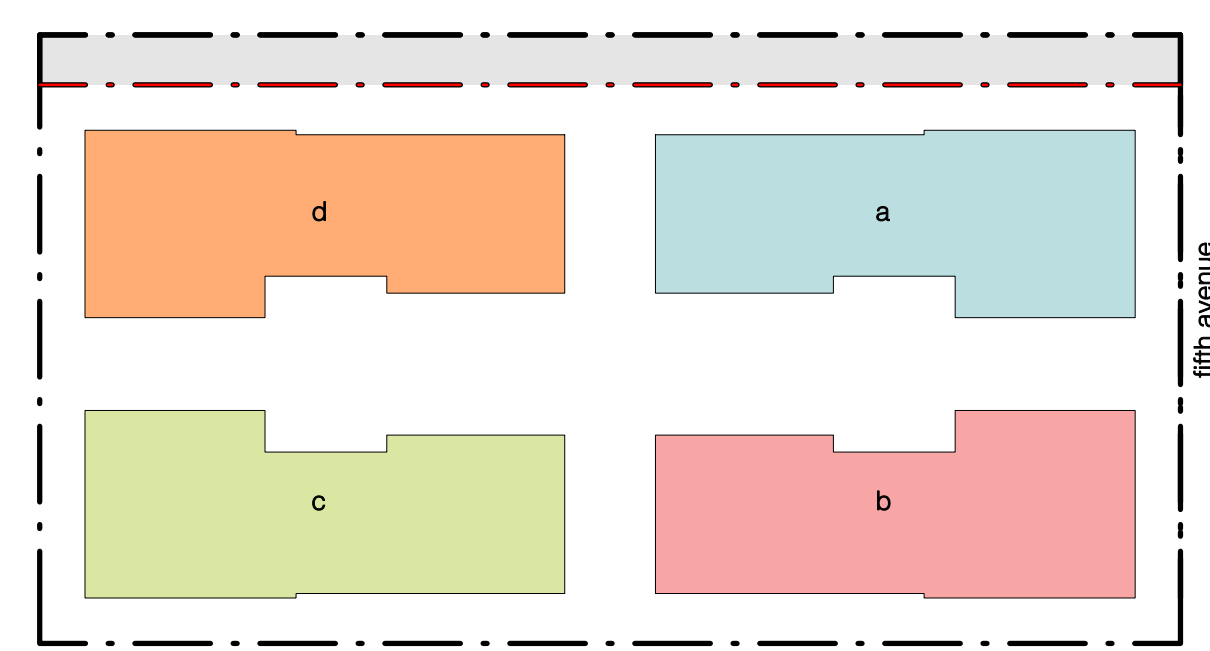
proposed road widening 6.6m

fifth avenue

future road



level 1 plan
1: 200



level 1
building key
1: 100

- b1 - bedroom 1
 - b2 - bedroom 2
 - b3 - bedroom 3
 - liv - living room
 - din - dining
 - kit - kitchen
 - bath - bath
 - st - storage
 - ens - ensuite
 - wlr - walk-in-robe
 - ldy - laundry
- σ203

level 1
185 fifth avenue, austral
residential apartments + basements
development application
gm architects
3/30a perambula rd, homebush west NSW 2140
info@gmarchitects.com.au

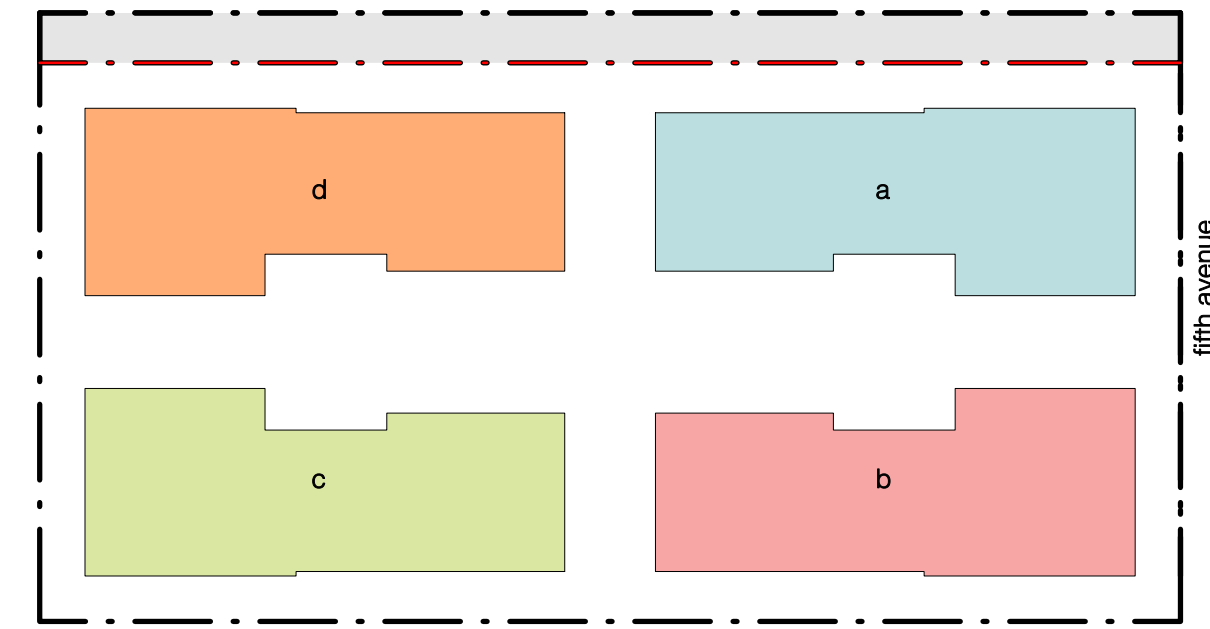
gm
9797 1599
n.raiser 9457

future road

future road 6.6m
proposed road widening 6.6m

fifth avenue

future road



- b1 - bedroom 1
- b2 - bedroom 2
- b3 - bedroom 3
- liv - living room
- din - dining
- kit - kitchen
- bath - bath
- st - storage
- ens - ensuite
- wir - walk-in-robe
- ldy - laundry

σ204

level 2

building key
1:1000

level 2
185 fifth avenue, austral

residential apartments + townhouses
development application
gm architects
3/30a parkside rd, homebush west NSW 2140
info@gmarchitects.com.au

gm
architects
9797 1599
n.raiser 9457

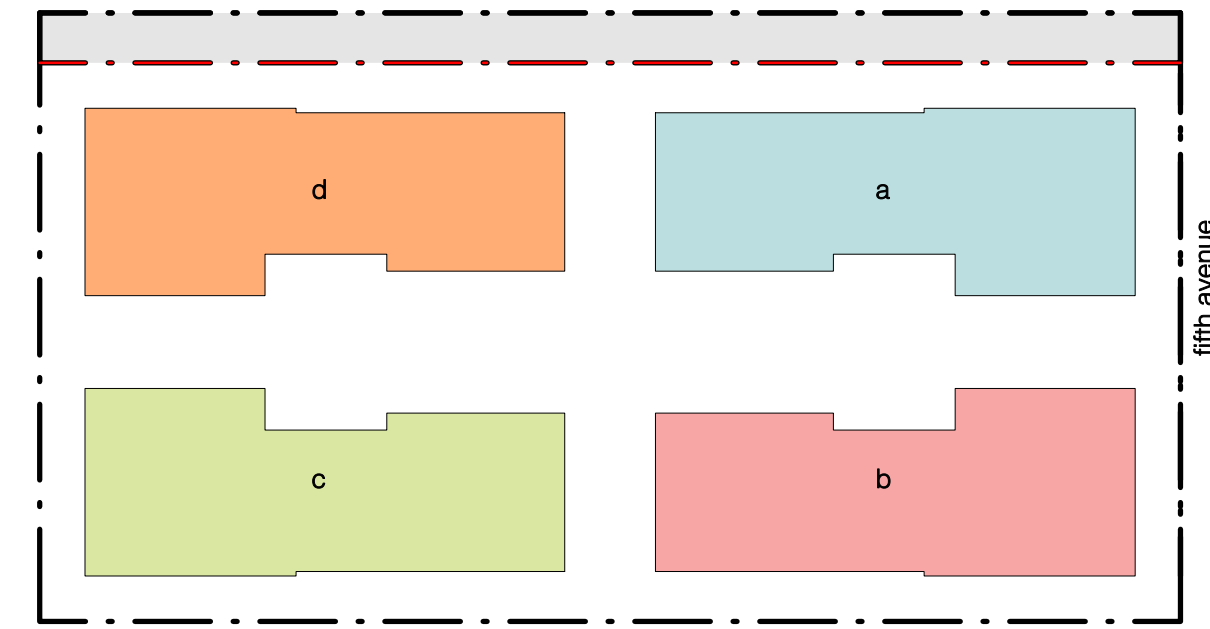
Date	Description

future road

future road 6.6m
proposed road widening 6.6m

fifth avenue

future road



level 3

building key
1:1000

- b1 - bedroom 1
 - b2 - bedroom 2
 - b3 - bedroom 3
 - liv - living room
 - din - dining
 - kit - kitchen
 - bath - bath
 - st - storage
 - ens - ensuite
 - wlr - walk-in-robe
 - ldy - laundry
- σ205

level 3
185 fifth avenue, austral

residential apartments + basements
development application
gm architects
330a parramatta rd, homebush west NSW 2140
info@gmarchitects.com.au

gm
architects
9797 1599
n.raiser 9457

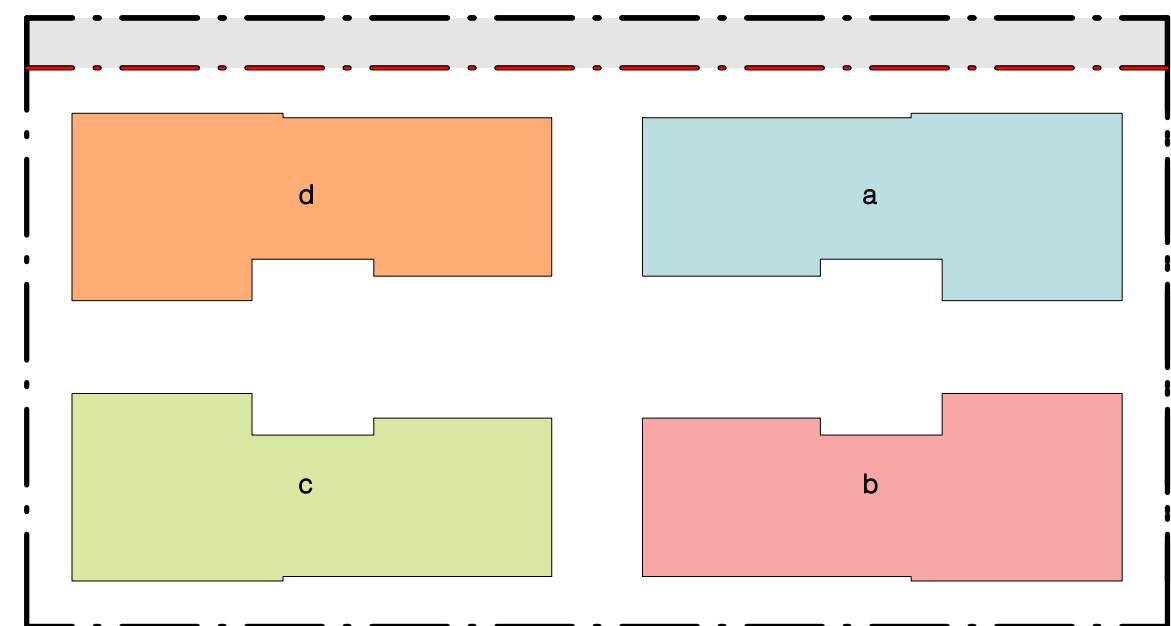
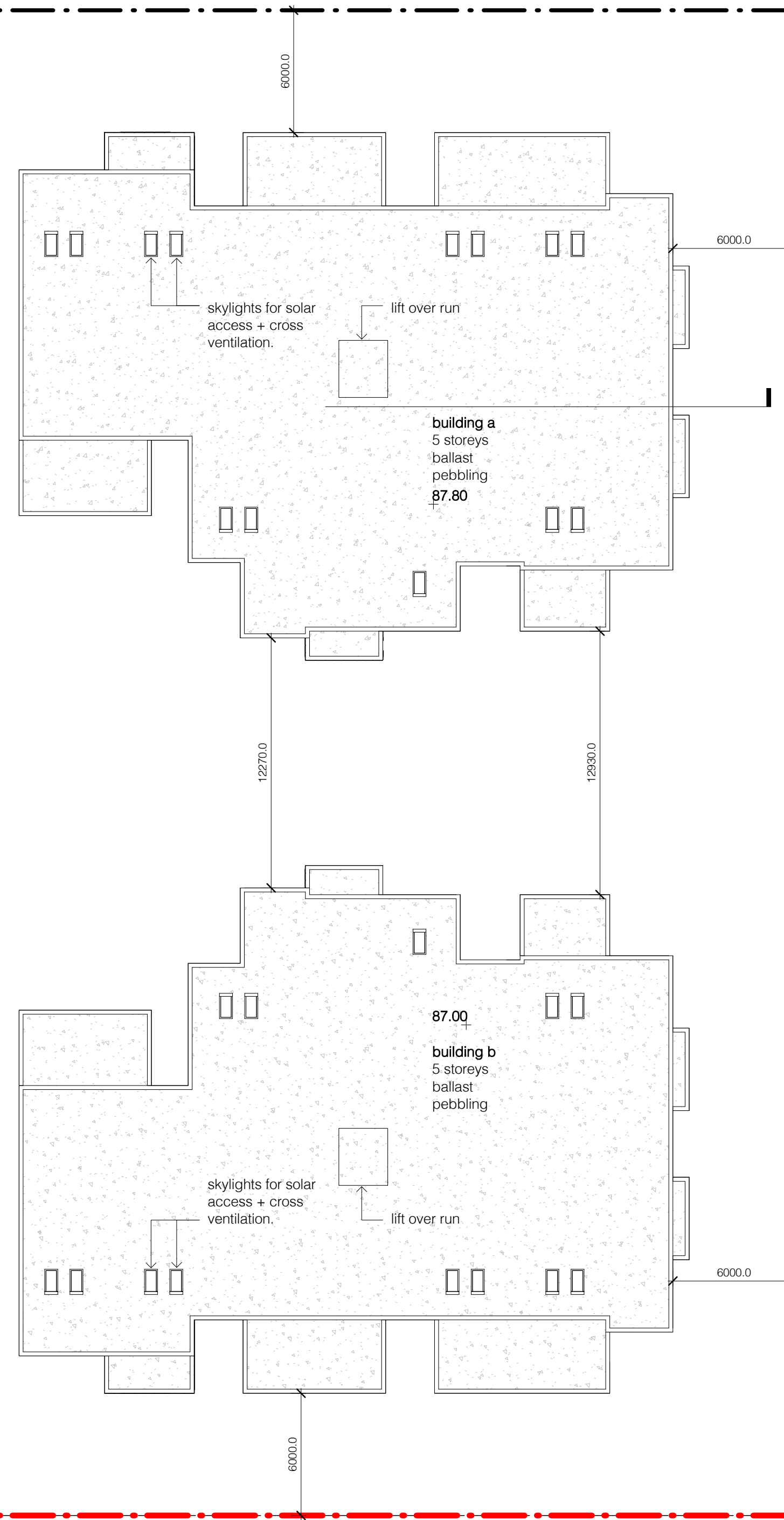
future road

proposed road widening 6.6m

future road 6.6m

fifth avenue

future road



- b1 - bedroom 1
- b2 - bedroom 2
- b3 - bedroom 3
- liv - living room
- din - dining
- kit - kitchen
- bath - bath
- st - storage
- ens - ensuite
- wir - walk-in-robe
- ldy - laundry

α207



Item	Date	Description



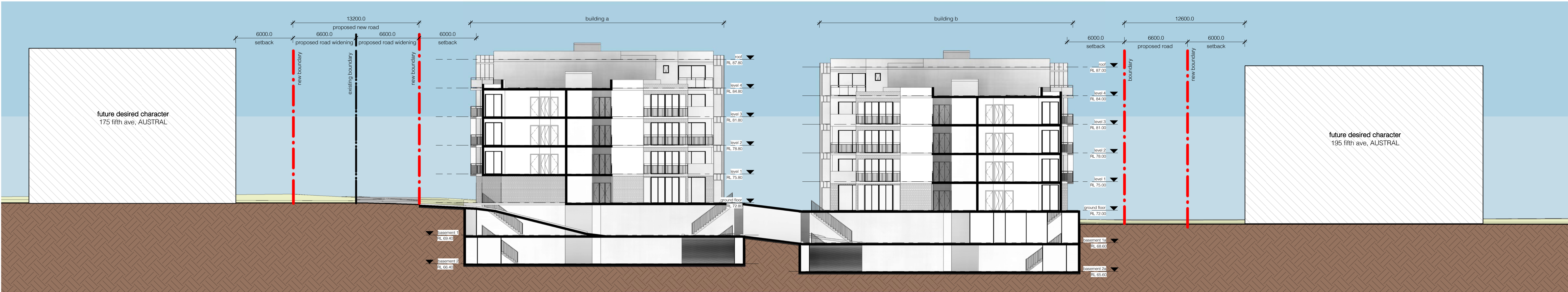
west elevation
1:200



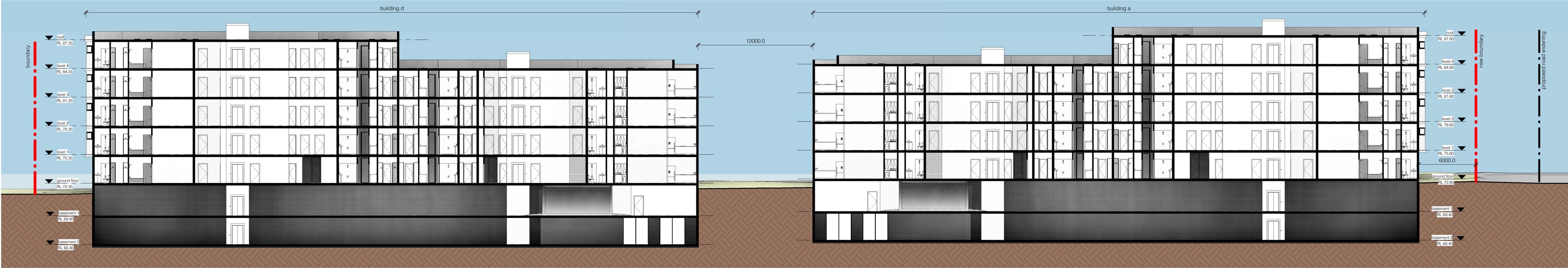
typical internal elevation 1
1:200



typical internal elevation 2
1:200



section a-a
1:200



section b-b
1:200

- b1 - bedroom 1
- b2 - bedroom 2
- b3 - bedroom 3
- liv - living room
- din - dining
- kit - kitchen
- bath - bath
- st - storage
- ens - ensuite
- wir - walk-in-robe
- ldy - laundry

α400

sections
185 fifth avenue, austral

residential apartments + basements
development application

gm architects
330a perambula rd, homebush west NSW 2140
info@gmarchitects.com.au

gm
architect
n.raiser 9457

Title	Date	Description

proposed road widening 6.6m

Sixth Ave

Fifth Avenue

Fifth Ave

Service

SJ Austral Farm Tyres

gm architects
330a paramatta rd, homebush west NSW 2140
info@gmarchitects.com.au 9797 1599



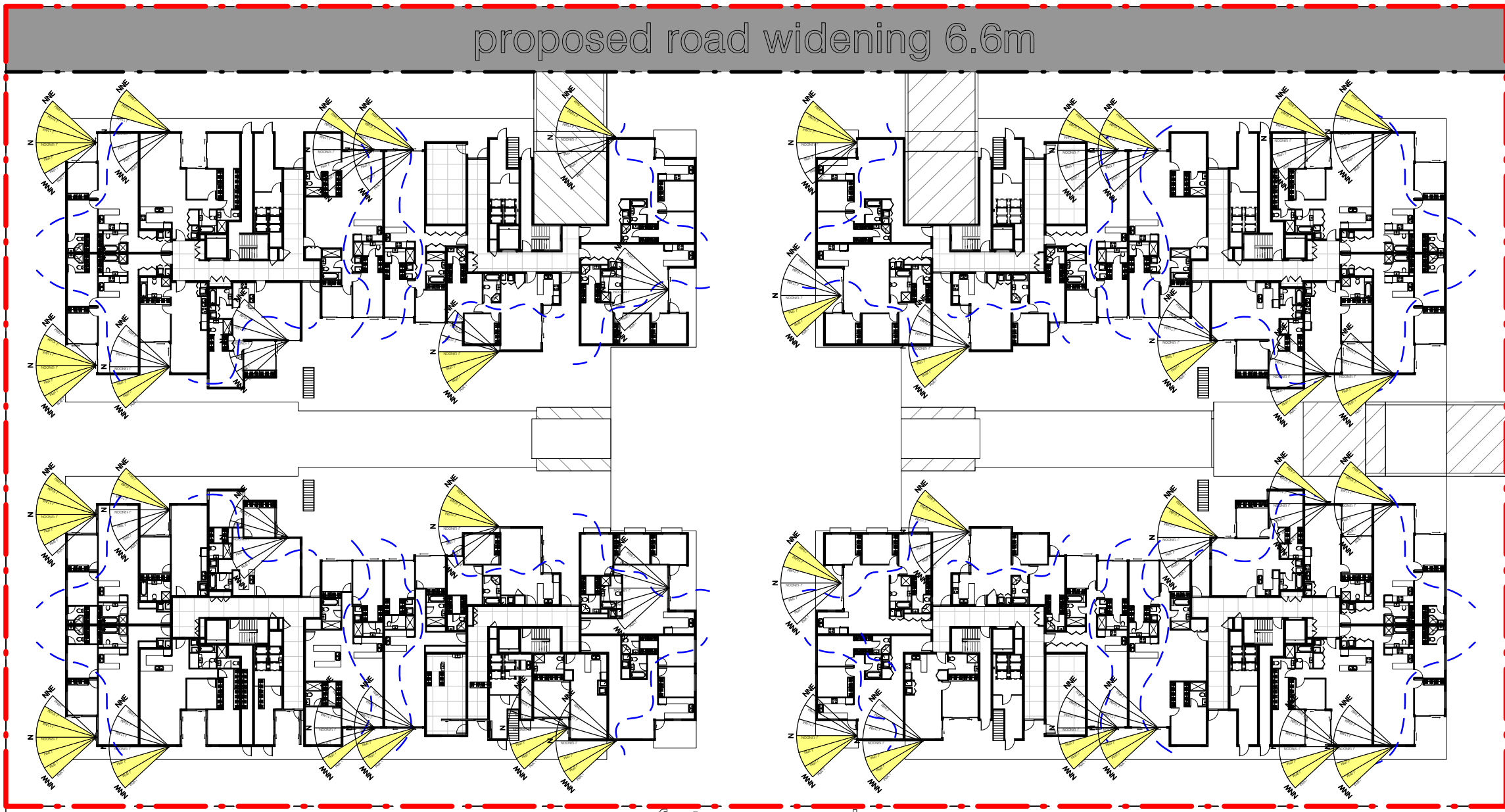
shadow diagrams - 21st june 1pm
1:1000



shadow diagrams - 21st june 2pm
1:1000



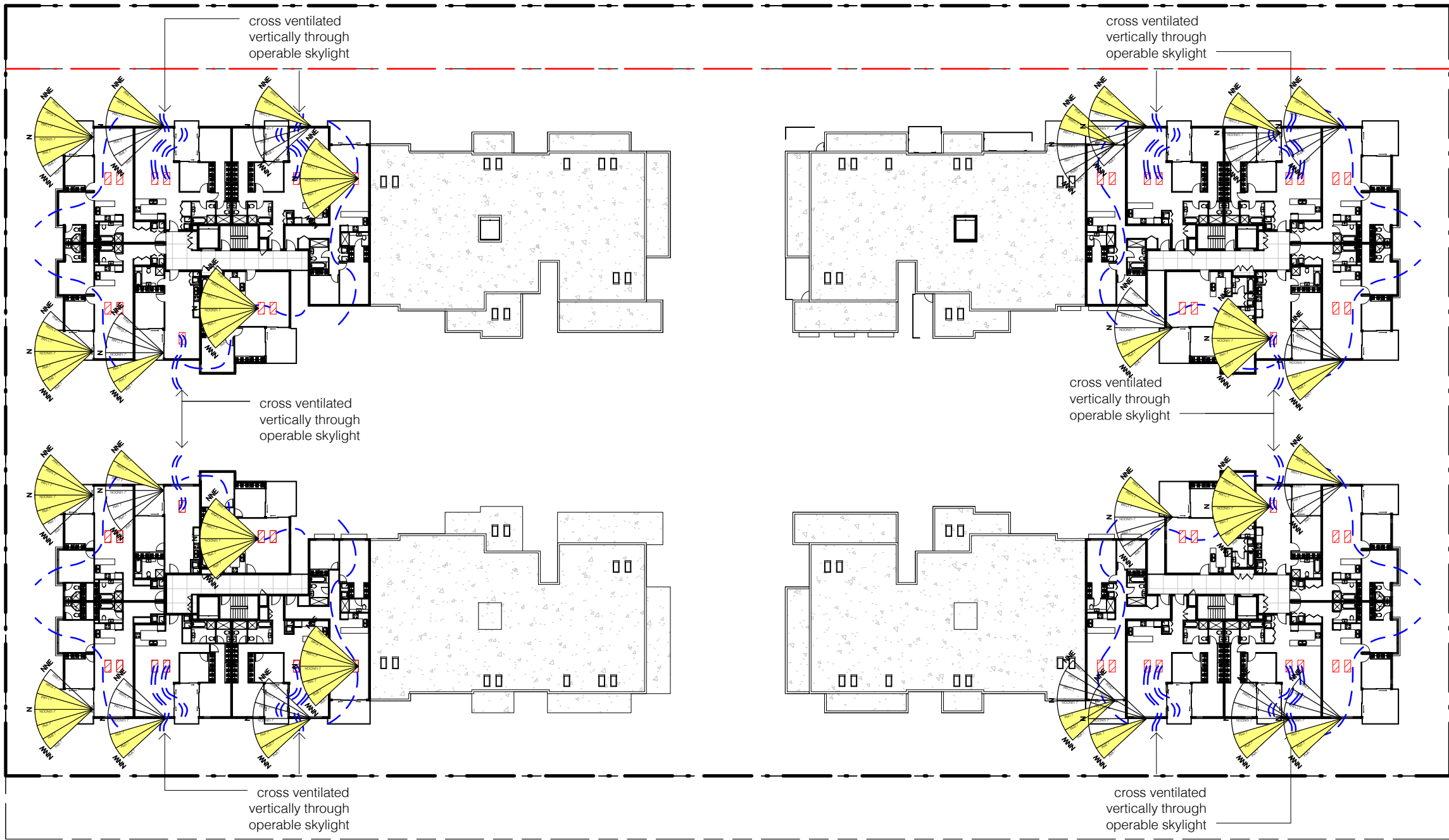
shadow diagrams - 21st june 3pm
1:1000



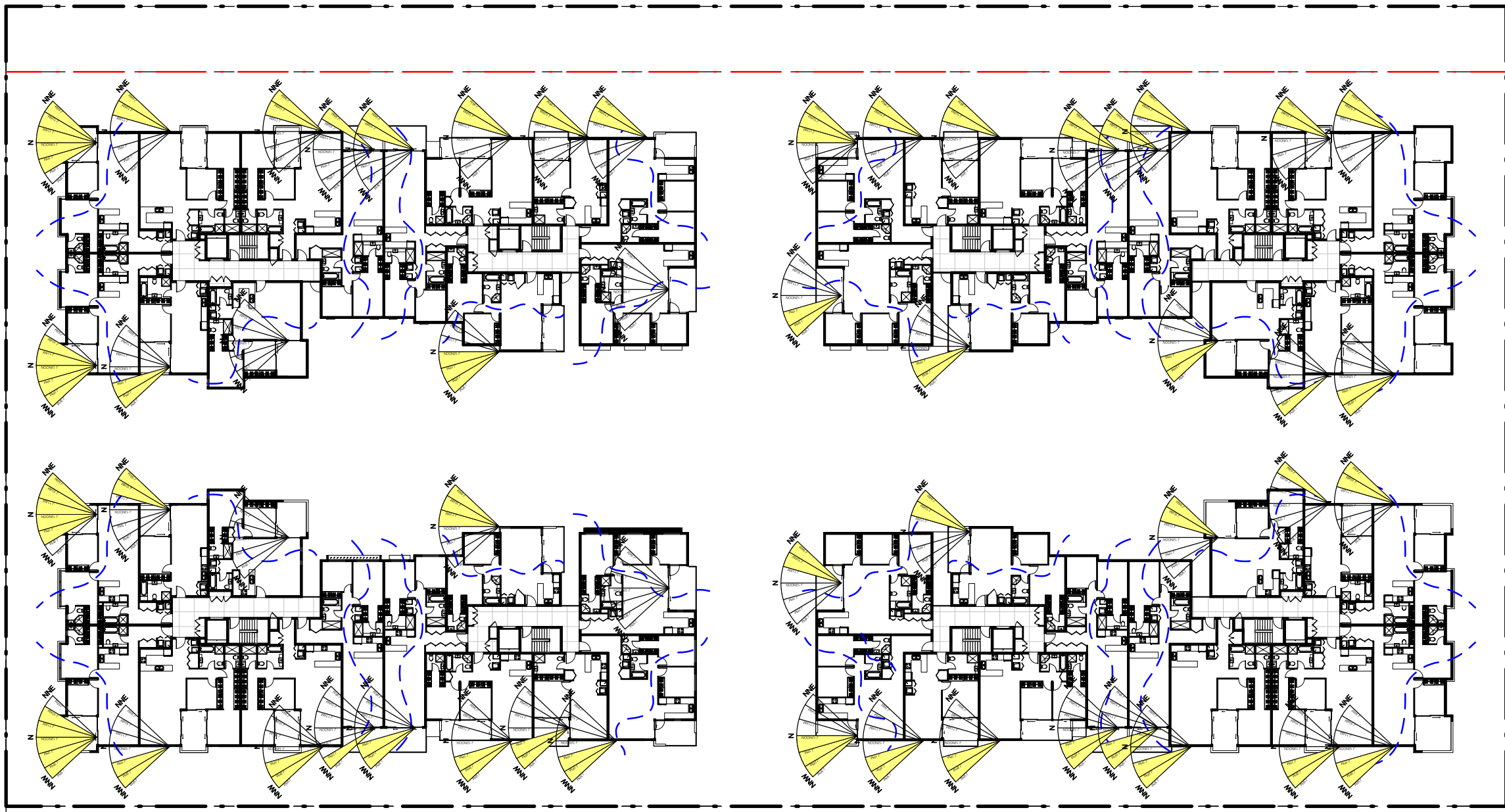
ground floor (solar + cross ventilation)
1:500



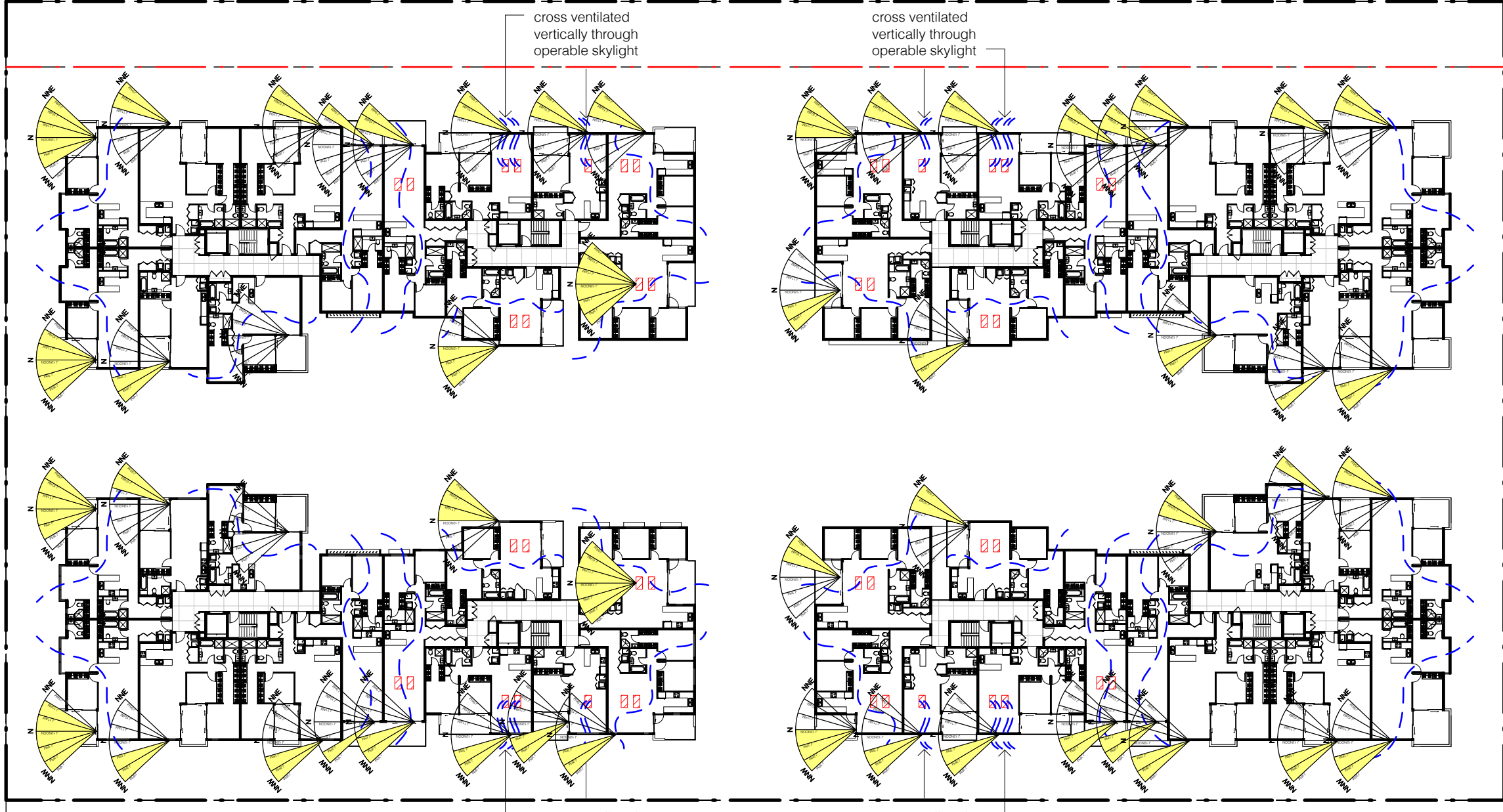
level 2 (solar + cross ventilation)
1:500



level 4 (solar + cross ventilation)
1:500



level 1 (solar + cross ventilation)
1:500



level 3 (solar + cross ventilation)
1:500

fifth avenue

fifth avenue

fifth avenue

fifth avenue

fifth avenue

solar + cross ventilation
185 fifth avenue, austin

residential apartments + basements
development application
gm architects
330a perambula rd, homebush west NSW 2140
info@gmarchitects.com.au

0600

gm architects
185 fifth avenue, austin
residential apartments + basements
development application
gm architects
330a perambula rd, homebush west NSW 2140
info@gmarchitects.com.au

Task	Date	Description

gm

