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**REMEDIATION ACTION PLAN**

**Property Address**

921 Punchbowl Road, Punchbowl NSW

**Prepared for**

Waldron Hill Projects Pty Ltd

**Date**

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**ABBREVIATIONS**

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

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## **1.0 INTRODUCTION**

Benviron Group (Benviron) was appointed by Waldron Hill Projects Pty Ltd, to prepare a Remediation Action Plan (RAP) for the property located at 921 Punchbowl Road, Punchbowl NSW ("the site"). The site is proposed to be redeveloped into a new facility for use as a registered club with; shops, retail, office & business on the ground floor; basement and at grade car parking, new residential unit towers in current car park area and residential units above the new registered club, new internal roads, landscaping & drainage works.

One previous report was identified at the time of writing this report and is listed below:

- Benviron Group (2016), "Detailed Site Investigation", 921 Punchbowl Road, Punchbowl NSW, Ref: E881, dated September 2016.

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.
- Provide an outline of the additional investigations (if required) to be carried out in order to address the recommendations identified in the previous

- investigation;
- 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	921 Punchbowl Road, Punchbowl NSW	
Lot/DP	Lot A in DP378634, Lot D in DP382627, Lot 6 in DP5245 Lot 14 & 15 in DP132440 & Lot 1 in DP236825	
County	Cumberland	
Nearest Survey Marker	SS86630 (17m south east of the site)	
Site Area #	1.770 hectares	
Local Government Area (LGA)	Canterbury Bankstown Council	
Current Zoning ##	Lot A in DP378634 – R2 Low Density residential Lot D in DP382627 – R2 Low Density Residential Lot 6 in DP5245 – R2 Low Density Residential Lot 14 & 15 in DP132440 – B1 Neighbourhood Centre Lot 1 in DP236825 – B1 Neighbourhood Centre	
Surrounding Land Uses	<i>North</i>	Residential properties.
	<i>South</i>	Canterbury Road then commercial & residential properties.
	<i>East</i>	Punchbowl Road then commercial (service station) & residential properties.
	<i>West</i>	Commercial and residential properties.

Notes: # refer to <http://maps.six.nsw.gov.au/>

## refer to Bankstown City Council Zoning Map published in  
<http://gispublicviewer.bankstown.nsw.gov.au/bccgis/RestPublicApplication.aspx>

### **3.2 Site description**

The site is located at 921 Punchbowl Road, Punchbowl NSW, in the Canterbury Bankstown Council municipality.

The site at 921 Punchbowl Road is irregular in shape and occupied by a two-storey brick commercial property surrounded by a large bitumen car park, concrete loading bay, garden beds and stormwater channel running through and beneath the site. The commercial property is utilised by the Croatian Club (RSL type venue).

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

### **3.3 Proposed development**

The site is proposed to be redeveloped into a new facility for use as a registered club with; shops, retail, office & business on the ground floor; basement and at grade car parking, new residential unit towers in current car park area and residential units above the new registered club, new internal roads, landscaping & drainage works.

Refer to **Appendix B - Proposed Development Plans**.

### **3.4 Local geology, hydrogeology, surface waters**

The borders the following two geological profiles:

- The Geological Map of Sydney (Geological Series Sheet 9130, Scale 1:100,000, 1983), published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Quaternary Age soils consisting of silty to peaty quartz sand, silt and clay. Ferruginous and humic cementation in places with common shell layers.
- The Geological Map of Sydney (Geological Series Sheet 9130, Scale 1:100,000, 1983), published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Triassic Age Shale of the Wianamatta Group, comprising black to dark grey shale and laminite.

The soil profile encountered during the DSI in 2016 is consistence with both geological profiles.

The nearest downgradient watercourse is a stormwater channel that is located beneath the site running through the central portion of the site in east west direction and along the western boundary in a north south direction. The stormwater channels appear to drain into Salt Pan Creek located approximately 531m south west of the site, which eventually discharges into the Georges River.

### **3.5 Previous environmental investigations**

One previous report was identified at the time of writing this report and is listed below:

- Benviron Group (2016), "Detailed Site Investigation", 921 Punchbowl Road, Punchbowl NSW, Ref: E881, dated September 2016.

### Benviron Group DSI September 2016

The investigation revealed the following areas of environmental concern:

- The chromium concentration within BH11 (SS2) is located in the fill layer to a depth of 0.3m BGL. Analysis of the deeper soil in BH11 (SS2) has not been completed at this location.
- The chromium concentration within BH19 is located in the fill layer to a depth of 0.3m BGL. Analysis of the deeper soil in BH19 has not been completed at this location.
- The chromium concentration within BH23 is located in the fill layer to a depth of 0.5m BGL. Analysis of the deeper soil in BH23 has not been completed at this location.
- The chromium concentration within BH24 is located in the fill layer to a depth of 0.5m BGL. Analysis of the deeper soil in BH24 has not been completed at this location.

The following data gaps were identified:

- The lateral and vertical extent of BH11, BH19, BH23 & BH24 is currently unknown and an appropriate remediation strategy should be devised as part of the remediation works to be carried out.
- The two storey Croatian Club building was in use at the time of the site investigation. No access was available to investigation the soil beneath the building. The approximate size of the building equates to 21% of the total site area or 3618m<sup>2</sup>. Sufficient samples were collected to satisfy the NSW EPA

Sampling Design Guidelines for a site of 1.770 hectares. However considering the size and age of the building further sampling beneath the building surface is recommended.

- Asbestos soil sampling (%w/w) is required to be completed once all buildings have been demolished.

Based on the results of the investigation, the abovementioned soil exceedance locations BH11, BH19, BH23 & BH24 requires remediation in order to render the site suitable for the proposed development, subject to the following:

- 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.
- An acid sulphate soils assessment is required to be completed once the proposed development plans have been finalised.
- 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).

### **3.6 Summary of Groundwater Findings**

The groundwater monitoring undertaken indicated no concerns with TRH, BTEXN, PAH, OC & PCB. Levels of dissolved cadmium, copper, nickel and zinc were detected above groundwater investigation levels. However, these excursions were considered to be background levels and therefore of limited concern.

## **4.0 CONCEPTUAL SITE MODEL - CURRENT**

### **4.1 Description of Chemicals of Concern, Sources, Pathways & Receptors**

#### **4.1.1 Chemicals of Concern**

##### Soils

The following chemicals of concern were identified in previous monitoring events and are outlined as follows:

- Chromium impacted hotspot at BH19, BH23, BH24 & SS2 (BH11).

##### Groundwater

The following chemicals of concern were identified in previous monitoring events and are outlined as follows:

- Levels of dissolved heavy metals were detected above groundwater investigation levels. However, these excursions were considered to be background levels and therefore of limited concern.

#### **4.1.2 Sources**

##### Soil

The most likely source of the contaminants of concern is the quality of the fill materials impacted from historical land use across the site.

#### **4.1.3 Pathways (Transport of COC)**

Potential exposure pathways include:

- Dermal;
- Ingestion; and
- Inhalation.

The potential for ingestion of soil is considered a negligible exposure pathway based on the proposed development which includes hard standing surfaces across the majority of the site.

The potential for ingestion of groundwater is considered as a potential exposure pathway. However, this risk is considered low as groundwater is not used at the site and will most likely rely on piped town water.

There is the potential for vapour to be present in the underlying profile within the site. As such, these gases potentially pose a risk to human health via the inhalation pathway.

#### **4.1.4 Receptors**

##### Human:

The site groundwater is not currently used for or planned to be used for drinking water as town water is provided by Sydney Water. Therefore, the exceedances of the drinking guideline are unlikely.

The most likely human receptor(s) would be persons exposed to groundwater extracted from a bore and used for non-domestic purposes such as for industrial, stock watering, recreation such as to fill household pools and water gardens, including watering of fruit and vegetables in private gardens.

The nearest downgradient watercourse is a stormwater channel that is located beneath the site running through the central portion of the site in east west direction and along the western boundary in a north south direction. The stormwater channels appear to drain into Salt Pan Creek located approximately 531m south west of the site, which eventually discharges into the Georges River.

##### Ecological

The ecological receptors would be surface water and benthic organisms in Salt Pan Creek.

#### **4.1.5 Potential for Migration**

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:



- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants identified as part of the site history review, site inspection and previous reports are present in solid (e.g. impacted fill, asbestos), liquid (e.g. dissolved in water) and gaseous/vapour forms.

The redevelopment works at site will create minimal unsealed ground surfaces and therefore, there is a low risk for migration of contaminants via wind-blown dust. Likewise, rainfall infiltration at the site is not expected due to the proposed sealed surfaces across the site based on the proposed development. The removal of the contaminated soil, will reduced the risk for any ongoing / future migration of soil contaminants.

Based on the historical uses, the site has the potential for possible migration of contaminants in liquid (on-off site migration) and gaseous form (ground gas / soil vapour).

#### **4.1.6 Preferential Pathways**

For the purpose of this assessment, preferential pathways have been identified as natural and/or man-made pathways that result in the preferential migration of COPCs as either liquids or gases.

Man-made preferential pathways are present throughout the site, generally associated with fill materials and services present beneath existing ground surface. Fill materials and service lines are anticipated to have a higher permeability than the underlying natural soil and/or bedrock.

The Sydney Water plans show a concrete base & brick walled stormwater channel running through and beneath the site. It is noted that Stormwater Channels are a potential offsite migration pathway.

The table below outlines the current working CSM for the site at the time of writing this report.

**Table 2: Conceptual Site Model - Current**

Potential Sources	Potential Receptor	Potential Exposure Pathways	Complete Linkages	Risk	Justification
Contaminated soil from possible placement of uncontrolled fill across the site. BH11, BH19, BH23, & BH24 were identified to contain soils impacted with HM above site criteria.	Site users or the general public	Dermal contact, inhalation or ingestion of exposed impacted soils	Yes (Current)	Medium	Direct contact with impacted soils is available as some surfaces are unsealed on the site.
			No (Future)	Negligible	Contaminated soils are likely to be remediated and removed during remediation works.
	Underlying Aquifer at Salt Pan Creek	Leaching and migration of contaminants through groundwater infiltration	Yes (Current)	High	Impacted fill soil contamination could migrate off site with surface water run-off.
			No (Future)	Negligible	If present, contaminated soil is likely to be remediated and removed.
Minor impacted groundwater with metals above groundwater investigation level	Site users, Workers or the general public	Dermal contact or inhalation	Yes (Current)	Yes	There is limited contaminated groundwater at this stage from DSI reporting.
			No (Future)	Negligible	If present, contaminated groundwater / vapour are likely to be remediated, removed or managed to prevent or minimise exposure at

Potential Sources	Potential Receptor	Potential Exposure Pathways	Complete Linkages	Risk	Justification
					unacceptable level.
	The aquatic ecosystems at Salt Pan Creek	Migration of impacted groundwater and surface water run-off	Yes (Current)	Yes	Impacted groundwater could potentially migrate offsite.
			No (Future)	Negligible	If present, contaminated groundwater / soil vapour is likely to be remediated and any remaining residual contamination would likely be at negligible concentrations.
Asbestos in buildings	Site user or visitors	Inhalation of airborne fibres	Limited (Current)	Low	If present, asbestos material is likely to be limited to the building fabric and would be in bonded form.
			No (Future)	Negligible	Licensed contractors would have to remove any asbestos likely to be present.

## 5.0 REMEDIATION CRITERIA

### 5.1 Soil

#### 5.1.1 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 proposed to be redeveloped into a new facility for use as a registered club with; shops, retail, office & business on the ground floor; basement and at grade car parking, new residential unit towers in current car park area and residential units above the new registered club, new internal roads, landscaping & drainage works.

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
<b>Heavy Metals</b>		
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
<b>Polycyclic Aromatic Hydrocarbons (PAHs)</b>		
Carcinogenic PAHs (as Bap TEQ)	4	NEPM 2013 - Table 1(A)1 HILs
Total PAHs	400	NEPM 2013 - Table 1(A)1 HILs
<b>Organochlorine Pesticides</b>		
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
Endrin	20	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
Methoxychlor	500	NEPM 2013 - Table 1(A)1 HILs
Mirex	20	NEPM 2013 - Table 1(A)1 HILs
Toxaphene	30	NEPM 2013 - Table 1(A)1 HILs
<b>Polychlorinated Biphenyls (PCBs)</b>		
PCBs	1	NEPM 2013 - Table 1(A)1 HILs
<b>Other Organics</b>		
PDBE (Br1-Br9)	2	NEPM 2013 - Table 1(A)1 HILs

Note - All values are in mg/kg

**5.1.2 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 indicate that the upper soil profile is more consistent with Silt & Clay.

**Table 4: Health Screening Levels (HSL) Criteria**


	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

### 5.1.3 Ecological Investigation Levels

Any applicable validation samples in the future will be assessed against the site derived EILs determined from the Benviron Group DSI (September 2016). A copy of the site derived EILs is provided below.

**Table 5: Site Derived EILs**

	EIL Analytes (mg/kg)						
	ARSENIC	CHROMIUM (VI) <sup>a</sup>	COPPER	LEAD	NICKEL	ZINC	NAPHTHALENE
<b>Site Derived Ecological Investigation Levels (EILs)</b>							
Fill BH5 (0.2m)	100	450	250	1,100	400	1,000	170
<b>Site Derived Ecological Investigation Levels (EILs)</b>							
Natural BH1 (0.8m)	100	410	220	1,100	270	710	170

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


#### 5.1.4 Ecological Screening Level (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 <sub>6</sub> -C <sub>10</sub> )	Coarse	125*	180*	215*	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F1 (C <sub>6</sub> -C <sub>10</sub> ) (Management Limits)	Coarse	-	700	700	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F2 (>C <sub>10</sub> -C <sub>16</sub> )	Coarse	25*	120*	170*	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F2 (>C <sub>10</sub> -C <sub>16</sub> ) (Management Limits)	Coarse	-	1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F3 (>C <sub>16</sub> -C <sub>34</sub> )	Coarse	-	300	1700	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F3 (>C <sub>16</sub> -C <sub>34</sub> ) (Management Limits)	Coarse	-	2500	3500	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F4 (>C <sub>34</sub> -C <sub>40</sub> )	Coarse	-	2800	3300	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				NEPM 2013 - Table 1(B) 6-7 EILs
F4 (>C <sub>34</sub> -C <sub>40</sub> ) (Management Limits)	Coarse	-	10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine				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 C<sub>6</sub>-C<sub>10</sub> fraction and subtract naphthalene from >C<sub>10</sub>-C<sub>16</sub> 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.

### 5.1.5 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			

### 5.1.6 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”*.

## 5.2 Groundwater

The NSW DECC has endorsed the use of the Groundwater Investigation Levels (GILs) given in the 1999 NEPM '*Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater*' (Amendment 2013) and the water quality trigger levels given in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000). These Guidelines provide criteria for:

- Aquatic ecosystems – both marine and fresh waters

The NEPM advises that 'when assessing groundwater contamination, the GILs are to be applied at the point of extraction and as response levels at the point of use, or where there is a likelihood of an adverse environmental effect at the point of discharge'.

For assessing groundwater quality, it is first necessary to assess the potential uses of groundwater downgradient of the site being assessed.

Potential uses of groundwater downgradient of the site include:

- Discharge to water bodies sustaining aquatic ecosystems particularly Fresh Water.
- Extraction of groundwater by local users.

The threshold concentrations presented in the ANZECC (2000) Fresh and Marine Waters Quality Guidelines are considered applicable for the protection of aquatic ecosystems of the receiving waters. As these guidelines apply to receiving waters, it is generally conservative to apply these to groundwater discharging to receiving waters. It is important to note that these are not threshold values at which an environmental

problem is likely to occur if exceeded, rather, if the trigger values are exceeded, then further action is required which may include either further site-specific investigations to assess whether or not there is an actual problem or management / remedial action should be undertaken.

It is considered that ***fresh water trigger*** values are applicable for investigating chemical concentrations in groundwater at the site, as the receiving body. The nearest downgradient watercourse is a stormwater channel that is located beneath the site running through the central portion of the site in east west direction and along the western boundary in a north south direction. The stormwater channels appear to drain into Salt Pan Creek located approximately 531m south west of the site, which eventually discharges into the Georges River. It is understood that the NSW EPA policy is that the trigger values for the protection of 95% of aquatic ecosystems should be used as groundwater assessment criteria when considering moderately or highly disturbed receiving environments. The receiving waters for groundwater at the site are considered to be moderately disturbed ecosystems and the ANZECC (2000) 95% protection values are therefore considered appropriate groundwater assessment criteria for the site.

## 6.0 ADDITIONAL INVESTIGATION

The following additional works are recommended to identified environmental concern during the Benviron Group DSI (September 2016).

The sampling strategy is based on our current level of understanding of the site conditions. However, the fieldwork and the sampling and analysis program may be subject to change based on the observations made during field work, such as depth of groundwater, actual geology beneath the site and visual extent of contamination.

For any unexpected findings during the assessment, the unexpected findings protocol provided in **Appendix A** shall be followed.

### 6.1 Soil

#### 6.1.1 Sampling Density & Location Rationale

The sampling density and location rationale is described below:

- Ten (10) additional boreholes will be drilled at the proposed locations shown in Figure 2 to allow for the collection of soil samples to target landscape areas, building footprint & further assessment of the soil quality based on the results from the Benviron Group DSI in 2016.
- Six (6) boreholes to be drilled for an Acid Sulphate Soils Assessment.

#### 6.1.2 Soil Sampling Methodology

In summary:

- Soil samples will be collected directly from the push tube / split spoon sampler.
- Samples will be transferred directly into appropriately labelled clean laboratory supplied containers;
- Samples will be transferred into chilled eskies for sample preservation;
- A Chain of Custody will be completed and forwarded to the laboratory. Sampling analysis is based on field observations.

Sampling of asbestos will be undertaken as follows:

- A minimum 10L sample from each sample location will be recovered;
- Each sample (minimum of 10 L) will be screened through a 7mm sieve and the material retained on the sieve examined for any bonded ACM and / or suspect material and forwarded to the laboratory for analysis if any suspected ACM is encountered;
- If visible FA material is present or suspected, the soil should be wetted to minimise the release of fibres;
- Identified bonded ACM and FA should be weighed for each sample; and
- One wetted 500ml sample from each sampling location was submitted for laboratory analysis for AF.

### **6.1.3 Soil Laboratory Analysis**

- Laboratory analysis for the additional soil samples will include the following HM, TRH, BTEX, PAH, OC, PCB & Asbestos.
- Acid Sulphate Soils field test, SPOCAS & Chromium Reducible.

## 6.2 Summary of Proposed Additional Investigation Works

The additional investigation is detailed in the following summary table as below.

**Table 8: Additional Investigation**

Item	Sampling Frequency	Analytes
<u>Soil Sampling</u> Ten (10) additional borehole locations to target landscape, building footprint and soil quality.  Six boreholes for an Acid Sulphate Soil Assessment	Ten (10) boreholes locations: 1-2 fill samples per borehole 1-2 natural sample per borehole  1 inter-laboratory duplicate 1 intra-laboratory duplicate Spike / Blank	HM, TRH, BTEX, PAH, OC, PCB & Asbestos.  TRH (C6-C10) & BTEXN  ASS Field test, SPOCAS & Chromium Reducible
Additional round of sampling of three (3) existing monitoring wells to further determine water quality at the site.	Three (3) existing groundwater sampling and one (1) new groundwater sampling  1 inter-laboratory duplicate 1 intra-laboratory duplicate  Spike / Blank	HM, TRH, BTEXN, PAH & VOC.  TRH (C6-C10) & BTEXN

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

Refer to **Figure 2** – Site Features, Borehole locations, Hotspots & Additional Location Plan.

## **7.0 REMEDIATION STRATEGY**

### **7.1 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.

### **7.2 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.



## **7.3 Remediation option review**

### **7.3.1 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.

### **7.3.2 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.

### **7.3.3 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.

### **7.3.4 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.

#### 7.4 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 9: Remediation options**

<b>Technical Characteristics</b>	<b>Option 1 Excavation – Off-Site Disposal</b>	<b>Option 2 Bioremediation</b>	<b>Option 3 Thermal Treatment</b>	<b>Option 4 Cap and Contain</b>
<b>Cost</b>	Low- Medium	Medium	High	Low
<b>Technical feasibility</b>	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
<b>Human Health Risks</b>	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
<b>Reliability</b>	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.
<b>Regulatory Approval</b>	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

<b>Technical Characteristics</b>	<b>Option 1 Excavation – Off-Site Disposal</b>	<b>Option 2 Bioremediation</b>	<b>Option 3 Thermal Treatment</b>	<b>Option 4 Cap and Contain</b>
<b>Disruption to Site Structures and Activities</b>	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
<b>Ongoing Liabilities</b>	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
<b>Contractor Experience</b>	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

### 7.5 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 is 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.

## 8.0 REMEDIATION WORKS

### 8.1 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 chromium impacted hotspots at BH19, BH23, BH24 & SS2 (BH11).

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.

### 8.2 Remediation program

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

#### **Stage One -Hazardous Materials Assessment & Site Preparation**

- A hazardous materials assessment of the buildings should be undertaken prior to demolition being carried out on site.
- **Site Contractor** to demolish site structures (which have development consent) and concrete slabs to make way for remedial works and under slab observations.

### **Stage Two – Additional Investigation**

- Ten (10) additional boreholes will be drilled at the proposed locations shown in Figure 2 to allow for the collection of soil samples to target landscape areas, building footprint & further assessment of the soil quality based on the results from Benviron Group DSI 2016.
- The sampling of three (3) existing monitoring wells to provide second round of water quality at the site.
- Six (6) boreholes to be drilled for an Acid Sulphate Soil Assessment.

### **Stage Three – Removal of previous soil impacted Hotspots (BH6)**

#### **BH11**

- Hotspot SS2 (BH11) – contains chromium impacted fill materials to a depth of 0.3m BGL. It is intended to initially excavate the Hotspot 2m long x 2m wide x 1m vertically deep. The material is to be classified in accordance with the NSW EPA Waste Classification Guidelines and can be disposed of at EPA licenced landfill facility that can accept the waste. The approximate volume to be disposed of is 4m<sup>3</sup>.
- The floors and walls of BH11 will be validated by taking 1 floor sample and 4 walls samples. Recovery of appropriate QA/QC samples.

#### **BH19**

- Hotspot BH19 – contains chromium impacted fill materials to a depth of 0.3m BGL. It is intended to initially excavate the Hotspot 2m long x 2m wide x 1m vertically deep. The material is to be classified in accordance with the NSW EPA Waste Classification Guidelines and can be disposed of at EPA licenced landfill

facility that can accept the waste. The approximate volume to be disposed of is 4m<sup>3</sup>.

- The floors and walls of BH19 will be validated by taking 1 floor sample and 4 walls samples. Recovery of appropriate QA/QC samples.

#### BH23

- Hotspot BH23 – contains chromium impacted fill materials to a depth of 0.5m BGL. It is intended to initially excavate the Hotspot 2m long x 2m wide x 1m vertically deep. The material is to be classified in accordance with the NSW EPA Waste Classification Guidelines and can be disposed of at EPA licenced landfill facility that can accept the waste. The approximate volume to be disposed of is 4m<sup>3</sup>.
- The floors and walls of BH23 will be validated by taking 1 floor sample and 4 walls samples. Recovery of appropriate QA/QC samples.

#### BH24

- Hotspot BH24 – contains chromium impacted fill materials to a depth of 0.5m BGL. It is intended to initially excavate the Hotspot 2m long x 2m wide x 1m vertically deep. The material is to be classified in accordance with the NSW EPA Waste Classification Guidelines and can be disposed of at EPA licenced landfill facility that can accept the waste. The approximate volume to be disposed of is 4m<sup>3</sup>.
- The floors and walls of BH24 will be validated by taking 1 floor sample and 4 walls samples. Recovery of appropriate QA/QC samples.

#### **Stage Four – Validation of Basement & Ground Floor**

- After removal of all fill soil material from the proposed basement area in accordance with the NSW EPA Waste Classification guidelines, the floors of exposed basement floor area & remaining ground floor areas will be sampled by taking thirty (30) floor samples plus QA/QC samples to validate the basement & ground floor area.

#### **Stage Five – 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.

### **8.3 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.

## **8.4 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.

## **8.5 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.

## **8.6 Contingencies during Remedial Works**

### **8.6.1 Contaminated Soils**

Follow the unexpected finds protocol as detailed in Section 16.2 & Appendix A. Works to be suspended until the environmental project manager can further assess impacted soils / materials.

### **8.6.2 USTs**

Systems to be removed and the excavations appropriately validated and backfilled by experienced contractor. Refer to Section 16.3 for more details.

### **8.6.3 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.

## **9.0 VALIDATION PLAN (DATA QUALITY OBJECTIVES)**

Data quality objectives have been developed for the validation assessment.

### **9.1 State the problem**

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

- Soil remediation is currently limited to the chromium impacted hotspots at BH11, BH19, BH23 & BH24.

### **9.2 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?



### **9.3 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 3.5);
- 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

### **9.4 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, Hotspots & Additional Location Plan; and
- The vertical extent of the soil removal is at least 1m BGL at BH11, BH19, BH23 & BH23 up to clean underlying material;

### **9.5 Decision Rules**

The following outlines the decision rules for the project:

**Table 10: 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).

	<p>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>.</p> <p>If the material fails the criteria, and no disposal receipts are provided, the answer is <i>No</i>.</p>
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## 9.6 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.

## 9.7 Optimising the Design for Obtaining Data

This step enables decision makers 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.

## 10.0 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.

### 10.1 Soil Validation Methodology

Soil sampling and handling is outlined in the table below:

**Table 11: 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	<p>Validation soil samples to be transferred directly into appropriately labelled clean laboratory supplied containers.</p> <p>Validation soil samples to be transferred into chilled eskies for sample preservation.</p> <p>A PID should be used during the collection of each validation soil sample if analysis includes volatiles.</p>

	<p>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:</p> <ul style="list-style-type: none"> <li>-Cleaning equipment in potable water to remove gross contamination;</li> <li>-Cleaning in a solution of Decon 90;</li> <li>-Rinsing in clean demineralised water then wiping with clean lint free cloths;</li> </ul> <p>A Chain of Custody to be completed and forwarded to the laboratory to ensure sample tracking.</p>
Sampling Frequency	<p><u>Remedial Hotspot Excavation (Validation Sampling):</u></p> <p>1 sample per 100m<sup>2</sup>, with one sample per 10 lineal metres along each wall (with a minimum of one sample per excavation wall)</p> <p><u>Stockpile sampling:</u></p> <p>Small Volumes (&lt;200m<sup>3</sup>)- 1 sample every 25m<sup>3</sup></p> <p>Large Volumes (&gt;200m<sup>3</sup>) as per Table 3 of the Victoria Sampling Guidelines June 2009 (IWRG702)</p>
Laboratory Quality Assurance and Quality Control	<p>The contracted laboratory to conduct in-house QA/QC procedures involving by not limiting to:</p> <p>Blanks, spike recoveries, laboratory duplicates &amp; analysis.</p>
Assessment of DQOs	<p>Provide analysis of the QA/QC samples and procedures &amp; provide assessment of the overall data quality.</p>

## **10.2 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.

## 11.0 VALIDATION WORKS

### 11.1 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 12: Soil Validation Sampling Program**

Item	Sampling Frequency	Analytes
Hotspots BH11, BH19, BH23 & BH24	1 floor sample, 4 wall samples  1 inter-laboratory duplicate 1 intra-laboratory duplicate Trip Spike & Trip Blank / day	Metals, TRH, BTEX & PAH
Validation basement & ground Floor	30 floor samples  1 inter-laboratory duplicate 1 intra-laboratory duplicate Spikes / blanks	HM, TRH, BTEXN, PAH, OC, PCB & Asbestos
Backfill Material (if required)	Certified VENM or 1 sample per 100m <sup>3</sup>	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 <sup>3</sup> , 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.

## 11.2 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 layer 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.

### **11.3 Validation of hotspot**

Following removal of soils from the hotspot, 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 hotspot areas as per Table 12.

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.

### **11.4 Validation of Basement & Ground Floor Areas**

Following removal of the fill at the site, photographic records of the basement floor of the excavation will be taken for future reference.

General site validation samples are proposed to be collected from the basement & ground floor areas following a systematic pattern and analysed for the contaminants of concern identified at these locations, including heavy metals, TRH, BTEX, PAH, OC, PCB & Asbestos. The soil samples will be collected from between 0-150 mm depth from freshly excavated surfaces. Samples will be recovered from thirty (30) locations across the site.

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.

### **11.5 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 soil's underneath stockpiles will be required after disposal of the stockpile off-site (where necessary).

### **11.6 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 1,000 m<sup>3</sup>. 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.

### **11.7 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 to eight 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.

## 12.0 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.

### 12.1 General QA/QC

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

**Table 13: 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:

## **12.2 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.

## **12.3 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.

## **12.4 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.

## 12.5 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.

## 12.6 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 14: Data Quality Indicator for the proposed Validation Program**

Data Quality Indicator	Frequency	DQI Indicator
<b>Completeness</b>		
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	All samples	All samples

Data Quality Indicator	Frequency	DQI Indicator
completed and holding times complied with.		
<b>Comparability</b>		
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
<b>Representativeness</b>		
Sampling appropriate for media and analytes	All samples	All samples
Samples adequately preserved	All samples	All samples
<b>Precision</b>		
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
<b>Accuracy</b>		

Data Quality Indicator	Frequency	DQI Indicator
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%



## **13.0 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.

## **14.0 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.

### **14.1 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.

#### **14.2 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.

#### **14.3 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.

#### **14.4 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.

## 14.5 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.

#### **14.6 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.

#### **14.7 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.

## **14.8 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.

## **14.9 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.

## **14.10 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.

#### **14.11 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 is 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.

## **14.12 Waste / Soil Management Plan (Importation, stockpiles, tracking & disposal)**

### **14.12.1 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.



#### **14.12.2      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

#### **14.12.3      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.

#### **14.12.4 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.

### **14.13 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.

## **15.0 OPERATIONAL CONTROLS**

### **15.1 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.

### **15.2 Public complaints registry**

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

### **15.3 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

#### **15.4 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.

#### **15.5 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.

## 16.0 CONTINGENCY MANAGEMENT9

The conditions that may be encountered when excavating is 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 15: 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 16.2 & Appendix A.
Discovery of USTs	Stop excavations, contact Benviron Group immediately. Follow the unexpected finds protocol and UST finds protocol outlined in section 16.2 & 16.3 & 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	<p>If excessive organic odours / vapours are generated, stop works and monitor for volatiles at the site boundaries using PID and upgrade PPE if necessary.</p> <p>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.</p> <p>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 &amp; community consultation procedure, that the project manager, client and remediation contractor:</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Temporarily pause site works to allow excessive odour to subside whilst implementing the control measures.</li> <li>3. Record logs for volatile emissions and odours.</li> </ol>
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 16.2 & 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.

### 16.1 Contact Persons

**Table 16: Contact Persons**

Responsible Party	Details
Principal Environmental Representative	Benviron Group PO Box 4405, East Gosford NSW 2250 Benjamin Buckley
Project Manager and Client	Waldron Hill Projects Pty Ltd Mario Pamboris 02 9557 5555

## 16.2 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
  - 1 sample every 25m<sup>3</sup>, with a minimum of three samples recovered.
  - Samples should be analysed for the chemicals of concern.
- Excavation Wall
  - 1 sample every 5m (from each distinct horizon / material type)
  - 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.

## 16.3 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 walls (2 samples per wall face) of each tank pit

#### **16.4 Groundwater Contingency**

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

## **17.0 REGULATORY APPROVALS AND LICENSES**

### **17.1 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.

### **17.2 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.

### **17.3 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.

#### **17.4 Development Consent and Control Plans**

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

#### **17.5 Asbestos Removal Regulations / Work Health Safety Regulations**

##### **17.5.1 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 2012), 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 10m<sup>2</sup> 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
  - Note: A Class B licence is required for removal of more than 10 m<sup>2</sup> of non-friable asbestos or ACM but the licence holder can also remove up to 10 m<sup>2</sup> of non-friable asbestos or ACM)
- ACD associated with the removal of non-friable asbestos or ACM
  - Note: A Class B licence is required for removal of ACD associated with the removal of more than 10 m<sup>2</sup> of non-friable asbestos or ACM but the licence holder can also remove ACD associated with removal of up to 10m<sup>2</sup> of non-friable asbestos or ACM



### **17.5.2 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.

### **17.5.3 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.

### **17.5.4 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 premise 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:

- contact (02) 8260 5885
- email to [adu@safework.nsw.gov.au](mailto:adu@safework.nsw.gov.au)

- delivery to 92-100 Donnison Street, Gosford 2250 or any Safework office

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

## **17.6 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.

### **17.7 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.

## **18.0 CONCLUSION**

It is considered that the site will be suitable for the proposed redevelopment into a new facility for use as a registered club with; shops, retail, office & business on the ground floor; basement and at grade car parking, new residential unit towers in current car park area and residential units above the new registered club, new internal roads, landscaping & drainage works, subject to the implementation of the remediation and validation works in accordance with this RAP.

## 19.0 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*.
- Benviron Group (2016), “Detailed Site Investigation”, 921 Punchbowl Road, Punchbowl NSW, Ref: E881, dated September 2016.
- Department of Urban Affairs and Planning – EPA (1998) “*Managing Land Contamination – Planning Guidelines – SEPP 55 – Remediation of Land*”.
- 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, 3<sup>rd</sup> 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.

## **20.0 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.

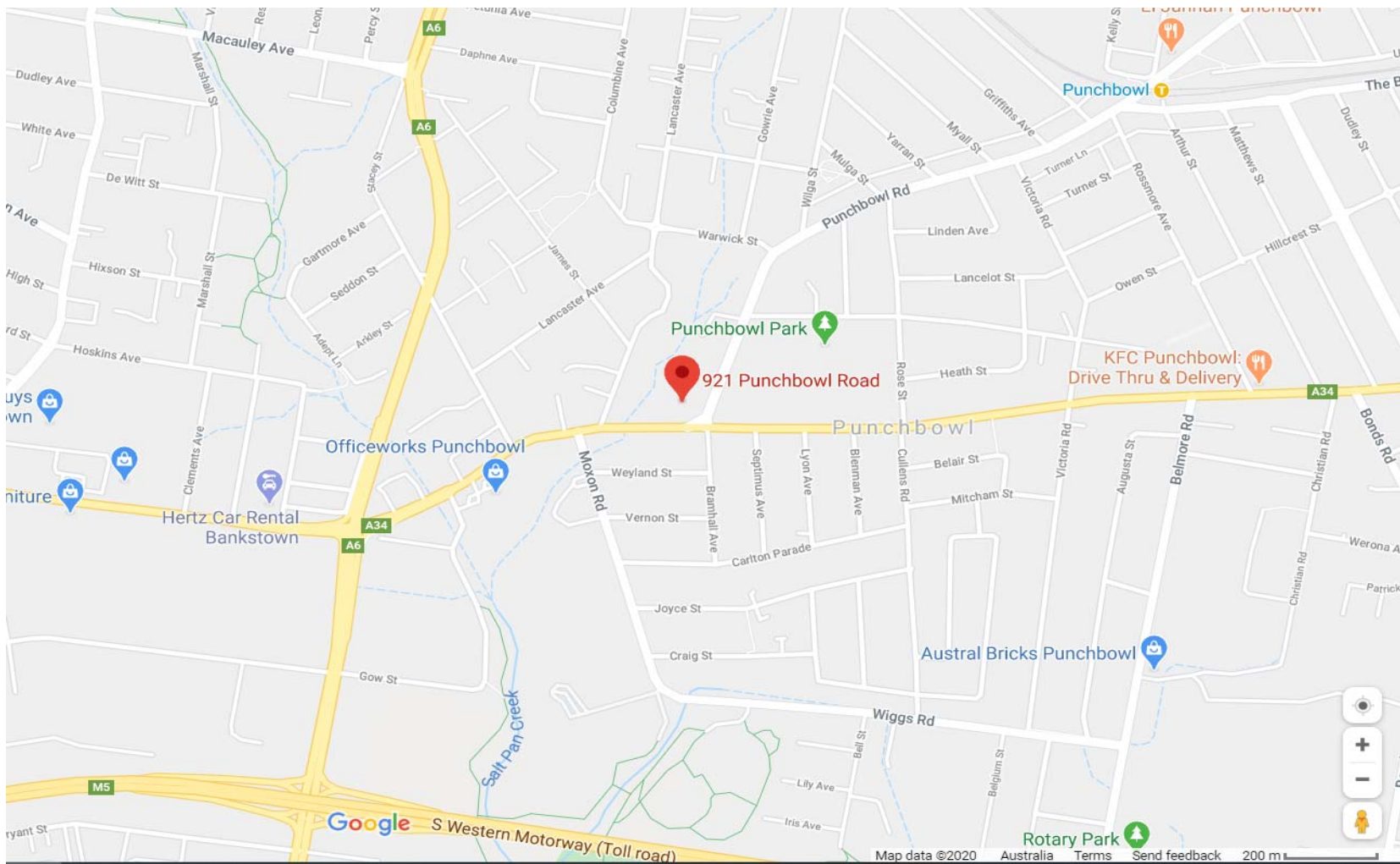
There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that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

FIGURE  
1

Job #  
E2232

## Site Locality

Waldron Hill Projects Pty Ltd

921 Punchbowl Rd, Punchbowl NSW

**FIGURE 2: SITE FEATURES, BOREHOLE LOCATIONS, HOTSPOTS &  
ADDITIONAL LOCATION PLAN**



Hotspots

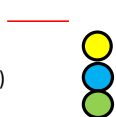
#### Key

Site Location

BG DSI 2016 Soil (BH)

BG DSI 2016 Soil & GW (BH)

Proposed Additional (BH)



DRAWN  
MS

FIGURE  
2

Job #  
E2232

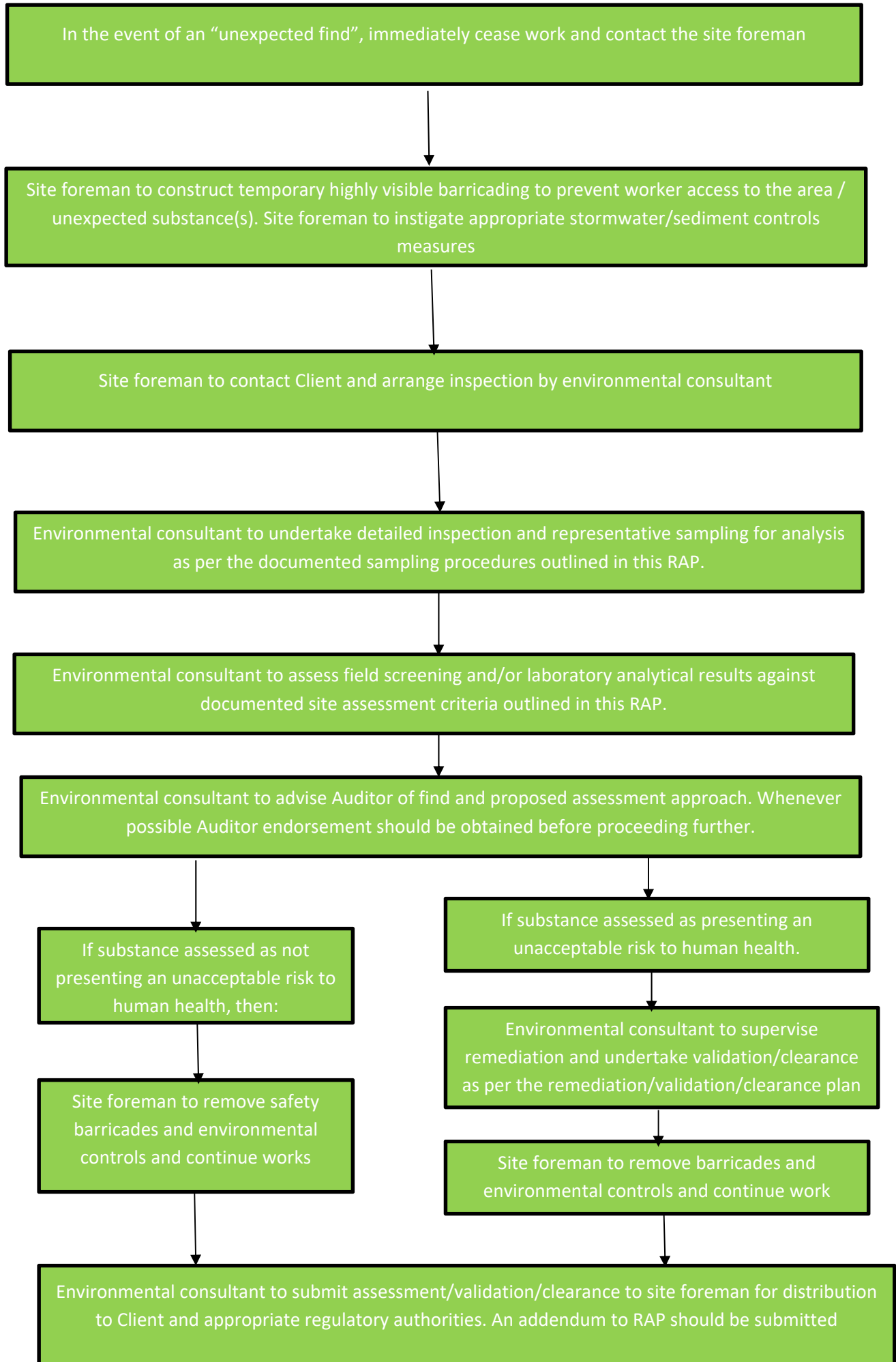
Site Features, Borehole Locations, Hotspots & Additional Location Plan

Waldron Hill Projects Pty Ltd

921 Punchbowl Road, Punchbowl NSW

## **APPENDIX A: UNEXPECTED FINDS PROTOCOL**





## **APPENDIX B: PROPOSED DEVELOPMENT PLANS**



DA SUBMISSION



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**ACN:** 161 791 715

Client  
**TBA**

Project  
**Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196**

Drawing Title  
**Ground Floor Plan**

Scale 1:500@ A1 1:1000@ A3	Date 21.07.16	Drawn AS	Checked CT
Job No. 00 00 00	Drawing No. <b>DA 1.02</b>	Issue A	

Design File Ref: Arch/Active/921 Punchbowl Rd/DA

Issue	Date	Description	By

Notes  
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**ACN:** 161 791 715

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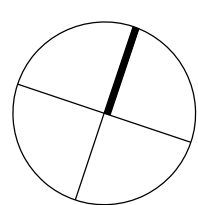
TBA

Project	Residential Development No. 921 Punchbowl Rd, Punchbowl NSW 2196
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Drawing Title
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Ground: North

Scale 1:250 @ A1 1:500 @ A3	Date 21.07.16	Drawn AS	Checked CT
Job No. 00 00 00	Drawing No. DA 1.01		Issue A
Design File Ref: Arch/Active/921 Punchbowl Rd/DA			



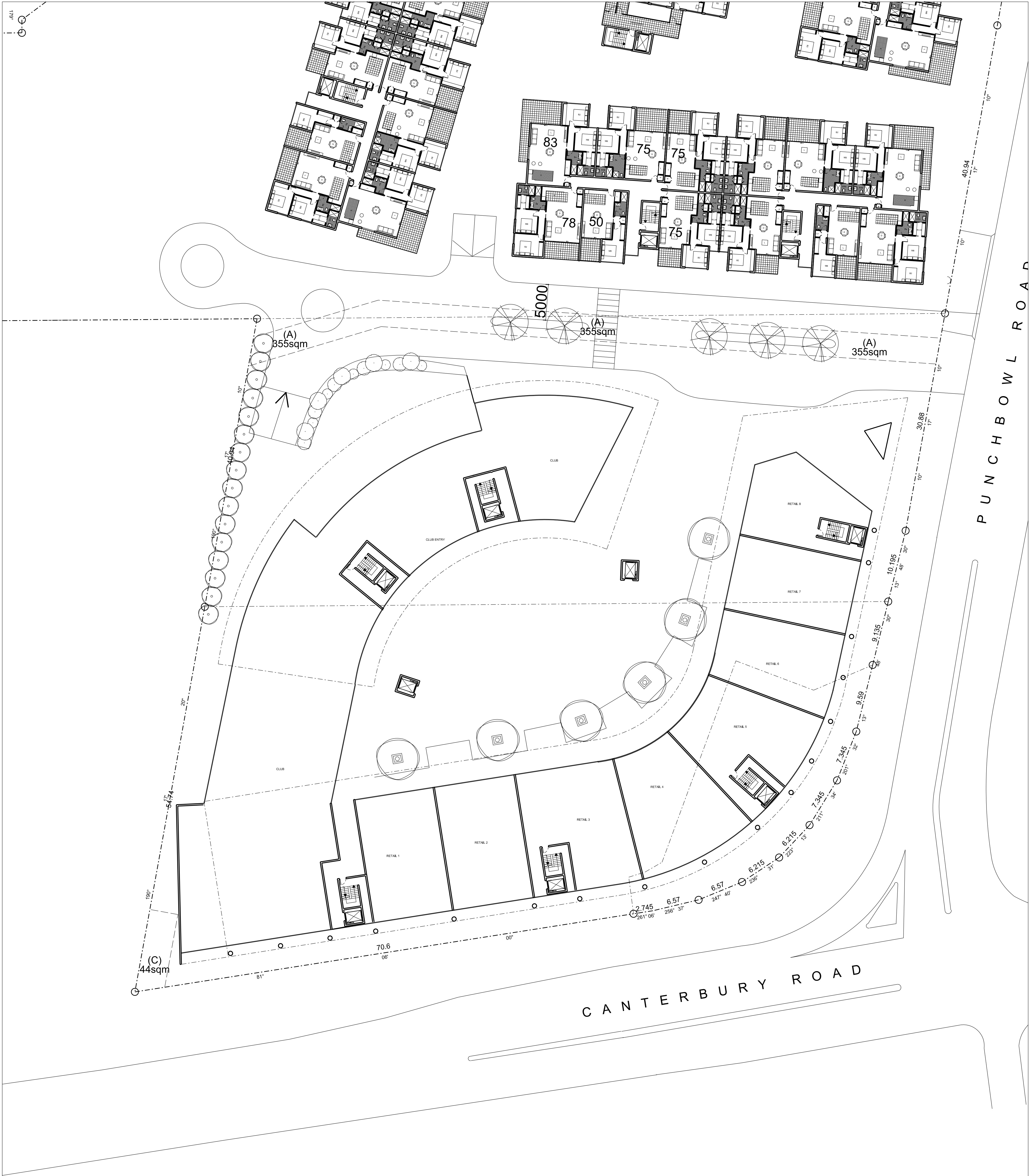
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Client

TBA

Project

**Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196**

Drawing Title

**Ground: South**

Scale  
1:250@ A1  
1:500 @ A3

Date

21.07.16

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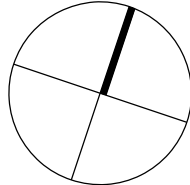
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**DA 1.00**

Issue

A

Design File Ref: Arch/Active/921 Punchbowl Rd/DA



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Fax: + 61 2 9587 4332  
E: info@cmtarchitects.com  
Web: www.cmtarchitects.com  
  
ACN: 161 791 715

Client  
**TBA**

Project  
**Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196**

Drawing Title  
**First Floor Plan**

Scale 1:500@ A1 1:1000@ A3	Date 21.07.16	Drawn AS	Checked CT
Job No. 00 00 00	Drawing No. <b>DA 1.08</b>	Issue A	

Design File Ref: Arch/Active/921 Punchbowl Rd/DA

Issue	Date	Description	By

Notes  
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ACN: 161 791 715

Client

TBA

Project

Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196

Drawing Title

First: North

Scale  
1:250@ A1  
1:500@ A3

Date

21.07.16

Drawn

AS

Checked

CT

Job No.

00 00 00

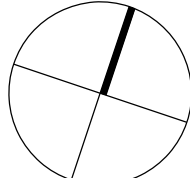
Drawing No.

DA 1.07

Issue

A

Design File Ref: Arch/Active/921 Punchbowl Rd/DA



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Issue	Date	Description	By
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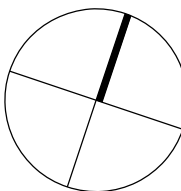
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**ACN:** 161 791 715

Client	TBA
Project	Residential Development No. 921 Punchbowl Rd, Punchbowl NSW 2196
Drawing Title	Second Floor Plan

Scale	Date	Drawn	Checked
1:500 @ A1	21.07.16	AS	CT
1:1000 @ A3			
Job No.	Drawing No.	Issue	
00 00 00	DA 1.05	A	

Design File Ref: Arch/Active/921 Punchbowl Rd/DA



Issue	Date	Description	By

Notes

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Client  
TBA  
  
Project  
Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196  
  
Drawing Title  
Second: North

Scale 1:250 @ A1 1:500 @ A3	Date 21.07.16	Drawn AS	Checked CT
Job No. 00 00 00	Drawing No. DA 1.04	Issue A	

Design File Ref: Arch/Active/921 Punchbowl Rd/DA

Issue	Date	Description	By

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Client

TBA

Project

Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196

Drawing Title

Second: South

Scale  
1:250 @ A1  
1:500 @ A3

Date

21.07.16

Drawn

AS

Checked

CT

Job No.

00 00 00

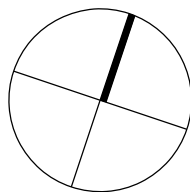
Drawing No.

DA 1.03

Issue

A

Design File Ref: Arch/Active/921 Punchbowl Rd/DA



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Issue	Date	Description	By
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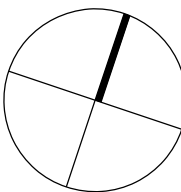
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**ACN:** 161 791 715

Client	TBA
Project	Residential Development No. 921 Punchbowl Rd, Punchbowl NSW 2196
Drawing Title	Third Floor Plan

Scale	Date	Drawn	Checked
1:500@ A1 1:1000@ A3	21.07.16	AS	CT
Job No.	Drawing No.	Issue	
00 00 00	DA 1.11	A	
Design File Ref: Arch/Active/921 Punchbowl Rd/DA			
			

Issue	Date	Description	By

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**ACN:** 161 791 715

Client  
**TBA**

Project  
**Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196**

Drawing Title  
**Third: North**

Scale 1:250@ A1 1:500@ A3	Date 21.07.16	Drawn AS	Checked CT
Job No. 00 00 00	Drawing No. <b>DA 1.10</b>	Issue A	

Design File Ref: Arch/Active/921 Punchbowl Rd/DA

Issue	Date	Description	By

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ACN: 161 791 715

Client	TBA
Project	Residential Development No. 921 Punchbowl Rd, Punchbowl NSW 2196
Drawing Title	Third: South

Scale	Date	Drawn	Checked
1:250@ A1 1:500@ A3	21.07.16	AS	CT
Job No.	Drawing No.	Issue	
00 00 00	DA 1.09	A	
Design File Ref: Arch/Active/921 Punchbowl Rd/DA			

Issue	Date	Description	By

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**ACN:** 161 791 715

Client	TBA
Project	Residential Development No. 921 Punchbowl Rd, Punchbowl NSW 2196
Drawing Title	Fourth Floor Plan

Scale	Date	Drawn	Checked
1:250@ A1 1:500@ A3	21.07.16	AS	CT
Job No.	Drawing No.	Issue	
00 00 00	DA 1.14	A	
Design File Ref: Arch/Active/921 Punchbowl Rd/DA			

Issue	Date	Description	By

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**ACN:** 161 791 715

Client  
**TBA**

Project  
**Residential Development  
No. 921 Punchbowl Rd,  
Punchbowl NSW 2196**

Drawing Title  
**Fourth: North**

Scale 1:250@ A1 1:500@ A3	Date 21.07.16	Drawn AS	Checked CT
Job No. 00 00 00	Drawing No. <b>DA 1.13</b>	Issue A	
Design File Ref: Arch/Active/921 Punchbowl Rd/DA			

Issue	Date	Description	By

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Client	TBA
Project	Residential Development No. 921 Punchbowl Rd, Punchbowl NSW 2196
Drawing Title	Fourth: South

Scale	Date	Drawn	Checked
1:250@ A1 1:500@ A3	21.07.16	AS	CT
Job No.	Drawing No.	Issue	
00 00 00	DA 1.12	A	
Design File Ref: Arch/Active/921 Punchbowl Rd/DA			

Issue	Date	Description	By

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# MIXED USE DEVELOPMENT

21 Canterbury Road, Punchbowl

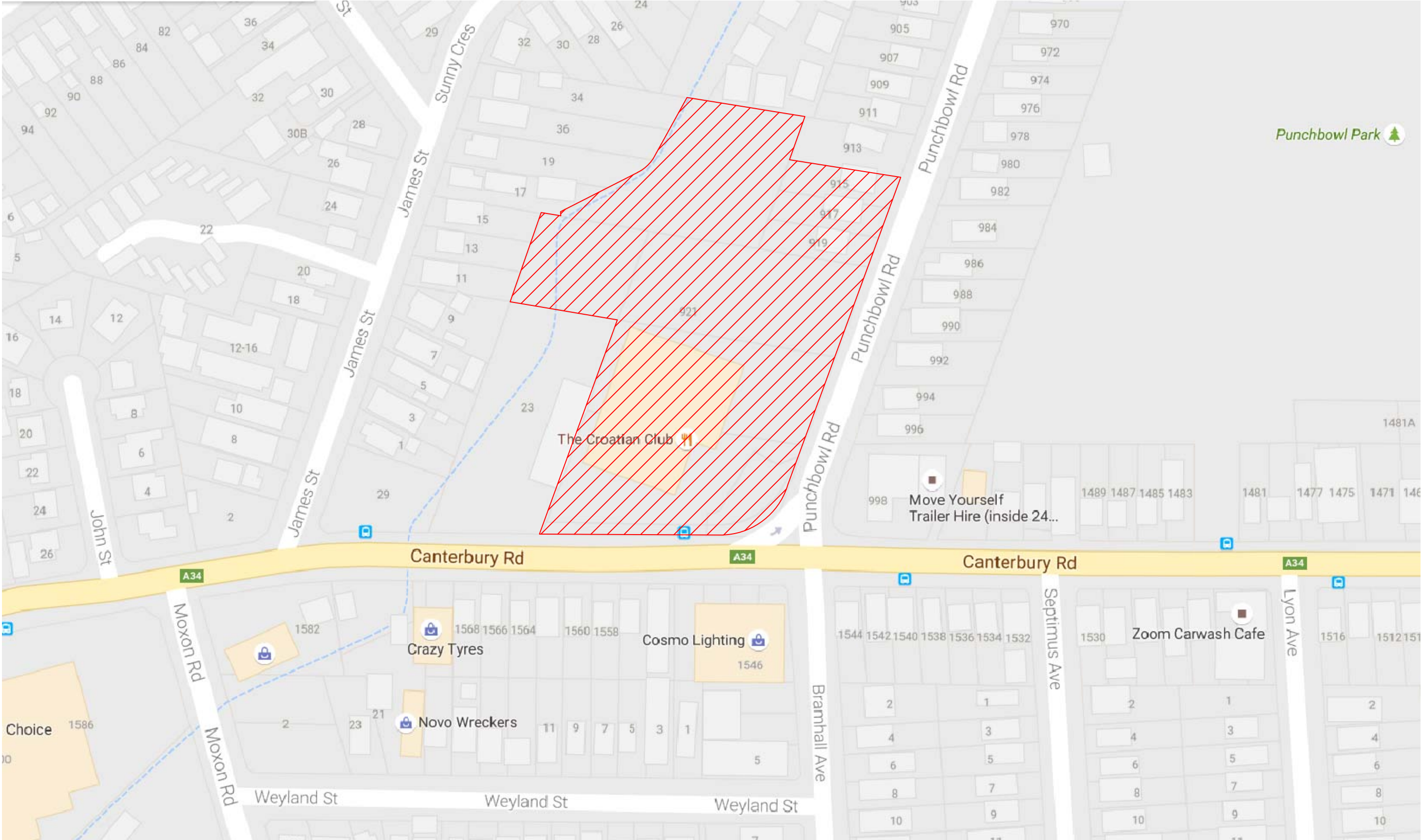
DWG NO.	DRAWING TITLE	SCALE	ISSUE	DATE
000	COVER SHEET & LOCATION PLAN	N.T.S.	E	01.06.2017
100	LANDSCAPE MASTERPLAN	1:400	E	01.06.2017
C100	LANDSCAPE MASTERPLAN RENDER	1:400	E	01.06.2017
101	LANDSCAPE PLAN - CIVIC PLAZA	1:200	E	01.06.2017
102	LANDSCAPE PLAN - RESIDENTIAL	1:200	E	01.06.2017
103	LANDSCAPE PLAN - RESIDENTIAL	1:200	E	01.06.2017
104	LANDSCAPE PLAN - LEVEL 3 TERRACE	1:50	E	01.06.2017
501	LANDSCAPE DETAILS	AS SHOWN	E	01.06.2017
502	LANDSCAPE SPECIFICATION & INDICATIVE PLANT SCHEDULE		E	01.06.2017

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E	For DA	PH	RS	01.06.2017
D	For DA	NP	RS	23.01.2017
C	For Approval	PH	RS	13.12.2016
B	For Review	PH	RS	21.11.2016
A	For Review	NH	RS	28.07.2016
Issue	Revision Description	Drawn	Check	Date

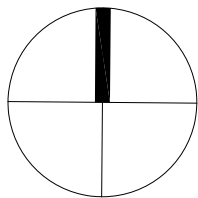
LEGEND



01  
000

LOCATION PLAN  
N.T.S.

Key Plan:



Client:  
**Waldron Hill Developments**

Architect:  
**CMT Architects**

Project:  
**21 Canterbury Road  
Punchbowl**

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Redfern NSW 2016  
Australia

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S I T E I M A G E

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DEVELOPMENT APPLICATION

Drawing Name:  
**COVER SHEET**

Scale: 1:1000 @ A1  
Job Number:  
SS16-3349

Drawing Number:  
000

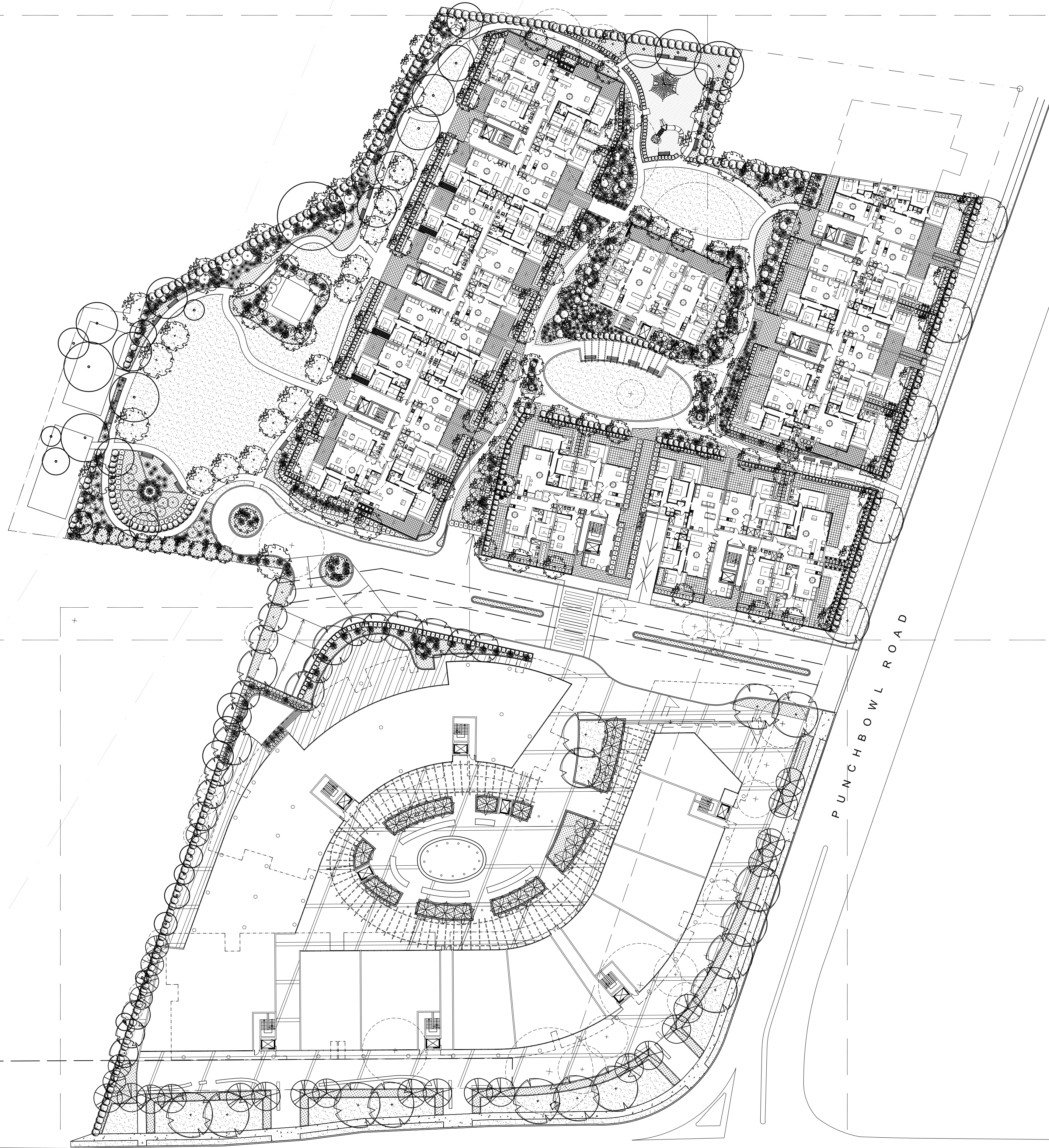
Sheet \_ of \_  
Issue:  
E

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102

103



CANTERBURY ROAD

101

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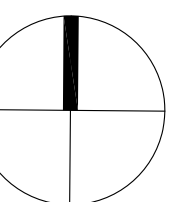
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D	For DA	NP	RS	23.01.2017
C	For Approval	PH	RS	13.12.2016
B	For Review	PH	RS	21.11.2016
A	For Review	NH	RS	28.07.2016
Issue	Revision Description	Drawn	Check	Date

#### LEGEND

- Proposed Tree Planting
- Proposed Palm Trees
- Proposed Shrub Planting
- Proposed Accent Planting
- Proposed Groundcover
- Turf
- Proposed Paving Type 1
- Proposed Paving Type 2
- Proposed Bench Seating
- Proposed Pergola Structure

Key Plan:



Client:

Waldron Hill Developments

Architect:

CMT Architects

Project:

21 Canterbury Road  
Punchbowl

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DEVELOPMENT APPLICATION

Drawing Name:

LANDSCAPE MASTERPLAN

Scale: 1:400 @ A1

Job Number:

SS16-3349

Sheet \_ of \_  
0 2 4 8 12 20m  
Drawing Number: Issue:

100 E





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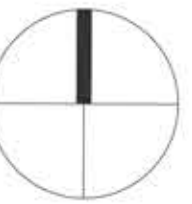
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E	For DA	PH	RS	01.06.2017
D	For DA	NP	RS	23.01.2017
C	For Approval	PH	RS	13.12.2016
B	For Review	PH	RS	21.11.2016
A	For Review	NH	RS	28.07.2016
Issue	Revision Description	Drawn	Check	Date

#### LEGEND

- Proposed Tree Planting
- Proposed Palm Trees
- Proposed Shrub Planting
- Proposed Accent Planting
- Proposed Groundcover
- Turf
- Proposed Paving Type 1
- Proposed Paving Type 2
- Proposed Bench Seating
- Proposed Pergola Structure

Key Plan:



Client:  
**Waldron Hill Developments**

Architect:  
**CMT Architects**

Project:  
**21 Canterbury Road  
Punchbowl**

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**DEVELOPMENT APPLICATION**

Drawing Name:  
**LANDSCAPE MASTERPLAN**

Scale: 1:400 @ A1

Job Number: SS16-3349

Drawing Number: C100

Sheet \_ of \_  
0 2 4 8 12 20m  
Issue: E

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CONTINUES ON 102

CONTINUES ON 103

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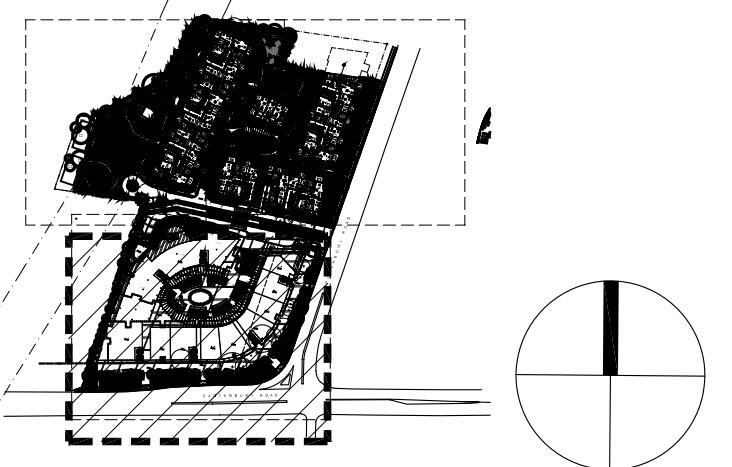
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E	For DA	PH	RS	01.06.2017
D	For DA	NH	RS	23.01.2017
C	For Approval	PH	RS	13.12.2016
B	For Review	PH	RS	21.11.2016
A	For Review	NH	RS	28.07.2016
Issue	Revision Description	Drawn	Check	Date

LEGEND

- Proposed Tree Planting
- Proposed Palm Trees
- Proposed Shrub Planting
- Proposed Accent Planting
- Proposed Groundcover
- Turf
- Proposed Paving Type 1
- Proposed Paving Type 2
- Proposed Bench Seating
- Proposed Pergola Structure

Key Plan:



Client:  
Waldron Hill Developments

Architect:  
CMT Architects

Project:  
21 Canterbury Road  
Punchbowl

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DEVELOPMENT APPLICATION

Drawing Name:  
LANDSCAPE PLAN  
CIVIC PLAZA

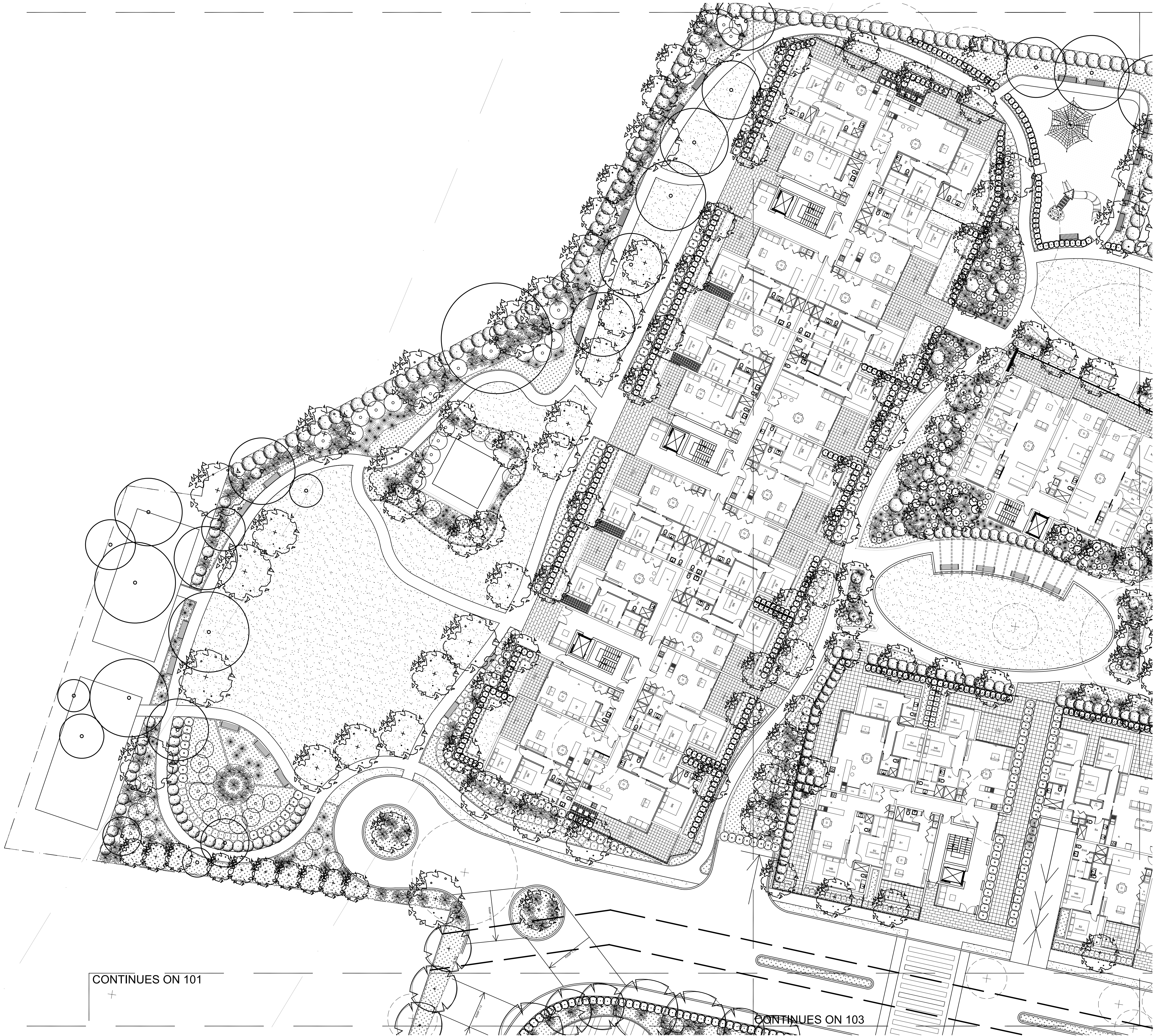
Scale: 1:200 @ A1

Job Number:  
SS16-3349

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101 E

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CONTINUES ON 101

CONTINUES ON 103

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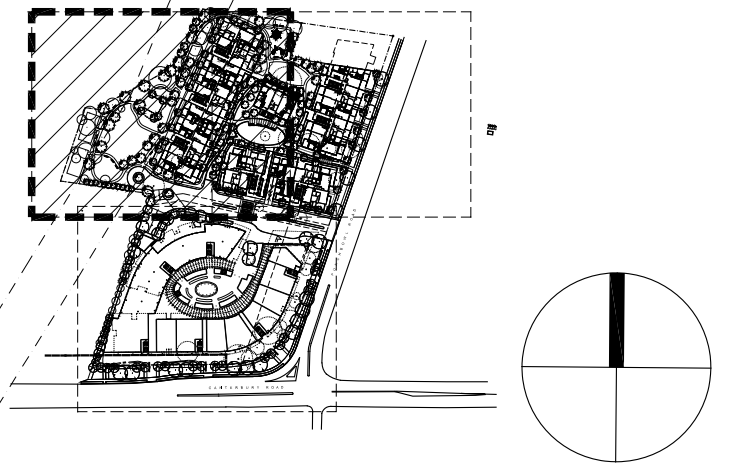
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B	For Review	PH	RS	21.11.2016
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Issue	Revision Description	Drawn	Check	Date

LEGEND

- Proposed Tree Planting
- Proposed Palm Trees
- Proposed Shrub Planting
- Proposed Accent Planting
- Proposed Groundcover
- Turf
- Proposed Paving Type 1
- Proposed Paving Type 2
- Proposed Bench Seating
- Proposed Pergola Structure

Key Plan:



Client:  
**Waldron Hill Developments**

Architect:  
**CMT Architects**

Project:  
**21 Canterbury Road  
Punchbowl**

**SITE IMAGE**

Level 1, 3-5 Baptist Street  
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**Landscape Architects**

**DEVELOPMENT APPLICATION**

Drawing Name:  
**LANDSCAPE PLAN  
RESIDENTIAL**

Scale: 1:200 @ A1

Job Number: SS16-3349

Sheet \_ of \_  
Drawing Number: 102  
Issue: E

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CONTINUES ON 102

CONTINUES ON 101

A D

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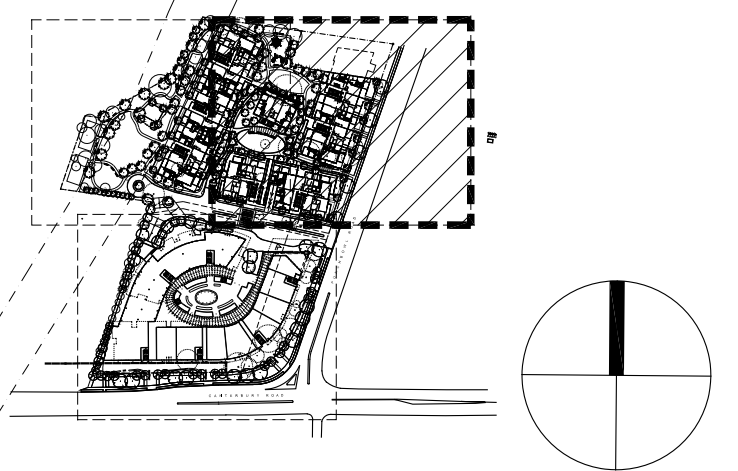
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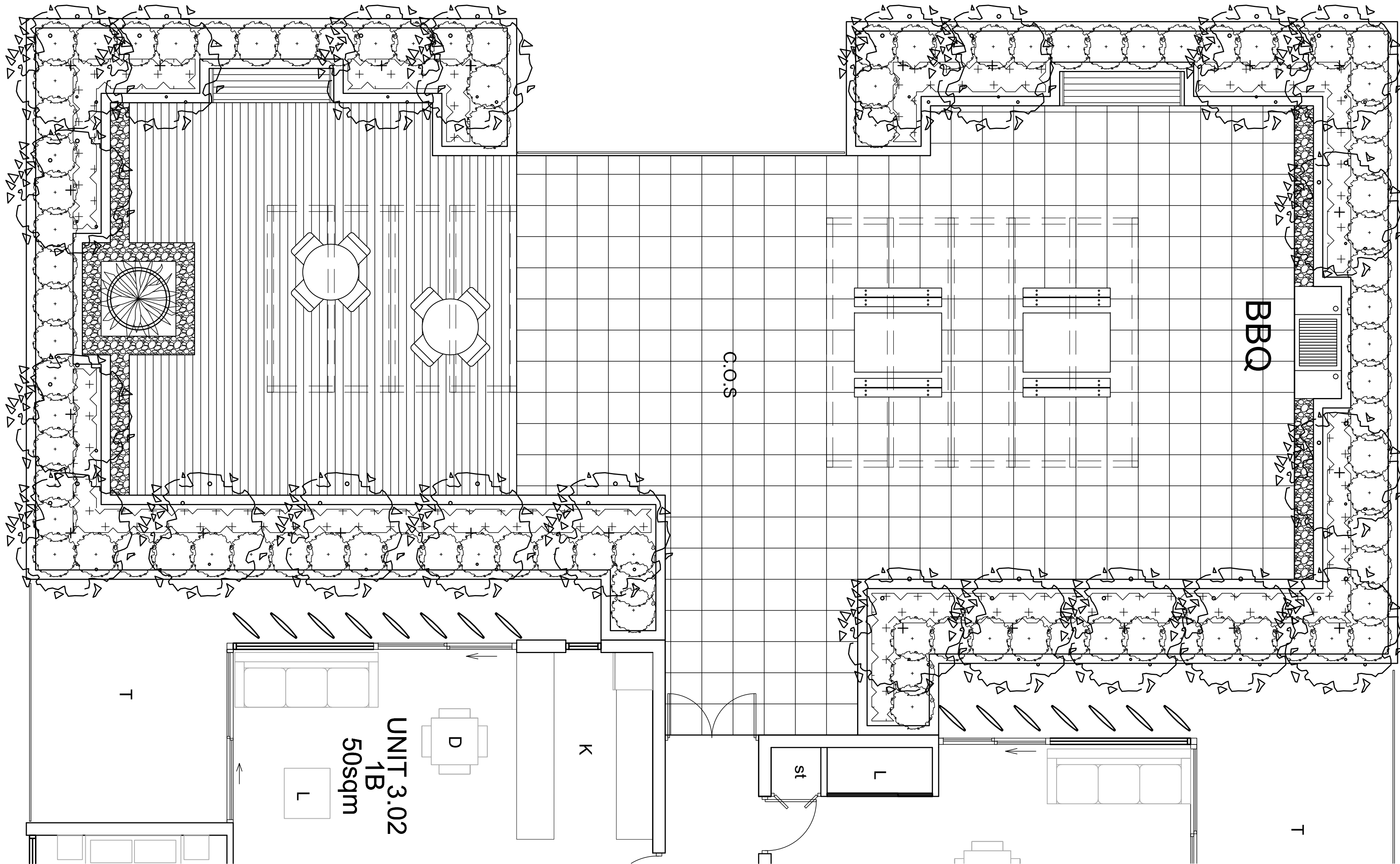
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Job Number: **SS16-3349**

Sheet \_ of \_  
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Drawing Number: **103** Issue: **E**





01  
104

LANDSCAPE PLAN - LEVEL 3 TERRACE

SCALE 1:50





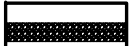



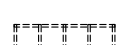

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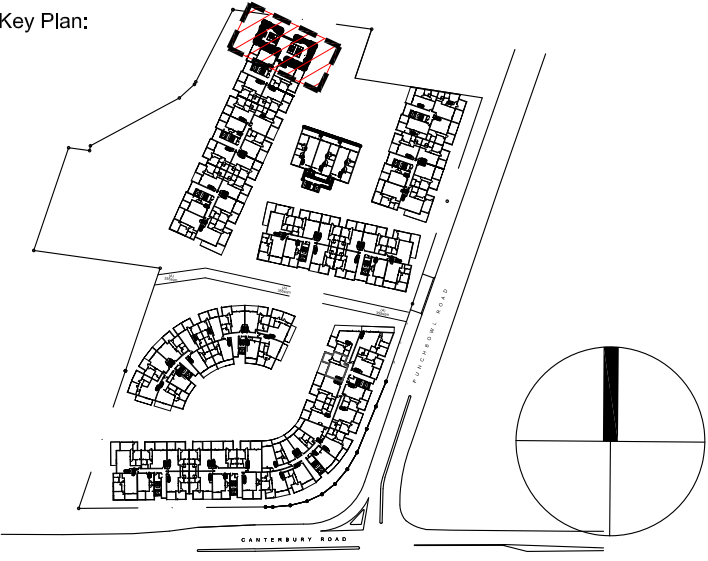
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-  Proposed Shrub Planting
-  Proposed Groundcover
-  Proposed Pot Planting
-  Proposed Pebble Paving
-  Proposed Timber Decking
-  Proposed Paving
-  Proposed Table & Chairs
-  Proposed Pergola Structure
-  BBQ facilities



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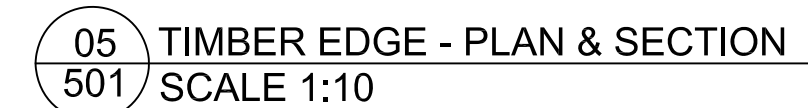
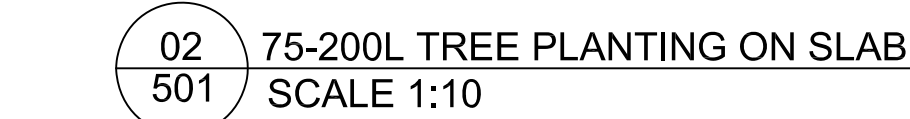
Drawing Name:  
**LANDSCAPE PLAN  
LEVEL 3 TERRACE**

Scale: 1:50 @ A1

Job Number: SS16-3349

Sheet \_ of \_  
Drawing Number: 104  
Issue: D





501 E



21 Canterbury Road, Punchbowl  
INDICATIVE PLANT SCHEDULE

BOTANIC NAME	COMMON NAME	HEIGHT	WIDTH	POT SIZE	WATER USE	INDIGENOUS/ EXOTIC
TREES						
<i>Acer negundo</i>	Box Alder	15m	8m	100Lt	L	Exotic
<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	25m	5m	100Lt	L	Indigenous
<i>Corymbia maculata</i>	Spotted Gum	30m	8m	100Lt	L	Indigenous
<i>Elaeocarpus reticulatus</i>	Blueberry Ash	12m	5m	100Lt	L	Indigenous
<i>Eucalyptus moluccana</i>	Grey Box	14m	8m	100Lt	L	Indigenous
<i>Eucalyptus robusta</i>	Swamp Mahogany	15m	6m	100Lt	L	Indigenous
<i>Fraxinus 'Raywood'</i>	Claret Ash	10m	7m	100Lt	M	Exotic
<i>Lagastroemia indica</i>	Crepe Myrtle	6m	3m	75Lt	L	Exotic
<i>Magnolia grandiflora 'Exmouth'</i>	Southern Magnolia	12m	8m	100L	M	Exotic
<i>Magnolia 'Little Gem'</i>	Dwarf Magnolia	5m	3m	75Lt	H	Exotic
<i>Melalauca quinquenervia</i>	Broad Leaf Paperbark	15m	7m	100Lt	L	Indigenous
<i>Pistacia chinensis</i>	Pistachio	8m	4m	75L	M	Exotic
<i>Tristaniopsis laurina</i>	Water Gum	10m	8m	100Lt	L	Indigenous
<i>Waterhousia floribunda</i>	Weeping Lillypilly	15m	8m	100Lt	M	Indigenous
SHRUBS						
<i>Abelia grandiflora</i>	Abelia	2m	2m	300mm	L	Exotic
<i>Acmena smithii 'Allyn Magic'</i>	Dwarf Acmena	0.5m	0.5m	300mm	L	Indigenous
<i>Acmena smithii 'Cherry Surprise'</i>	Cherry Surprise	3m	2m	300mm	L	Indigenous
<i>Banksia ericifolia</i>	Heath Banksia	4m	3m	300mm	L	Indigenous
<i>Buxus microphylla</i>	Japanese Box	1.5m	1.5m	300mm	M	Exotic
<i>Breynia oblongifolia</i>	Coffee Bush	3m	1.5m	300mm	L	Indigenous
<i>Callistemon citrinus 'White Anzac'</i>	Lemon Scented Bottlebrush	1m	2m	300mm	L	Exotic
<i>Callistemon viminalis Little John</i>	Little John Bottlebrush	0.8m	0.8m	300mm	L	Exotic
<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush	6m	01.5m	300mm	L	Indigenous
<i>Convolvulus cenorum</i>	Silver Bush	0.6m	0.8m	300mm	L	Exotic
<i>Elaeocarpus reticulatus</i>	Blueberry Ash	3m	3m	300mm	L	Indigenous
<i>Eriostemon myoporoides</i>	Wax Flower	1.5m	1.5m	300mm	L	Indigenous
<i>Gardenia augusta Florida</i>	Gardenia	1.5m	1.5m	300mm	H	Exotic
<i>Leucophyta brownii</i>	Cushion Bush	1m	1m	300mm	L	Exotic
<i>Murraya paniculata</i>	Mock Orange	3m	2m	300mm	M	Exotic
<i>Persoonia levis</i>	Broad-leaf Geebung	4m	2m	300mm	L	Indigenous
<i>Pittosporum tobira 'Miss Muffet'</i>	Dwarf Pittosporum	0.8m	1.5m	300mm	L	Exotic
<i>Photinia glabra 'Rubens'</i>	Dwarf Photinia	3m	2m	300mm	L	Exotic
<i>Rhaphiolepis Oriental Pearl</i>	Indian Hawthorne	1.5m	2m	300mm	L	Exotic
<i>Syzygium australe 'Tiny Trev'</i>	Dwarf Lilly Pilly	0.8m	0.8m	300mm	M	Exotic
<i>Syzygium 'Cascede'</i>	Pink Flowering Lilly Pilly	2.5m	1.5m	300mm	M	Exotic
<i>Viburnum tinus</i>	Laurestinus	3m	2m	300mm	L	Exotic
<i>Westringia fruticosa</i>	Native Rosemary	2m	2m	300mm	L	Indigenous
ACCENT						
<i>Asplenium australasicum</i>	Birds Nest Fern	1m	1m	300mm	L	Indigenous
<i>Cycas revoluta</i>	Japanese Sago	1.5m	1.5m		M	Exotic
<i>Doryanthes excelsa</i>	Gynea Lily	2m	2m	200mm	L	Indigenous
<i>Phormium tenax 'Bronze Baby'</i>	Dwarf Flax	0.75m	0.8m		L	Exotic
<i>Strelitzia reginae</i>	Bird of Paradise	1.5m	1.5m	300mm	M	Exotic
<i>Yucca Sp.</i>	Yucca	1.5m	1m	200mm	L	Exotic
GROUNDCOVERS AND GRASSES						
<i>Carpobrotus glaucescens</i>	Pigface	1m	1m	150mm	L	Exotic
<i>Carex appressa</i>	Tall Sedge	0.8m	0.6	150mm	M	Indigenous
<i>Convolvulus mauritanicus</i>	Ground Morning Gloy	0.1m	0.9m	150mm	L	Exotic
<i>Clivia miniata</i>	Kaffir Lily	0.45m	0.5m	150mm	H	Exotic
<i>Dianella 'Breeze'</i>	Breeze Flax Lily	0.7m	0.6m	150mm	L	Indigenous
<i>Dianella caerulea</i>	Paroo Lily	0.6m	0.6m	150mm	L	Indigenous
<i>Dianella 'Cassa Blue'</i>	Cassa Blue Flax Lily	0.40	0.40	150mm	L	Indigenous
<i>Dianella 'Silver Streak'</i>	Silver Streak Flax Lily	0.5m	0.4m	150mm	L	Indigenous
<i>Hardenbergia violaeacea</i>	False Sarsaparilla	0.3m	2m	150mm	L	Exotic
<i>Hibbertia scandens</i>	Climbing Guinea Flower	0.3m	4m	150mm	L	Indigenous
<i>Imperata cylindrica</i>	Blady Grass/Cogon Grass	0.6m	0.3m	150mm	M	Exotic
<i>Microlaena stipoides</i>	Weeping Grass	0.7m	0.3m	150mm	L	Indigenous
<i>Liriope muscari 'Evergreen Giant'</i>	Lily Turf	0.6m	0.5m	150mm	M	Exotic
<i>Lomandra longifolia</i>	Matt Rush	1m	0.5m	150mm	L	Indigenous
<i>Lomandra longifolia 'Tanika'</i>	Mat Rush	0.3m	0.7m	150mm	L	Indigenous
<i>Poa poiformis 'Courtney'</i>	Poa	0.5m	0.2m	150mm	L	Indigenous
<i>Scaevola aemula 'Mauve Clusters'</i>	Purple Fan Flower	0.3m	0.6m	150mm	M	Exotic
<i>Themeda australis</i>	Kangaroo Grass	0.6m	0.3m	150mm	L	Indigenous
<i>Trachelospermum jasminoides</i>	Star Jasmine	.75m	6m	150mm	M	Exotic
<i>Viola hederacea</i>	Native Violet	0.1m	0.3m	150mm	L	Indigenous

LANDSCAPE SPECIFICATION NOTES

GENERALLY

THE CONTRACTOR SHALL PLACE ORDERS FOR THE DELIVERY OF ALL MATERIALS, SUPPLIES, ETC., IMMEDIATELY AFTER SIGNING THE CONTRACT AND ENSURE THE SUPPLIERS GUARANTEE DELIVERY AT ALL TIMES TO ACCORD WITH THE CONSTRUCTION PROGRAM.

SITE PREPARATION

ENSURE ALL PROVISIONS FOR LANDSCAPE TO BE PROVIDED BY THE BUILDER ARE COMPLETE AND ALL CONTRACTORS RUBBISH AND DEBRIS IS REMOVED;

DRAINAGE CELL AND FILTER FABRIC

FOR ON–SLAB AREAS INSTALL AN APPROVED 'DRAINAGE CELL' PRODUCT TO COMPREHENSIVELY COVER THE BOTTOM OF ALL PLANTERS.

OVER DRAINAGE CELL TO ON–SLAB AREAS, A POLYFELT GEOTEXTILE LINING (AS SUPPLIED BY 'POLYFELT TS' OR APPROVED EQUIVALENT) IS TO BE INSTALLED TO COVER THE BOTTOM OF ALL PLANTERS, TURNED UP 300MM AND TAPED TO THE PLANTER SIDES TO ENSURE SOIL MIX DOES NOT ESCAPE INTO DRAINAGE OUTLETS/HOLES.

INSTALL MIN. 50MM COARSE RIVER SAND OVER ALL GEOTEXTILE LINING PRIOR TO INSTALLATION OF SOIL MIX.

ABORIST MANAGEMENT OF TREE PROTECTION

A QUALIFIED AND APPROVED ABORIST IS TO BE CONTRACTED TO UNDERTAKE OR MANAGE THE INSTALLATION OF PROTECTIVE FENCING, AND TO UNDERTAKE SUCH MEASURES AS HE DEEMS APPROPRIATE TO PRESERVE THE SUBJECT TREES TO BE RETAINED. THE ARBORIST IS TO BE RETAINED FOR THE ENTIRE CONTRACT PERIOD TO UNDERTAKE ONGOING MANAGEMENT AND REVIEW OF THE TREES.

IMPORTED SOIL MIX

IMPORTED LIGHTWEIGHT SOIL MIX FOR ON–SLAB AREAS AND POTS:  
LIGHTWEIGHT SOIL MIX SHALL BE COMPOSED OF THE FOLLOWING MATERIALS AND MIXED IN THE GIVEN PROPORTIONS TO PRODUCE A MATERIAL WITH A PH 6.0–6.5

SOIL MIX PER CUBIC METRE SHALL CONSIST OF:

- 30% KENTHURST BLACK LOAM
- 30% DOUBLE WASHED COARSE SAND
- 20% AUSTRALIAN PEAT
- 10% COMPOSTED BARK FINES
- 10% COMPOSTED HARDWOOD DUST

FERTILISER PER CUBIC METRE SHALL CONSIST OF

- 500GMS CALCIUM NITRATE
- 500GMS POTASSIUM SULPHATE
- 750GMS SUPERPHOSHATE MICRO FINE
- 1 KG IBDU (NITROGEN SLOW RELEASE)
- 1 KG SLOW RELEASE NUTRICOTE

PLANT MATERIAL

ALL PLANTS SHALL BE WELL GROWN, DISEASE FREE NURSERY STOCK, AND TRUE TO SPECIES TYPE. NO SPECIES SHALL BE SUBSTITUTED WITHOUT THE APPROVAL OF THE SUPERINTENDENT. NO VARIEGATED STRAIN SHALL BE USED UNLESS NOMINATED.

ALL PLANTS SHALL BE OF THE SIZE AND QUALITY CONSISTENT WITH THE NORMAL INDUSTRY EXPECTATION FOR THE NOMINATED CONTAINER SIZE. PLANTS NOT CONSISTENT WITH THE ABOVE MAY BE REJECTED WITH REPLACEMENT STOCK SUBJECT TO THE APPROVAL OF THE SUPERINTENDENT.

ALLOW TWO AGRIFORM SLOW RELEASE PELLETS PER 5–25 LITRE PLANT AND ONE PER 150MM PLANT. ALL FERTILISER IS TO BE APPLIED IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.

MULCH

TO MASS PLANTING AREAS AND STREET TREES INSTALL 75MM THICKNESS OF GRADED PINE BARK AS SUPPLIED BY AUSTRALIAN NATIVE LANDSCAPES P/L OR APPROVED EQUIVALENT. ALL MULCH SHALL BE FREE OF VEGETATIVE REPRODUCTIVE PARTS OF WEEDS

IRRIGATION SYSTEM

SUPPLY AN AUTOMATIC WATERING SYSTEM USING 'TORO IRRIGATION SYSTEM' OR SIMILAR APPROVED, WITH MICRO–JET SPRINKLER HEADS AND LOW DENSITY, RUBBER MODIFIED POLYPROPYLENE RETICULATION, TO INCLUDE FILTERS, BENDS JUNCTIONS, ENDS AND OTHER ANCILLARY EQUIPMENT. THE LANDSCAPER SHALL NOMINATE HIS SOURCE OF SUPPLY FOR THE WATERING SYSTEM AND OBTAIN APPROVAL FROM THE SUPERINTENDENT BEFORE PLACING ORDERS FOR EQUIPMENT OR SUPPLY.

A SCHEMATIC PLAN OF THE PROPOSED IRRIGATION SYSTEM IS TO BE PREPARED BY THE CONTRACTOR, SHOWING SOLENOIDS, PIPE DIAMETERS, AND ALL NOZZLE AND TRICKLE ATTACHMENT TYPES (INCLUDING SPRAY/HEAD ANGLE), FOR REVIEW BY THE SUPERINTENDENT PRIOR TO INSTALLATION

THE CONTRACTOR IS TO LIASE WITH THE HYDRAULIC ENGINEER AND COUNCIL AS NECESSARY, TO ENSURE THE THE IRRIGATION SYSTEM CONFORMS WITH ALL THE COUNCIL AND WATER BOARD CODES AND REQUIREMENTS.

PROVIDE AN AUTOMATIC CONTROLLER THAT PROVIDES FOR TWO WEEK SCHEDULING AND HOURLY MULTI–CYCLE OPERATION. THE CONTROLLER SHALL MANUAL OVERRIDE. PROGRAMMING SHALL BE UNDERTAKEN BY THE CONTRACTOR WHO SHALL ADVISE ON THE OPERATION OF THE SYSTEM.

PROVISION OF SECURE HOUSING FOR THE AUTOMATIC IRRIGATION CONTROLLER TO BE LOCATED IN ASSOCIATION WITH THE LANDSCAPE CONTRACTOR AND LOCATION CONFIRMED BY THE SUPERINTENDENT. WIRING TO CONNECT REMOTE SOLENOID LOCATIONS IS TO BE PROVIDED. THE CONTROLLER SHALL BE LOCATED IN A DRY PLACE, PROTECTED FROM THE WEATHER, AND ALL CABLE CONNECTIONS SHALL BE MADE WITH WATERPROOF CONNECTORS.

WATER SUPPLY POINTS TO BE SUPPLIED BY BUILDER.

IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ENSURE AND GUARANTEE SATISFACTORY OPERATION OF THE IRRIGATION SYSTEM.

AFTER THE SYSTEM HAS BEEN INSTALLED TO THE SATISFACTION OF THE SUPERINTENDENT, THE INSTALLATION SHALL BE TESTED UNDER KNOWN WORKING CONDITIONS. ACCEPTANCE OF THE INSTALLED PLANT AND EQUIPMENT SHALL BE SUBJECT TO THESE BEING SATISFACTORY.

TREATED PINE TIMBER EDGING

TIMBER EDGE: 100 X 25mm CCA TREATED RADIATA PINE  
TIMBER STAKES: 50 X 50 X 500mm CCA TREATED RADIATA PINE–SHARPENED AT ONE END.

INSTALL IN LOCATIONS SHOWN ON THE DRAWINGS FLUSH TO FINISHED SURFACE LEVELS.

TURF

TURF ALL LANDSCAPE AREAS AS SHOWN ON THE LANDSCAPE DRAWINGS. TURF IS TO HAVE AN EVEN THICKNESS OF NOT LESS THAN 25mm. OBTAIN TURF FROM AN APPROVED GROWER. FURNISH A WARRANTY FROM THE GROWER THAT THE TURF IS FREE FROM WEEDS AND OTHER FOREIGN MATTER. DELIVER TURF TO THE SITE WITHIN 24 HOURS OF BEING CUT, AND LAY IT WITHIN 24 HOURS OF BEING DELIVERED.

TO PREPARE GRADED AREAS TO RECEIVE TURF, EXCAVATE THE AREA AND CULTIVATE SO AS TO ALLOW FOR IMPORTING OF 100mm OF TURF UNDERLAY SOIL. REMOVE ALL STONES OVER 50mm Ø AND REMOVE ALL WEEDS AND FOREIGN MATTER. SPREAD SOIL MIX A.B.S TO A DEPTH OF 100mm AND GRADE TO APPROPRIATE LEVELS TO ACHIEVE GENERAL EVEN GRADES TO DRAINAGE OUTLETS INSTALLED BY OTHERS.

LAY THE TURF ALONG THE LAND CONTOURS WITH STAGGERED, CLOSE BUTTED JOINTS, SO THAT THE FINISHED TURF SURFACE IS FLUSH WITH ADJACENT FINISHED SURFACES OF PAVING AND THE LIKE. AS SOON AS PRACTICABLE AFTER LAYING, ROLL THE TURF WITH A ROLLER WEIGHING NOT MORE THAN 90kg PER METRE OF WIDTH FOR SANDY OR LIGHT SOILS.

WATER AS NECESSARY TO KEEP THE SOIL MOIST TO A DEPTH OF 100MM. PROTECT NEWLY TURFED AREAS AGAINST TRAFFIC UNTIL GRASS IS ESTABLISHED. FERTILISE TWO WEEKS AFTER LAYING FERTILISE A.B.S

'TOP DRESS' THE TURF WHEN IT IS ESTABLISHED TO A DEPTH OF 10MM WITH COARSE WASHED RIVER SAND. RUB THE DRESSING WELL INTO THE JOINTS AND CORRECT ANY UNEVENNESS IN THE TURF SURFACES.

MAINTENANCE

THE CONTRACTOR SHALL MAINTAIN THE CONTRACT AREAS BY THE IMPLEMENTATION OF INDUSTRY ACCEPTED HORTICULTURAL PRACTICES, AS WELL AS RECTIFYING ANY DEFECTS THAT BECOME APPARENT IN THE WORKS UNDER NORMAL USE.

THE CONTRACTOR SHALL MAINTAIN THE WORKS AND MAKE GOOD ALL THE DEFECTS.

LANDSCAPE MAINTENANCE SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING: WATERING, ADJUSTMENT OF THE IRRIGATION SYSTEM, RUBBISH REMOVAL, REPLACING FAILED PLANTS, MAINTAINING MULCH, PRUNING, INSECT AND DISEASE CONTROL, AND CLEANING OF THE SURROUNDING AREA.

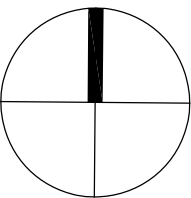
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S I T E I M A G E

Landscape Architects

DEVELOPMENT APPLICATION

Drawing Name:  
**LANDSCAPE SPECIFICATIONS  
& INDICATIVE PLANT SCHEDULE**  
Sheet \_ of \_

Scale: AS SHOWN  
Job Number: Drawing Number: Issue:

SS16-3349 502 E



TABLE OF EASEMENTS  
(A) EASEMENT FOR DRAINAGE IN C76545  
(AN) LEASE TO OPTIMISE IN C70502  
(C) RIGHT OF WAY AND EASEMENT FOR ELECTRICITY PURPOSES 2.07 WIDE IN B166752  
(S) EASEMENT FOR TRANSMISSION LINE IN G14266  
(T) EASEMENT FOR TRANSMISSION LINE IN F08354

NOTE: DIMENSIONS SHOWN HAVE BEEN COMPILED FROM  
VARIOUS LAND AND PROPERTY INFORMATION. USR PLANS ARE APPROXIMATE AND  
WILL REQUIRE A FULL BOUNDARY SURVEY FOR PROPER DETERMINATION.

