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28th April 2017

The General Manager
Cumberland Council
1 Susan Street,
AUBURN NSW 22144

To whom it may concern,

RE: CLAUSE 4.6 VARIATION – PARRAMATTA LOCAL ENVIRONMENTAL PLAN 2011
54-68 FERNDELL STREET, SOUTH GRANVILLE - LOT 50 IN DP816718
EXCEEDANCE OF HEIGHT – DEVELOPMENT STANDARD (CLAUSE 4.3)

FDC Construction and Fitout Pty Ltd (FDC) is acting on behalf of Grand Sasanqua Pty Ltd, the owners of the site, and Jaycar Electronics Group, the future occupant of the site to design and construct the proposed facility.

The proposed development will include the construction of one large industrial building and multiple smaller industrial buildings that will be used by Jaycar Electronics Group for the purposes of 'warehouse and distribution' activities. The proposal also includes the refurbishment and fitout of an existing administration building on site, car parking, landscaping and installation of associated services and infrastructure.

The proposed development involves the construction of 3 warehouse buildings, each which is proposed to be constructed to a height of 13.7 metres (at the main ridge line). This would contravene Clause 4.3 of the Parramatta Local Environmental Plan 2011 that permits a maximum height of 12 metres for new development.

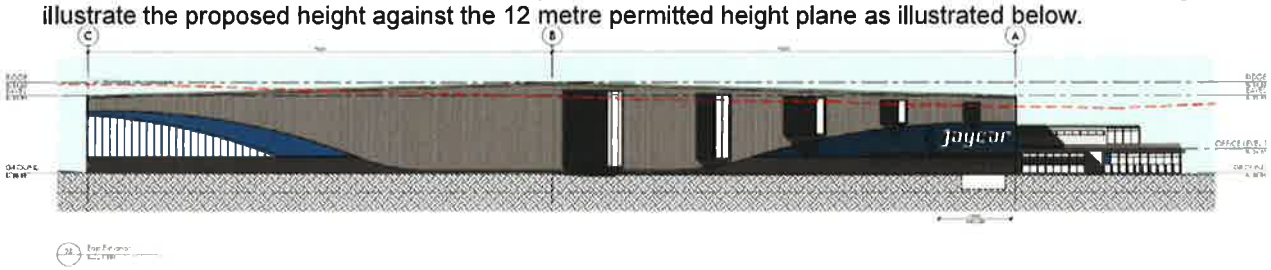
Clause 4.6 of *Parramatta Local Environmental Plan 2011* relates to 'Exceptions to development standards' and allows the consent authority to consider, 'a written request from the applicant that seeks to justify the contravention of the development standard by demonstrating:

a) *that compliance with the development standard is unreasonable or unnecessary in the circumstances of the case, and*

b) *that there are sufficient environmental planning grounds to justify contravening the development standard'.*

The following section provides such justification and confirms that the proposal is, *'in the public interest because it is consistent with the objectives of the particular standard and the objectives for development within the zone'.*

JEG's decision to construct a 13.7 metre high warehouse reflects the availability of contemporary storage and retrieval infrastructure as well as fire protection infrastructure. The attached architectural images illustrate the proposed height against the 12 metre permitted height plane as illustrated below.



Clause 4.6 - Exceptions to Development Standards

Test	Comment
IN1 General Industrial – Zone Objectives	
To provide a wide range of industrial and warehouse land uses.	The proposal involves the construction of a new warehouse for Jaycar Electronics Group to undertake storage and distribution of their products throughout Australia and New Zealand.
To encourage employment opportunities.	JEG will directly employ 230 staff to operate the facility. The majority of these staff will relocate form the existing Rydalmere facility. Overtime, as the company expands, further employment opportunities will exist to the benefit of the local and regional community.
To minimise any adverse effect of industry on other land uses.	This report has assessed potential impacts of the proposal on existing land uses and has proved that any impacts are minimal or can be appropriately mitigated. Such impacts should be considered in the context that the broader locality is zoned for the purposes of industrial development, despite there being potential conflict with nearby residential properties. The proposed building height does not result in overshadowing impacts that would affect current or future adjoining land uses. While it will result in visual impacts for the site and locality, such impacts are mitigated through the retention of existing (and established) landscape setback to Ferndell Street. The positive visual benefits of constructing a new architecturally designed building will favourably contribute to the streetscape along Ferndell Street.
To support and protect industrial land for industrial uses.	The proposal involves industrial development on industrially zoned land.
To facilitate a range of non-industrial land uses that serve the needs of workers and visitors.	Not applicable with reference to the height of the proposal.
Clause 4.3 Height of Buildings (Objectives)	
(a) to nominate heights that will provide a transition in built form and land use intensity within the area covered by this Plan	The maximum height established by the LEP is appropriate in the context of the older style industrial development seen throughout the locality. The size and scale of the proposed development (and site) is unique in the context of this location but extremely commonplace in more recently developed industrial areas such as Eastern Creek and Erskine Park. Warehouses of this nature (at a height of 13.7 metres) are common place in such locations.
(b) to minimise visual impact, disruption of views, loss of privacy and loss of solar access to existing development,	While the proposed development will result in visual impacts for the site and locality, such impacts are mitigated through the retention of existing (and established) landscape setback to Ferndell Street. The positive visual benefits of constructing a new architecturally designed building will favourably contribute to the streetscape along Ferndell Street. The development will not result in the loss of views, privacy or solar access associated with any nearby residential development. It is considered appropriate in the context of this primarily industrial locality.
(c) to require the height of future buildings to have regard to heritage sites and	No heritage sites or buildings are locality within close proximity of the site. Therefore, the proposed building heights should be considered appropriate in this regard.

Test	Comment
their settings	
(d) to ensure the preservation of historic views,	The proposed development will not affect any historic views.
(e) to reinforce and respect the existing character and scale of low density residential areas,	The proposed development will take place on an industrial zoned site and will generate significant employment opportunities and economic benefits for the locality. Whilst there are residential properties in close proximity, impacts associated with the new development can be mitigated through good architectural design and the retention of existing vegetation along Ferndell Street.
(f) to maintain satisfactory sky exposure and daylight to existing buildings within commercial centres, to the sides and rear of tower forms and to key areas of the public domain, including parks, streets and lanes.	Despite bot being within a commercial centre, the proposed height exceedance will not affect sky/daylight exposure.

Is compliance unreasonable or unnecessary in this instance?

If compliance with maximum height provisions contained in Clause 4.3 were to be enforced, the proposal would not proceed. Having undertaken an extensive search for suitable sites, alternatives would need to be reconsidered including sites in other localities (potentially outside of NSW).

Given the importance of the proposed variation to the viability of the overall project it therefore seems unreasonable or unnecessary to enforce the maximum height limit, given that few environmental impacts are anticipated.

The proposed variation will facilitate the operation of an industrial warehouse facility that will employ 230 people. It is therefore reasonable and necessary to support the proposed variation in order to achieve the objectives nominated for the IN1 General Industrial Zone.

Environmental planning grounds justifying the contravention of height

The following points summarise the planning merits associated with the proposed contravention of the nominated height requirement:

- The proposed variation does not result in any overshadowing impacts that would affect the amenity or operation of current or future development on adjoining properties;
- The proposed structure has been designed to a high architectural standard ensuring that the development will result in positive impacts on the streetscape. Existing landscaping (including many advanced trees) will be retained within the Ferndell Street setback to mitigate the impacts of new development on site.
- The proposed warehouse has been designed and positioned to ensure that it is integrated with the overall development.
- The overall development has been designed to ensure that a high standard of built form and urban design is achieved. As the locality evolves over coming years, the proposal will be well suited in the context of surrounding development;
- Efficiencies generated by increasing the height of the proposed

Test	Comment
	facility also benefit the environment by reducing the potential footprint of the building; ▪ JEG will directly employ 230 staff to operate the facility.
Is the proposed variation in the public interest?	The proposal to construct a 13.7 metre high structure to accommodate JEG's operation is in the best interests of the public. The benefits in allowing JEG to establish a localised, and purpose built facility will include: ▪ The employment of 230 people within an area defined to accommodate employment opportunities; ▪ The construction of appropriate facilities to establish and grow JEG's business; ▪ The proposed development is generally consistent with the public's expectations for development of the South Granville Industrial Area and more specifically the IN1 General Industrial Zone; ▪ The proposed variation is consistent with the objectives of Clause 4.3 in regard to height controls for development and certainly represents an example of applying Clause 4.6 to create flexibility where development standards seem unreasonable or unnecessary; ▪ While it will result in visual impacts for the current environment, such impacts are mitigated through good design and the retention of established trees within the landscape setback to Ferndell Street.

It is requested that Council consider this variation request and permit the development as proposed despite non-compliance with a development standard of the LEP. Should you have any queries in relation to this documentation, please contact the undersigned on 8117 5104 or 0401 061 119.

Yours sincerely
FDC Construction and Fitout Pty Ltd

Tim Bainbridge
Planning Manager

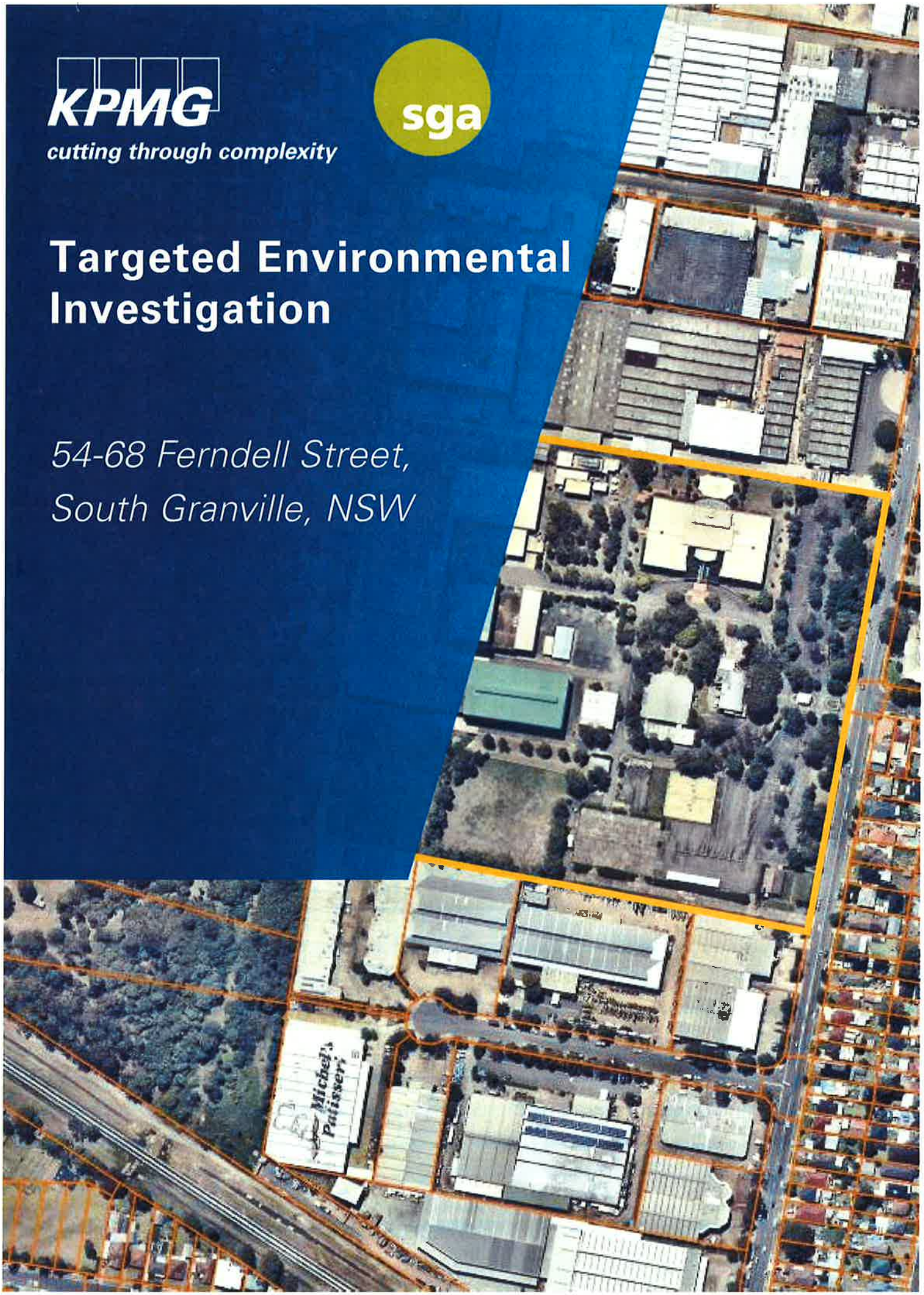
KPMG

cutting through complexity

sga

Targeted Environmental Investigation

54-68 Ferndell Street,
South Granville, NSW



Prepared for:	**Grand Sasanqua Pty Ltd** 320 Victoria Road Rydalmere NSW 2116
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Glossary of General Terms	
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
CEC	Cation Exchange Capacity
CEMP	Construction Environmental Management Plan
COCs	Chemicals of Concern
CSM	Conceptual Site Model
DA	Development Application
DCB	Dichlorobenzene
DO	Dissolved Oxygen
DQO	Data Quality Objective
EC	Electrical Conductivity
EILs	Environmental Investigation Levels
EPA	Environmental Protection Authority
ESLs	Environmental Screening Levels
GILs	Groundwater Investigation Levels
HILs	Health Investigation Levels
HSLs	Health Screening Levels
LOR	Limit of Reporting (laboratory)
mbgl	Meters Below Ground Level
MDQIs	Measurement Data Quality Indicators
NAPL	Non-aqueous Phase Liquid
NATA	National Association of Testing Authorities
NEPM ASC	National Environment Protection Council (1999) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) (Amended 2013)
ORP	Oxidation Reduction Potential
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance / Quality Control
SWLs	Standing Water Levels
TCE	Trichloroethene/Trichloroethylene
TEI	Targeted Environmental Investigation
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
TRVI	Toxicity Reference Value Inhalation
USTs	Underground Storage Tanks
VC	Vinyl chloride
VOCC	Volatile Organic Chlorinated Compounds
VOCs	Volatile Organic Hydrocarbons

1 Executive Summary

KPMG SGA Property Consultancy Pty Ltd (KPMG SGA) was engaged by Grand Sasanqua Pty Ltd (Grand Sasanqua) to undertake a Targeted Environmental Investigation (TEI) at 54-68 Ferndell Street, South Granville NSW (the site). The site was historically used as a chemical manufacturing and research facility by Merck Sharp and Dohme (MSD) since the mid-1950s. Currently the site is owned by Grand Sasanqua with the majority of the site buildings subject to demolition as part of the preliminary Jaycar Electronics Group (JEG) development works. Refer to the KPMG SGA (2017) PSI for a more detailed description of the site's history including previous environmental investigations and remediation works.

A PSI assessing the historical contamination at the site was submitted as part of a Development Application (DA) for the proposed JEG commercial head office and main product storage and distribution facility. The proposed development plan has been summarised in the PSI.

This TEI will be submitted as a supplementary report for the DA addressing the identified data gaps from the PSI.

KPMG SGA's PSI assessed the potential for site soils, soil vapour and groundwater to be impacted by chemicals of concern (COCs) which may affect the suitability of the site for the proposed commercial/industrial JEG development. The proposed development involves the construction of three on-grade warehouses and offices over the central portion of the site. Review of preliminary cut and fill plans indicates fill shall be added to the majority of the building central footprints (Appendix A).

The central portion of the site has been subject to previous contaminating activities associated with its historical land use. The main COCs of concern including chlorobenzenes (volatile organic compounds [VOCs]), BTEX, petroleum hydrocarbons and lead. In addition, the site has previously undergone remediation associated with pharmaceutical waste disposal and arsenic impacted soils.

The conceptual site model (CSM) in the PSI highlighted the following human health risks:

- future site users may be exposed to inhalation of VOCs through vapour intrusion to proposed central warehouse building, associated with the BRW2 plume. Refer to Figure 2 and the URS Figure in Appendix B
- future site users may be exposed to inhalation of BTEX and petroleum hydrocarbons through vapour intrusion within the proposed building / warehouse
- there may be potential for site workers to encounter impacted soils during localised earth moving works associated with construction and ongoing site use.

The objectives of the TEI were too assess the risk of:

- the presence and nature of volatile organic compounds within soil vapour beneath the central portion of site associated with the known chlorinated benzene groundwater plume, with consideration for the DA's commercial and industrial use

- the presence and nature COCs within soil beneath the central dock area, Dangerous Goods depots 5 and 6 and areas of former USTs with consideration for the DA's commercial and industrial use.

The TEI comprised of the following work:

- drilling, soil sampling and analysis of 16 targeted boreholes across the site
- groundwater sampling and analysis of 7 selected existing ground water wells
- installation, sampling and analysis of 7 soil vapour wells.

Based on the findings of the TEI undertaken, KPMG SGA consider that the site is suitable for the proposed JEG commercial/industrial development providing the below recommendations are followed. KPMG SGA form this opinion due to the fact that:

- No COCs were identified above the adopted guidelines in the soil samples collected and analysed.
- No COCs were identified above the adopted guidelines in the soil vapour samples collected.

Concentrations of benzene, chlorobenzene, 1,2 dichlorobenzene, 1,4 dichlorobenzene concentrations were detected above the adopted criteria at groundwater well BRW2. Potential inhalation of VOCs by future site users remains a possibility due to the proposed construction of the warehouse building in association with the BRW2 plume. KPMG SGA recommends the following:

- a construction design that would not cause a preferential vapour pathway to the newly constructed building. If this is not possible a more detailed risk assessment will be required to assess the appropriate vapour controls for the building / warehouse
- ambient air testing prior to occupation of the building to validate that the COC vapour intrusion is not entering the building
- annual groundwater monitoring of wells BRW2, BRW3, BRW4 and BRW5 to assess the trends of the chlorinated benzene plume.

A Construction Environmental Management Plan is recommended to be produced by an environmental consultant to include:

- an unexpected findings protocol specifying how to manage identification of potential contamination (such as asbestos) during the development works
- soil management including separation, stockpiling, testing, classification, and offsite disposal in accordance with NSW Waste Classification guidelines
- groundwater management in the event that groundwater is encountered during the development.

2 Introduction

KPMG SGA were engaged to undertake a Targeted Environmental Investigation (TEI) at 54-68 Ferndell Street, South Granville NSW (the site), refer to Figure 1. This TEI should be read in conjunction with the KPMG SGA (May 2017) Preliminary Site Investigation, 54 – 68 Ferndell Street South Granville, NSW (PSI).

A Preliminary Site investigation (PSI) assessing the historical contamination at the site was submitted as part of a Development Application (DA) for the proposed Jaycar Electronics Group (JEG) commercial head office and main product storage and distribution facility. The proposed development plan has been summarised in the PSI.

This TEI will be submitted as a supplementary report for the DA addressing the identified environmental data gaps from the PSI.

KPMG SGA confirm that this report for KPMG SGA project 314465.01 and issued on 20 July 2017 and 4 August 2017 has been prepared for the benefit of Grand Sasanqua in accordance with the agreed scope of work set out in our executed Enagement Letter, dated 9 June 2017.

A party, other than Grand Sasanqua, may only rely on the report if it has executed a formal Letter of Reliance with KPMG SGA. If you have not executed a formal Letter of Reliance with KPMG SGA and you choose to rely upon the report or any part thereof you will do so entirely at your own risk.

2.1 Background

The site was historically used as a chemical manufacturing and research facility by Merck Sharp and Dohme (MSD) since the mid-1950s. Currently the site is owned by Grand Sasanqua with the majority of the site buildings subject to demolition as part of the preliminary JEG development works. Refer to the KPMG SGA (2017) PSI for a more detailed description of the site's history including previous environmental investigations and remediation works.

KPMG SGA's PSI assessed the potential for site soils, soil vapour, or groundwater to be impacted by chemicals of concern (COCs) which may affect the suitability of the site for the proposed commercial/industrial JEG development.

The proposed development is the construction of three on-grade warehouses and offices over the central portion of the site. Review of preliminary cut and fill plans indicates fill shall be added to the majority of the building central footprints (Appendix A).

Until 2003 MSD were required to conduct and provide groundwater monitoring round reports to the NSW Environmental Protection Authority (EPA). Ongoing annual groundwater monitoring continued till January 2014, with additional groundwater monitoring conducted by KPMG SGA in 2016. A chlorinated benzene plume at BRW2 was NSW EPA's main concern, however correspondence between the EPA and MSD in 2003 detailed that the EPA was satisfied that the plume was not migrating offsite. The subsequent GMEs have since validated this statement.

The PSI identified the following locations, activities and COCs as summarised in Table 1. Solomon's Hill and the site's general fill material is not part of this investigation as it has either been previously assessed or will not be affected by the proposed development. Refer to Appendix B for URS Historical Site Layout Figure (URS, November 2013, Environmental Site Investigation, Merck Sharp and Dohme, South Granville NSW [Reference 9]).

Table 1 Summary of Historical Contaminants of Concern

Location / Source	Activity	COC
Deeper semi confined shale groundwater plume within centre of the site in vicinity of BRW2.	Former chemical manufacturing building. Residual bedrock impact following excavation and remediation.	Chlorobenzenes (1,2-Dichlorobenzene, 1,3-Dichlorobenzene and 1,4-Dichlorobenzene)
Solomons Hill	Stockpiling of remediated landfill waste. (characterised and remediated).	Chlorobenzenes and residual pharmaceutical product
Former USTs in the vicinity of the former chemical building, central loading dock, admininstration building and former Lan-O-Leen building.	Former fuel, oil and mineral spirit USTs removed as part of remediation program in 1987	Hydrocarbons BTEX VOCs Lead
Central Dock and Dangerous Goods Depot 5 and 6	Former tank and drum storage and USTs. Formerly stored waste oils, alcohols, ethanol and solvents.	Hydrocarbons VOCs
Entire site	General fill material	Surficial asbestos

2.2 Objective

The objective of TEI was to assess the risk associated with data gaps identified in the PSI and assess the implications of such risks to the proposed development, as listed:

- The presence and nature of volatile organic compounds within soil vapour beneath the central portion of site associated with the known chlorinated benzene groundwater plume, with consideration for the DA's commercial and industrial use.
- The presence and nature COCs within soil beneath the central dock area, Dangerous Goods depots 5 and 6 and areas of former USTs with consideration for the DA's commercial and industrial use.

2.3 Scope of Works

The TEI scope of works undertaken were as follows:

- provision of a sampling plan showing proposed sampling locations
- provision of a Safe Work Method Statement
- undertake a 'Dial Before You Dig' search and location of underground services using a service locator
- drilling of a total of sixteen (16) targeted soil investigation boreholes to at least 0.5 metres into natural soil or refusal

- collection of soil samples at each borehole from fill, disturbed, or visually impacted layers as well as natural soil
- detailed logging of each borehole by an experienced scientist including description of soil texture, colour, inclusions, moisture, odour and signs of contamination
- purging and sampling of seven (7) existing groundwater monitoring wells using a peristaltic pump and disposable Teflon tubing
- measurement of field groundwater parameters (temperature, electrical conductivity, pH, redox state and dissolved oxygen until the parameters stabilised
- drilling of a total of seven (7) targeted soil vapour wells to approximately 1 metre below ground level (mbgl)
- purging and sampling of seven (7) soil vapour wells using laboratory certified SUMMA canisters and flow control devices
- field works and sampling in line with KPMG SGA's standard quality assurance procedures including the collection and analysis of duplicate samples for quality control purposes
- laboratory analysis of selected samples at a NATA accredited laboratory for COCs including heavy metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene and xylene (collectively known as BTEX), polycyclic aromatic hydrocarbons (PAHs), phenols, and volatile organic compounds (VOCs)
- provision of an TEI report detailing the findings of the field investigation and the evaluation of laboratory results with reference to the current of National Environment Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) Measure 1999 (Amended 2013) (NEPM ASC) (Reference 7) and state-based legislation and guidelines.

3 Site Location and Description

The site is located at 54-68 Ferndell Street, South Granville, NSW as depicted in Figure 1.

The details are summarised in the Table 2 below:

Table 2 Summary of Site Location and Description

Item	Details
Address	54-68 Ferndell Street, South Granville, NSW
Land Identifier	Lot 50 on DP816718
Total Site Area	Approximately 100,327 m^2
Local Government Authority	Cumberland Council
Site Location Map	Figure 1
Sample Locations	Figure 2

3.1 Environmental Setting

The geology underlying the site, as described in the Geological Survey NSW (1983) – Sydney 1:100,000 Geological Sheet, consists of Triassic aged Ashfield Shale which is part of the Wianamatta Group. This geological unit is described as shale, carbonaceous claystone, laminate, fine to medium grained lithic sandstone with rare coal.

The Australian Soil Resource Information System describes the soil on the site as falling within the sodosol soil order, using the Australian Soil Classification System. Sodosols are soils with strong texture contrast between A horizons and sodic B horizons which are not strongly acid. Generally Sodosols are considered to have low permeability.

Previous environmental investigations have described the site geology as consisting of shallow to moderately deep red and brown Podzolic soils on crests, upper slopes and well drained areas, with deep yellow Podzolic soils and Soloths on lower slopes and in areas of poor drainage (Blacktown Grouping). The eastern part of the site may potentially be located within developed terrain (Department of Land and Water Conservation, 1:100,000 Soil Landscape Series Sheet 9130, Sydney, 1989).

Bore logs from previous investigations suggest that the soils are typically described as orange-grey clays with a medium to high plasticity and minor gravel inclusions to a depth of approximately 3 metres below ground level (mbgl) where weathered shale and clay was encountered between 3 mgbl to 7 mbgl with a shale bedrock starting at 7 mbgl. The previous soil descriptions are comparable to the field observation made by KPMG SGA on the 20 to 22 of June 2017.

A review of the ASRIS Coastal Acid Sulphate Soil Risk Map has identified that the site is located over an area with a low probability of occurrence of acid sulfate soils. Review of the Parramatta City Council Local Environmental Plan revealed that is

located within a Class 5 area of land, indicating that acid sulfate soils are not expected to affect the proposed development at the site.

The hydrogeology of the area has been based on the previous groundwater monitoring investigations (Reference 9 and KPMG SGA, 2016, Review of Environmental Risk – 54 Ferndell St, South Granville, NSW [Reference 16]) which have identified an upper and lower aquifer beneath the site. The upper aquifer was located within the fill materials while the lower aquifer was located within the shale bedrock. The standing groundwater level for the deeper aquifer is depths ranging from 2 to 3 mbgl. A groundwater elevation contour map was developed by URS (Reference 9), which showed an inferred flow direction towards the east north east. On the 28 and 29 June, KPMG SGA observed the standing water level to be between 2.7 mbgl and and 4.5 mbgl, (refer to Section 6.4.2).

Based on the soil and geological review, the site is in an area located over relatively impermeable clays, overlying potentially fractured shale bedrock. The depth to groundwater is approximately 5 mbgl in a semi confined aquifer. Based upon this information, the potential migration of COCs within this geological system is considered to be moderate.

4 Data Quality Objectives

Development of data quality objectives (DQOs) for each project is a requirement of NEPM ASC. This is based on a DQO process formulated by the United States Environmental Protection Agency (US EPA) for contaminated land assessment and remediation. The method provides sound guidance for a consistent approach in understanding site assessment and remediation.

The DQO process has seven steps. Each of these steps has been given due consideration in the undertaking of this project. In brief, these steps are:

Step 1: State the problem and establish the DQO team.

Step 2: Determine the possible and probable actions that will resolve the problems.

Step 3: Identify the informational inputs to assist in the problem resolution.

Step 4: Define the boundaries of the study (geographical, temporal, etc.).

Step 5: Develop and define decision rules.

Step 6: Specify tolerable limits to reduce probability of incorrect decisions.

Step 7: Ensure the quality of the information obtained.

Step 1 — State the Problem

Grand Sasanqua is in the process of submitting a DA for the proposed JEG commercial/industrial development at the site and have been requested by the Cumberland Council to include a 'Contamination Report'.

Previous investigations and the KPMG PSI have identified soil and groundwater contamination at the Site. This investigation is designed to address the following data gaps in the conceptual site model:

- Assess the presence and nature of volatile organic compounds within soil vapour beneath the central portion of site associated with the known chlorinated benzene groundwater plume, with consideration for the DA's commercial and industrial use
- Assess the presence and nature COCs within soil beneath the central dock area, Dangerous Goods depots 5 and 6 and areas of former USTs with consideration for the DA's commercial and industrial use

Step 2 — Identify the Decision

The principal decisions to be made were:

- What were the nominated COCs potentially present within soil, vapour, and groundwater beneath the site?
- What were the suitable human health and ecological criteria for the prosed industrial commercial land use?
- What were the concentrations of these COCs within the within soil, vapour, and groundwater?
- Were concentrations of the nominated COCs within soil and groundwater above the site criteria when evaluated using the nominated decision rules?

- Is the site suitable for proposed commercial/industrial land use and the JEG development from the perspective of protection of human health and the environment?
- If not suitable for current or proposed land use, what further works are required to further assess suitability or make the site suitable?

Step 3 — Identify the Inputs to the Decision

The study inputs comprised existing information and information collected during the site inspection. These included:

- review of site characteristics
- observations made during the field investigation
- soil, soil vapour and groundwater laboratory analysis using NATA accredited methods
- consideration of soil, soil vapour and groundwater laboratory results with reference to relevant guidelines.

Step 4 — Define the Study Boundaries

The temporal period of the study was limited to site conditions at the time of the fieldwork (20 to 29 June 2017).

The scope of the study is limited to that described in Section 2.3. The physical boundary of the study area is defined in Section 3 and shown on Figure 2.

Practical constraints to the collection of data include:

- the availability of information contained within the previous environmental investigations
- the physical constraints posed by such factors as buildings, site structures, and large vegetation that may affect site access during the inspection
- the financial budget approved by the client.

The nominated COCs for soil, soil vapour, and groundwater were based on a range of COCs potentially associated with the historical use of the site for pharmaceutical manufacturing. The following groups of primary COCs had been derived from the PSI CSM as shown in Table 3.

Table 3 Summary of Contaminants of Concern

Location / Source	COC
Deeper semi confined shale groundwater plume within centre of the site in vicinity of BRW2.	**Groundwater** Chlorinated benzenes (1,2-Dichlorobenzene, 1,3-Dichlorobenzene and 1,4-Dichlorobenzene)
	Soil Vapour VOCs
Soil from the former USTs in the vicinity of the former chemical building, central loading dock, admininstration building and former Lan-O-Leen building.	**Soil** Hydrocarbons BTEX VOCs Lead
Central Dock and Dangerous Goods Depot 5 and 6	**Soil** Hydrocarbons VOCs

Step 5 — Develop and Define Decision Rules

Under the DQO process, it is important to nominate action levels for decision making.

In order to make a correct decision, the input laboratory data obtained needs to be confirmed to be suitable. Acceptable limits for field data analysis (relative percent differences (RPDs) for primary and duplicate results) were less than 50 percent, however a range of up to 150% can be acceptable (depending on the origin of the sample and volatility of the chemicals present). Acceptable limits for laboratory duplicate analysis were set based on site specific information such as background concentrations. These are summarised in as the measurement data quality indicators (MDQIs) (as shown in Table 4) Measurement Data Quality Objectives, which were used to establish whether the DQOs have been met.

It should be noted that NEPM ASC references Standards Australia AS 4482.1 (Reference 1), specifies MDQIs for precision should be ≤50% RPD. However, they also acknowledge that low concentrations and organic compounds in particular, can be acceptably outside this range. AS 4482.1 suggests that ≤50% RPD be used as a 'trigger' and values above this level of repeatability need to be noted and explained.

Note, due to the small scope of this investigation, no inter laboratory duplicates, rinsate blanks or trip blanks were assessed.

Table 4 Measurement Data Quality Objectives

Parameters	Procedure	Minimum Frequency	>5<10 x LOR4	>10 x LOR
Precision (Repeatability)	Field Duplicates	1 in 20 (for metals and semi volatiles)	<80-100 RPD	<50-80 RPD
	Field Duplicates	1 in 20 (volatiles)	<150 RPD	<130 RPD
	Lab Replicate	1 in 20	<50 RPD	<30 RPD
Accuracy	Reference Material	1 in 10	60% to 140% R	80% to 120% R
	Matrix spikes	1 in 10	60% to 140% R	80% to 120% R
	Surrogate spikes	1 in 10	60% to 140% R	80% to 120% R
Representativeness	Reagent Blanks	1 per batch	No detection	No detection
	Holding Times	Every sample		
Blanks	Trip Blank	1 per batch	No detection	No detection
	Rinsate Blanks	1 per batch	No detection	No detection
Sensitivity	Limit of Reporting	Every sample	2 x LOR	< investigation criteria

Note(s):
1. RPD – relative percentage difference
2. % R – percent recovery
3. LOR – limit of reporting
4. no limit at <5x LOR
5. the MDQI is usually specified in the standard method. If not, use the default values set out in this table

Once the laboratory data for the COC had been deemed suitable for use, based on the MDQIs, the following decision rules were used to make an assessment if concentrations of COCs were acceptable levels from a human health and ecological risk perspective.

The decision rules for soil (where there is considered to be sufficient data):

- the 95% upper confidence level (UCL) of the mean of the COC must be below the nominated investigation level
- the mean concentration of the COCs must be below the nominated investigation level
- no single sample concentration can exceed 250% of the nominated investigation level
- the standard deviation of the COC population must be below 50% of the investigation level.
- The nominated investigation levels are discussed in Section 5.

As such, if statistical analysis of concentrations of individual COCs are in agreement with the decision rule then concentrations of COCs onsite were considered to be below the investigation criteria. If the contrary occurs, then further investigation, remediation or risk assessment may be warranted.

Statistical analysis will only be warranted when elevated concentrations of COCs are detected and analysis is considered likely to provide evidence that the concentrations are not statistically significant.

Step 6 — Specify Tolerable Limits on Decision Errors

There are two types of decision errors. If one assumes that the site is impacted by COCs (the null hypothesis):

a) deciding that the site is not impacted when it actually is (Type I error). The consequence of this error may be unacceptable ecological or health risk for future users of the site

b) deciding that the site is impacted when it is not (Type II error). The consequence of this error is that the client or a future potential owner will pay for further investigation / remediation that is not necessary

If the null hypothesis position that the site is impacted is adopted, the estimation of a 95% UCL will reduce the occurrence of decision error (a) errors to 5%.

Step 7 — Optimise the Design

During the DQO process the sampling design was optimised through several iterations. Optimisation of the design included evaluating Steps 1 - 6 of the DQO process. The following are the key steps taken to optimise the sample design:

- sampling design based on area coverage, available information on infrastructure and soil/fill conditions within the investigation area
- revisions of sampling locations on site prior to fieldworks taking into account access constraints, location of underground services, infrastructure and work health and safety considerations
- adjustment of sample analysis plan based on field observations and soil samples collected.

The final field program and sampling pattern was considered optimal taking into account the purpose of the investigation, access constraints, budget and temporal limitations. A detailed discussion on the sampling program is presented in Section 6.

5 Investigation Criteria

The following sections outline the investigation assessment criteria for soil, groundwater and soil vapour adopted during the TEI.

5.1 Investigation Assessment Criteria

The National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM 1999) is made under the National Environment Protection Council Act 1994 and was developed to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry. The NEPM 1999 was amended on 16 May 2013, with subsequent national implementation, and is referred to within this report as NEPM ASC.

The NEPM ASC Schedule B1 – Guideline on Investigation Levels for Soil and Groundwater provides a framework for the use of investigation and screening levels for soil, soil gas and groundwater. The framework is based on a matrix of human health, ecological and groundwater investigation and screening levels in conjunction with guidance for specific COCs. The investigation levels and screening levels presented in the NEPM ASC are the concentrations of a COC above which further appropriate investigation and evaluation would be required.

The guidelines included:

- **Ecological Investigation Levels (EILs)** – for selected metal and organic substances and are applicable for assessing risk to terrestrial ecosystems.
- **Ecological Screening Levels (ESLs)** – for BTEX, total petroleum hydrocarbon (TPH) and benzo(a)pyrene compounds and are applicable for assessing risk to terrestrial ecosystems.
- **Groundwater Investigation Levels (GILs)** – for a broad range of metal and organic substances. The GILs are the concentrations of a COC in groundwater above which further investigation (point of extraction) or a response (point of use) is required. GILs are based on Australian Water Quality guidelines and drinking water guidelines and are applicable for assessing human health risk and ecological risk from direct contact (including consumption) with groundwater
- **Health Investigation Levels (HILs)** – for a broad range of metal and organic substances. The HILs are applicable for assessing human health risk via all relevant pathways of exposure.
- **Health Screening Levels (HSLs)** – for BTEX, TRH and naphthalene compounds and are applicable to assessing human health risk via the inhalation and direct contact pathways.
- **Petroleum Hydrocarbon Management Limits (Management Limits)** – are applicable to TPH compounds only. They are applicable as screening levels following evaluation of human health and ecological risks and risks to groundwater resources. They are relevant for operating sites where significant sub-surface

leakage of TPH compounds has occurred and when decommissioning industrial and commercial sites. The Management Limits are only applied where applicable.

- **Interim Soil Vapour Health Investigation Levels (Interim HILs)** - for selected volatile organic chlorinated compounds (VOCCs) and are applicable to assessing human health risk by the inhalational pathway

5.2 Derivation of Assessment Criteria

Application of these investigation and screening levels form the basis of a Tier 1 risk assessment. If concentrations are found to exceed the applicable investigation levels, further investigations and a site specific risk assessment may be necessary.

5.2.1 Soil Criteria

The current and intended future use of the Site is commercial/industrial. In addition, commercial/industrial land uses are present in the majority of the surrounding areas, particularly in the inferred down-gradient direction from the Site.

Health Investigation Levels (HILs)

A single set of health investigation level (HIL) values is presented in the NEPM 1999 (2013 amendment). KPMG has adopted HIL-D values for a commercial and industrial land use.

Health Screening Levels (HSLs)

As the main soil type for this site is clay, HSL-D with clay soil for a commercial and industrial land therefore been adopted to assess for vapour intrusion from soils.

Ecological Screening Levels (ESLs)

The ESLs for a commercial/industrial land use are considered most appropriate and have been selected.

Ecological Investigation Levels (EILs)

In applying the EILs for specific heavy metals, the Ambient Background Concentration (ABC) were calculated and appropriate Added Contaminant Limits (ACL) chosen based on physiochemical soil characteristics including soil pH and cation exchange capacity (CEC). For the purposes of this investigation, soil pH and CEC were based on sample results collected from the material on site. The EILs were calculated using the NEPC EIL - Interactive Calculation Spreadsheet.

5.2.2 Groundwater Criteria

The groundwater investigation levels adopted include the ANZECC 2000 Investigation levels for freshwater aquatic ecosystems (Duck Creek nearest sensitive receptor) and the Australian Drinking Water guidelines. It should be noted that due to the highly disturbed nature and commercial/industrial use of the site (and surrounding sites) the potential for groundwater on the site to be utilised for drinking water purposes is considered to be minimal. The investigation will therefore prioritise assessment against the freshwater aquatic ecosystem investigation levels. For chlorobenzene the ANZECC 2000 GILs only provide guidelines which are described as low reliability criteria. These guidelines have been formulated from limited studies into the potential adverse effects of the particular COC and therefore they are considered low reliability.

The low reliability guideline for chlorobenzene is 55 µg/L, this guideline was adopted by URS in the annual monitoring, however the drinking water guideline for chlorobenzene is 300 µg/L, therefore KPMG SGA have in this instance referred to both the low reliability guideline level of 55 µg/L and the drinking water guideline level of 300 µg/L.

The HSLs have been developed for groundwater at 2 to <4 mbgl. While unlikely following the proposed development works it possible that the groundwater may be shallower than this. It is also noted that groundwater HSLs are not available for VOCs.

5.2.3 Soil Vapour Criteria

The investigation is intended to provide guidance on potential risks to future site occupants by via vapour intrusion of VOCs. Interim HILs for selected volatile organic chlorinated compounds (VOCCs) and HSLs for petroleum hydrocarbon vapours were adopted. There are no interim HILs for chlorinated benzenes. The tier one vapour criteria for chlorinated benzenes was calculated using the NEPM HIL calculator.

The following Toxicity Reference Value Inhalation (TRVI) (mg/m^3) were inputted into the NEMP HIL calculator (Reference 7)):

- Chlorobenzene - 0.05 mg/kg/per day (US EPA Provisional Peer Review Toxicity Values [Reference 11])
- 1,2 Dichlorobenzene – 0.2 mg/kg/per day (US EPA Superfund Health Effects Assessment Summary Tables [Reference 12])
- 1,4 Dichlorobenzene – 0.8 mg/kg/per day (US EPA Integrated Risk Information Systems [Reference 13])

Using the above values, the derived Tier one screening HIL criteria for chlorinated benzenes are:

- Chlorobenzene – 2,100 µg/m^3
- 1,2 Dichlorobenzene – 9,100 µg/m^3
- 1,4 Dichlorobenzene – 33,000 µg/m^3

6 Field Investigation

6.1 Sampling Analysis Plan and Methodology

A dial before you dig (DBYD) plans were obtained and reviewed to identify the entry points of underground services onto the Site. A service contractor (Durkin) was engaged to identify underground services that may be present beneath the selected locations. A service wand and ground penetrating radar was used.

6.1.1 Soil Investigation

The soil intrusive investigation included sixteen (16) targeted borehole (BH) locations across the site, as shown in Figure 2. BH1 to BH16 were drilled using the push tube method to 0.5 metres into natural material or refusal. The boreholes depths were drilled between 2.2 - 3.5 mbgl.

The key potential sources of COCs considered the historical industrial site use. Sampling locations were designed to target historical potentially contaminating areas identified in the PSI (reference 6). The soil sampling locations are shown on Figure 2.

The laboratory analysis schedule for samples was determined in consideration of these potential sources. The COCs are listed in Section 4.

6.1.2 Soil Sampling Methodology

A total of 71 primary soil samples were collected directly from push tubes liners. Each soil sample was collected with disposable nitrile gloves and placed into laboratory provided glass jars with Teflon lids and minimal headspace. Headspace vapour was assessed by using a photoionisation detector (PID) and recorded on the borehole logs. Each sample container was clearly labelled with the project number, sample location and date of sample collection using a waterproof marker. Upon collection, samples were immediately placed into a chilled cooler for storage and later transport to the laboratory.

6.1.3 Groundwater Investigation

Seven existing groundwater wells were sampled, as shown on Figure 2. BRW1A was not located due to demolition works and was not sampled.

6.1.4 Groundwater Sampling Methodology

The following groundwater well sampling procedure was undertaken:

- Prior to sampling, standing water levels (SWL) were measured.
- Wells were sampled and purged using a minimal drawdown technique, where the standing water levels were monitored and the pumping rate altered so the well screen was not dewatered. A peristaltic pump was used for the groundwater sampling. This is considered appropriate due to the shallow depth to groundwater, which was considered unlikely to have resulted in significant lifting pressure and degassing of VOCs. Dedicated tubing for each sampling location was used to minimise the potential for cross contamination. Monitoring of chemical

characteristics with a calibrated groundwater multi parameter water meter was undertaken to confirm samples were representative of formation water. Groundwater wells were sampled once the chemical characteristics stabilised as follows:

- ± 10 % for dissolved oxygen (DO)
- ± 3% for electrical conductivity (EC)
- ± 0.05 pH units
- 10 mV oxidation reduction potential (ORP).

- Samples were collected in laboratory supplied bottles. Inline field filtering (0.45 um) and acid preservation was undertaken for metals analysis samples.
- Upon collection, samples were placed immediately into ice filled coolers for storage and transport to the laboratory.

6.1.5 Soil Vapour Investigation

The soil vapour works were undertaken on 28 July 2016. The following procedures were undertaken onsite:

- Installation of soil vapour ports (constructed of 152mm stainless steel screens connected to the surface via Teflon tubing) in selected locations and depths around the BRW2 plume area.
- Purging of soil vapour ports using a 6L certified Silcosteel Summa Canister
- Collection of vapour samples from soil vapour ports using 1 litre certified Silcosteel SUMA Canister equipped with calibrated and leak checked flow restrictors
- Sampling equipment was held within a plastic chamber during sampling and an isopropyl alcohol soaked rag was placed in the vicinity of all soil vapour ports to assess the potential of leakage from the vapour ports or Suma canister connections

The laboratory analysis schedule for samples was determined in consideration of these potential sources. The COCs are listed in Section 4.

6.1.6 Soil Vapour Sampling Methodology

Vapour ports were installed by initially hand auguring to the target depth. Refer to Table 6 for soil vapour port depths. Vapour screens were then inserted to the base depth of the borehole and 2-4 mm graded sand was placed around and above the screened port. Powdered and pellet bentonite was placed in three contiguous layers to the surface and hydrated slowly to ensure water did not infiltrate the sand pack or vapour screen. Prior to sampling, each vapour port was left to equilibrate for approximately 1 hour period and then purged approximately 3.5 x the sample train and sand screen volume using a laboratory provided summa canister.

Prior to sampling a stop test was performed to assess airtight integrity of the sample train. In the event that the sample train did not maintain a negative pressure (indicative of a leak) the connections were re-checked and the stop test was conducted again. Sample collection did not begin until the sample train was deemed to be airtight.

Sampling was undertaken using laboratory provided vapour canisters, regulators and sample tubing. A volatile isopropyl alcohol source was placed within the shroud, in close proximity to the canister/vapour port during sampling to assess the integrity of

the bentonite slab seals installed during vapour port construction and connection seals between canisters, regulators and the sampling tubes. Soil vapour port sampling was undertaken over a 1 hour sampling period.

The summa canisters pressure was noted before and after sampling for comparison with reading collected by envirolab before shipping and analysis.

A duel canister manifold was used at sample VS-7 to collect a duplicate, blind replicate sample.

Each sample canister was clearly labelled with the project number, sample location and date of sample collection using individually assigned labels. Once collected, all samples were carefully wrapped and stored for transportation to the laboratory.

6.2 Rationale for Sampling Pattern Selection

A sampling pattern was developed based on the PSI and through the DQO process. The rationale of the TEI sampling pattern for soil, soil vapour and groundwater is summarised in the Table 5 below. The positions of the sampling locations are shown on Figure 2.

Table 5 Rational for Sample Pattern Selection

Sample ID	Location	Justification
BH01 to BH04	Dock 5 finished goods warehouse & distribution centre	Previously not investigated due to concerns with services and concrete slab thickness. Potential contamination from historical site use and proximity to the former loading dock USTs and Dangerous Goods warehouse. The four boreholes and collection of samples has characterise the potential COC under the building.
BH05 and BH06	Former USTs in the loading dock between Dock 2 and Dock 5	USTs removed in 1988. There are no historical reports discussing the condition of the soil. Previously not investigated due to concerns with services and concrete slab thickness. Potential COC associated with historical USTs has been characterised by the two boreholes.
BH07, BH08, BH10	Former depot 5 & 6 Dangerous Goods warehouse	Previously investigated had not adequately characterised the potential COC. The three boreholes and collection of samples has characterised the potential COC under the building.
BH09 and BH11	The Former AST south of the medical building	Previously investigated had not adequately characterised the potential contamination. The two boreholes and collection of samples has characterised the potential COC associated with AST building.
BH12 to BH16	The Lan-O-Leen Building with former solvent USTs	USTs have been removed. There are no historical reports discussing the condition of the soil post removal. Only one previous borehole location has been identified for this area from a Dames & Moore 2014, Preliminary Contamination Assessment. The drilling of the four additional boreholes and collection of samples has characterise the potential COC associated with former USTs.
BRW2, BRW3, BRW4, BRW5, BRW7, BRW9 and	BRW2, BRW3, BRW4, BRW5, BRW7, BRW9 and PH12	Central area of the site and north east of the site

VS1- VS-7	Central area of the site	KPMG in 2016 had conducted a preliminary soil vapour screening with three soil vapour wells. The soil vapour concentrations were below the adopted criteria. The concentrations of chlorinated benenze in the groundwater warranted additional investigation with increase sample location and under a second time frame to observe temporal effects (if any).

6.3 Laboratory Analysis

The following laboratory analysis was undertaken by Envirolab, as shown in Table 6, using NATA accredited methods. The analytes selected are based on the COCs for the site.

Table 6 Soil, Water and Soil Vapour analytical schedule

Analytes	Soil Samples	Number of Duplicates	Water Samples	Number of Duplicates	Vapour Samples	Number of Duplicates
Petroleum hydrocarbons/ BTEXN	33	2	7	1	7	1
Polycyclic Aromatic Hydrocarbons (PAHs)	33	2	7	1	-	-
Heavy Metals	33	2	7	1	-	-
Phenols	7	0	-	-	-	-
Volatile Organic Compounds	18	0	7	0	-	-
Chlorinated Compounds	-	-	-	-	7	1
pH and CEC	3	0	-	-	-	-

6.3.1 Quality Assurance

The quality assurance and quality control procedures undertaken as part of this project are outlined in Appendix E of this report and procedures are referenced in NEPM ASC (Reference 7). Field procedures were designed to prevent/minimisation cross-contamination, analyte loss and to ensure samples and results were representative of actual conditions.

Five (5) soil field duplicate samples were collected with two (2) intra laboratory samples analysed. One (1) groundwater and one (1) soil vapour field duplicate sample was collected and analysed. The results of the duplicate samples were compared to those of the primary sample as a measure of method precision.

A soil vapour leak detection test was performed using isopropanol (IPA) as leak detection tracer. The detected IPA concentration was within acceptable limits and a results table is reported in Appendix E.

The soil vapour canister pressure before shipment was within 1 Hg to that observed by the field scientist, prior to sampling. The final field canister pressure measurement

compared to pressure prior to analysis was within 1 Hg, indicating that the integrity of the canisters was maintained during transport to and from site.

A detailed discussion on quality procedures and results for this investigation is presented in Appendix E. In general, the quality of the data set was considered to be reliable and acceptable.

6.4 Fieldwork Observations

The intrusive field works were undertaken from 20 and 29 June 2017. The following sections outline the fieldwork observations for soil, groundwater and vapour.

6.4.1 Soil Observations

The boreholes depths were drilled between 2.2 mbgl to 3.5 mbgl. Refusal was encountered at five attempted locations for the two boreholes around the former USTs at the loading dock and Dock 5 finished goods warehouse & distribution centre. The two boreholes could not be drilled elsewhere due to a stormwater channel and a sub slab void running beneath the building. In addition, sub-surface concrete was encountered below the floor concrete slab, causing refusal.

In general, the soil stratigraphy at the site (BH01 to BH16) can be summarised as:

- Concrete was present from 0.0 - 0.15 mbgl at BH01 to BH06 and BH10. Asphalt was present from 0.0 - 0.1 mbgl at BH12 to BH16.
- Fill material generally consisting of brown sand and gravel was generally observed to 0.5 mbgl.
- Reworked brown, red, orange and grey clay with gravel with sand lenses were observed to depths of 1.0 – 2.5 mbgl.
- Natural material consisting of grey with orange, yellow or red mottling clay, which was firm and a high plasticity.

Possible black staining was observed in a number bores within the reworked clay material. No further visual evidence of contamination or odours were observed. The PID concentrations were generally less than 10 ppm. BH02 recorded the highest PID concentration of 42.5 ppm.

Borehole locations are presented on Figure 2 and borehole logs are presented in Appendix C.

6.4.2 Groundwater Observations

The following groundwater field measurements were taken during the investigation, as presented in Table 7.

Table 7 Groundwater field chemical characteristics

ID	SWL* (mbgl)*	Temp (°C)	ORP (mV)	pH (units)	DO (%)	EC (ms/cm)	Comments
BRW2	3.002	23.1	-91	6.69	-4.5	21.8	Clear, no odour
BRW3	2.712	23.0	-132	6.87	-3.4	25.4	Clear with an slight organic odour

BRW4	3.350	22.2	-183	6.91	-2.9	29.2	Clear with an slight organic odour
BRW5	3.344	21.7	19	6.91	-3.3	18.95	Clear, no odour
BRW7	4.486	21.0	-21	7.03	2.3	18.16	Clear, no odour
BRW9	4.542	20.02	-136	7.21	18.57	14.82	Clear, no odour
PH12	4.054	21.4	-248	6.98	-3.0	21.7	Clear, no odour

Note(s):
1. SWL – standing water level measured prior to the collection of the groundwater samples

6.4.3 Soil Vapour Observations

The following is a summary of soil vapour port depth and observations, as presented in Table 8.

Table 8 Summary of Soil Vapour Ports Depths and Observations

ID	Depth (mbgl)	Comments / Contamination Observations
VS-1	0.85	No visual contamination or odour observed.
VS-2	0.85	No visual contamination of odour observed.
VS-3	0.7	Firm clay refusal at 0.7 mbgl. No visual contamination or odour observed.
VS-4	0.95	Asbestos cement debris encountered at 0.45 mbgl. No visual contamination or odour observed.
VS-5	0.95	No visual contamination or odour observed.
VS-6	1.05	No visual contamination or odour observed.
VS-7	0.75	No visual contamination or odour observed.

7 Laboratory Results

7.1 Soil

A summary of the soil laboratory results are presented in Tables 1 to 4 at the end of the report. A full copy of the laboratory analysis certificates are presented in Appendix D.

Concentrations of all COCs were identified below the laboratory limit of reporting or below the adopted criteria.

7.2 Groundwater

A summary of the groundwater laboratory results are presented in Table 5 at the end of the report. A full copy of the laboratory analysis transcripts are presented in Appendix D.

The following COCs within samples analysed were identified to be above the relevant criteria:

- The concentration of arsenic within sample BRW9 (24 µg/L) was above the adopted freshwater GIL and drinking water GIL of 13 µg/L and 10 µg/L respectively.
- The concentration of benzene within sample BRW2 (4 µg/L) was above the adopted drinking water GIL of 1 µg/L.
- The concentration of chlorobenzene within sample BRW2 (39 µg/L) was above the adopted drinking water GIL 10 µg/L.
- The concentration of 1,4 Dichlorobenzene within sample BRW2 (270 µg/L) was above the adopted freshwater GIL and drinking water GIL of 60 µg/L and 40 µg/L respectively.
- The concentration of 1,2 Dichlorobenzene within sample BRW2 (6,200 µg/L) was above the adopted freshwater GIL and drinking water GIL of 160 µg/L and 1,500 µg/L respectively.

7.3 Soil Vapour

A summary of the soil vapour laboratory results are presented in Table 6 at the end of the report. A full copy of the laboratory analysis certificates are presented in Appendix D.

Concentrations of all COCs were identified below the laboratory limit of reporting or below the adopted criteria.

8 Discussion and Conceptual Site Model

The following sections discuss the findings of the TEI works, including: the soil, groundwater and soil vapour results and provide a revision to the conseptual site model (CSM).

8.1 Soil

Soil results for the TEI were below the adopted criteria for each borehole. Therefore soil contamination was not identified at the following historical areas:

- The former USTs in the loading dock between Dock 2 and Dock 5 (BH05 and BH06)
- The Dock 5 finished goods warehouse & distribution centre (BH01 to BH04)
- Depot 5 & 6 Dangerous goods warehouse (BH07, BH08 and BH10)
- The Former AST south of the medical building (BH09 and BH11)
- The Lan-O-Leen Building with former solvent USTs (BH12 to BH16)

The soil is suitable to remain on the site for commercial / industrial land use. If soil is to be removed from site, a waste classification will be required from a suitability qualified consultant for disposal at a licensed landfill facility. Asbestos cement debris was identified within vapour borehole VS-4. Any future excavation in this area should adopt appropriate workplace health and safety (WHS) protocols.

8.2 Groundwater

Groundwater sampling was indicated concentrations were in excess of the adopted criteria at BRW2 and BRW9. The following section discusses the exceeding results.

8.2.1 Groundwater VOCs

Groundwater VOC results for the TEI were generally below the adopted criteria with exception of benzene, chlorobenzene, 1,2 dichlorobenzene and 1,4 dichlorobenzene concentrations above the adopted criteria at BRW2. The historical URS groundwater monitoring reports have previously reported elevated concentrations of these exceeding analysts at BRW2. .

The plume of benzene, chlorobenzene, 1,2 dichlorobenzene, 1,4 dichlorobenzene around BRW2 does appears to be stable both from a chemical and hydrogeological perspective and is not migrating down gradient or offsite, with no detections of VOCs at BRW3. The existing monitoring wells should be protected under the proposed building works. If the wells BRW2, BRW3, BRW4 and BRW5 are to be destroyed they should be adequately decommissioned and reinstalled at the completion of works. Ongoing monitoring of the plume is recommended following the building works, as the proposed works may change the dynamics of the plume, with the installation of footings.

8.2.2 BRW9 Arsenic Result

Arsenic was reported above the adopted criteria in BRW9. These concentrations are slightly above the Freshwater GIL limit. This result is considered to be low risk, with the down gradient monitoring wells BRW5, BRW 7 and PH12 did not record concentration above the adopted criteria. No further action is required to monitor BRW9.

8.3 Soil Vapour

Soil vapour results were below the adopted criteria for each vapour well. The results indicate that the identified elevated concentrations of VOCs in groundwater are not resulting in a vapour intrusion risk in the site's current (undeveloped) state. Furthermore, as the proposed development includes the placement of fill above the identified groundwater impact, and the provision of a hardstand concrete slab for the warehouse, the risk of vapour intrusion into the proposed warehouse is minimal. However, the concentration of VOCs within the groundwater are elevated at concentrations which could potentially result in vapour intrusion risk should a preferential pathway be created such as a building footings or piling.

Currently in Australia there are no published groundwater criteria for chlorinated benzenes which address the potential for vapour intrusion from a groundwater source. The lack of a presence of a guideline for a particular chemical of concern's "source and pathway" does not negate the need for consideration of that relevant chemical of concern.

In order to allow screening level comparisons KPMG SGA has adopted the methodology the USEPA published OSWER Draft Guidance for evaluating the Vapour Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface vapour intrusion guidance) (Reference 14).

While this document is not directly applicable in the site it provides a method for undertaking screening assessment for groundwater source for protection of vapour intrusion, and thus allowing comparison with the NEPM (ASC) interim soil vapour health investigation levels for VOCs.

An approximation of the soil vapour concentration at the groundwater interface may be made by using Henrys Law. For the maximum concentration of 1,2 Dichlorobenzene in (6,200 µg/L) the potential maximum vapour concentration at the water / air interface can be calculated as follows.

The Henrys Law Constant (H') for 1,2Dichlorobenzene is 0.54 (dimension less) (US Department of Commerce, National Institute of Standards and Technology, NIST Chemistry WebBook, SRD 69, Seen July 2017, [Reference 15]). 6,200 µg/L times 0.54 (rate constant) = 3,348 mg/m^3 (with unit conversions). This would be above the adopted vapour criterion of 9,100 µg/m3 for the site. However this is a highly conservative number as it does not allow for natural attention of the vapour through the soil profile.

KPMG SGA recommends a construction design that would not cause a preferential vapour pathway to the newly constructed warehouse building. If this not possible, a more detailed risk assessment will be required to assess the appropriate vapour controls. In addition to ensuring that a vapour preferential pathway is not created, KPMG SGA recommend that ambient air testing be conducted prior to occupation of the building to validate that vapour intrusion has not occurred.

8.4 Updated Conceptual Site Model

The following Table 9 Conceptual Site Model is an updated version of the PSI conceptual site model.

Table 9 Conceptual Site Model

Sources	COC	Media	Receptor	Exposure Route	Comments	Pathway complete	Recommended Action
Groundwater plume in vicinity of BRW2	Chlorinated benzenes	Soil/Rock	Human	Inhalation	Potential inhalation of VOCs by future site users. Potential for vapour intrusion risk to proposed warehouse building.	Unlikely	**Not Applicable**
				Dermal contact / Ingestion	There may be potential for site workers to encounter impacted soils during localised cutting in the area.	Unlikely	**Manage in accordance with a site specific Construction Environmental Management Plan (CEMP)**
			Ecological species and soil microbial processes	Direct Contact	Onsite ecological receptors not identified.	Unlikely	**Not Applicable**
		Groundwater	Human	Inhalation	Potential inhalation of VOCs by future site users. Potential for vapour intrusion risk to proposed warehouse building in association with the BRW2 plume.	Potential	**Construction design that would not cause a preferential vapour pathway to the newly constructed warehouse building. Ambient air testing prior to occupation of the building to validate that the COC vapour intrusion is not entering the building**
				Drinking	No drinking water utilisation in immediate area	Unlikely	**Not Applicable**
				Direct Contact	Groundwater not expected to be encountered during development activities.	Unlikely	**Not Applicable**
			Ecological species (offsite)	Direct contact / Ingestion	Groundwater plume is considered to be stable and not affecting offsite ecological receptors (e.g. within Duck Creek) as confirmed by the EPA in 2003 and subsequent groundwater investigations.	Unlikely	**Groundwater monitoring required post construction**

Sources	COC	Media	Receptor	Exposure Route	Comments	Pathway complete	Recommended Action
Solooms Hill	Chlorinated benzenes	Soil/Rock	Human	Inhalation	The soils used to build Solomons Hill were noted to have been excavated from the former landfill areas and remediated prior to placement. It is considered that any residual contamination would be minor. In addition, there is currently no building in this area, nor is it expected that the proposed warehouse will affect this area.	Unlikely	Should soils from Solomons Hill be excavated during earthworks, assess suitability for re-use on site.
				Dermal contact / Ingestion		Unlikely	
			Ecological species and soil microbial processes	Direct Contact	Onsite ecological receptors not identified.	Unlikely	Not Applicable
Former USTs in the vicinity of the former chemical building, central loading lock, admin building, and former Lan-O-Leen building	Hydrocarbons VOCs BTEX Lead	Soil	Human	Inhalation	Although the USTs were removed in 1987, no validation reports have been provided, resulting in the potential for residual COCs to remain in the surrounding soil. There may be potential for site workers to encounter impacted soils during localised cutting in the area.	Unlikely	Not Applicable
				Dermal contact / Ingestion			
			Ecological species and soil microbial processes	Direct Contact	Onsite ecological receptors not identified.	Unlikely	Not Applicable
Central Dock and sDangerous Goods Depot 5 and 6	Hydrocarbons VOCs	Soil	Human	Inhalation	Spills and leaks from stored chemicals may have resulted in localised soil impacts in the vicinity of the Dangerous Goods depots. These areas have not previously been investigated. Construction workers and future site users may be affected by inhalation of vapours.	Unlikely	Not Applicable
				Dermal contact / Ingestion			
			Ecological species and soil microbial processes	Direct Contact	Onsite ecological receptors not identified.	Unlikely	Not Applicable

Eastern end of former Lan-O-Leen building	Arsenic	Soil	Human	Inhalation	Non-volatile chemicals therefore not inhalation not applicable.	Unlikely	Not Applicable
				Dermal contact / Ingestion	These soils have previously been disposed offsite.	Unlikely	Not Applicable
			Ecological species and soil microbial processes	Direct Contact	Onsite ecological receptors not identified.	Unlikely	Not Applicable
Entire site	Asbestos	Soil	Human	Inhalation	Potential for fill materials to be contain surficial asbestos which may be disturbed during excavation.	Potential	Manage in accordance with a site specific Construction Environmental Management Plan (CEMP). If asbestos identified in soil during development works, it may be necessary to manage under an ongoing Environmental Management Plan.

9 Conclusion & Recommendations

Based on the findings of the TEI undertaken, KPMG SGA consider that the site is suitable for the proposed JEG commercial/industrial development providing the below recommendations are followed. KPMG SGA form this opinion due to the fact that:

- No COCs were identified above the adopted guidelines in the soil samples collected and analysed.
- No COCs were identified above the adopted guidelines in the soil vapour samples collected.

Concentrations of benzene, chlorobenzene, 1,2 dichlorobenzene, 1,4 dichlorobenzene concentrations were detected above the adopted criteria at groundwater well BRW2. Potential inhalation of VOCs by future site users remains a possibility due to the proposed construction of the warehouse building in association with the BRW2 plume. KPMG SGA recommends the following:

- a construction design that would not cause a preferential vapour pathway to the newly constructed building. If this is not possible a more detailed risk assessment will be required to assess the appropriate vapour controls for the building / warehouse
- ambient air testing prior to occupation of the building to validate that the COC vapour intrusion is not entering the building
- annual groundwater monitoring of wells BRW2, BRW3, BRW4 and BRW5 to assess the trends of the chlorinated benzene plume.

A Construction Environmental Management Plan is recommended to be produced by an environmental consultant to include:

- an unexpected findings protocol specifying how to manage identification of potential contamination (such as asbestos) during the development works
- soil management including separation, stockpiling, testing, classification, and offsite disposal in accordance with NSW Waste Classification guidelines
- groundwater management in the event that groundwater is encountered during the development.

10 Limitations

This report has been prepared by KPMG SGA in response to and subject to the following limitations:

1. The specific instructions received from Grand Sasanqua Pty Ltd.
2. The Engagement Letter between KPMG SGA and Grand Sasanqua Pty Ltd dated 9 June 2017 including the Scope Limitations and Terms and Conditions of Business contained within.
3. The report has been prepared to a specific scope of works as set out in Section 2.3 of this report.
4. May not be relied upon by any third party not named in this report for any purpose except with the prior written consent of KPMG SGA (which consent may or may not be given at the discretion of KPMG SGA).
5. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason.
6. The report only relates to the site located at 54-68 Ferndell Street, South Granville, NSW ("the site").
7. The report relates to the site as at the date of the inspection as conditions may change thereafter due to natural processes and/or site activities.
8. No warranty or guarantee is made in regard to any other use than as specified in the scope of works.

11 References

1. Australian and New Zealand Environment and Conservation Council/ Agriculture and Resource Management Council of Australia and New Zealand, Guidelines for Fresh and Marine Water Quality, ANZECC/ARMCANZ 2000
2. AS4482.1–2005 Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: non-volatile and semi-volatile compounds. Standards Australia
3. AS4482.2–1999 Guide to the sampling and investigation of potentially contaminated soil, Part 2: volatile substances, Standards Australia
4. Department of Land and Water Conservation, 1:100,000 Soil Landscape Series Sheet 9130, Sydney, 1989
5. Geological Survey NSW (1983) – Sydney 1:100,000 Geological Sheet
6. KPMG SGA, May 2017, Preliminary Site Investigation, 54 – 68 Ferndell Street South Granville, NSW (PSI)
7. National Environment Protection Council (1999) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) (Amended 2013)
8. Safe Work Australia (2013) Workplace Exposure Standards For Airborne Contaminants
9. URS (November 2013) Environmental Site Investigation, Merck Sharp and Dohme, South Granville NSW
10. URS (January 2014) Round 24 Groundwater Monitoring – 2013, 54 -68 Ferndell Street South Granville NSW
11. US EPA Provisional Peer Review Toxicity Values
12. US EPA Superfund Health Effects Assessment Summary Tables
13. US EPA Integrated Risk Information Systems
14. USEPA published OSWER Draft Guidance for evaluating the Vapour Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface vapour intrusion guidance) EPA530-D-02-004 November 2002
15. US Department of Commerce, National Institute of Standards and Technology, NISTChemistry WebBook, SRD 69 (Seen July 2017)
16. KPMG SGA, 2016, Review of Environmental Risk – 54 Ferndell St, South Granville, NSW

SITE FIGURES

N

Source: Google Maps

CLIENT	Grand Sasanqua Pty Ltd
PROJECT	Targeted Environmental Investigation 54-68 Ferndell Street, South Granville NSW
TITLE	Figure 1 - Site Location

SCALE	DATE	DRAWING No.	ISSUE
NTS	19/07/2017	314465.01 Figure 1	A
DRAWN: J.A. / CHECKED: D.J.	JOB No. 314465.01		

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Sydney NSW 2000
Phone: +61 2 9335 7000
Fax: +61 2 9335 7001
Email: sydsga@kpmg.com.au
Web: www.sgapropertycom

Site Boundary

Borehole Location

Soil Vapour Location

Existing Groundwater Well Sample Location

Source: Nearmap

N

CLIENT: Grand Sasanqua Pty Ltd

PROJECT: Targeted Environmental Investigation - 54-68 Ferndell Street, South Granville NSW

TITLE: Figure 2 - Sampling Locations

SCALE	DATE	DRAWING No.	ISSUE
NTS	02/06/2016	314465.01 Figure 2	A

DRAWN	CHECKED	JOB No.
J.A.	D.J.	314465.01

KPMG SGA Property Consultancy

nettletontribe

Jaycar Electronics

54 - 68 Ferndell street, South Granville
nsw 2142

GENERAL

10248_DA-000	COVER SHEET

FLOOR PLANS

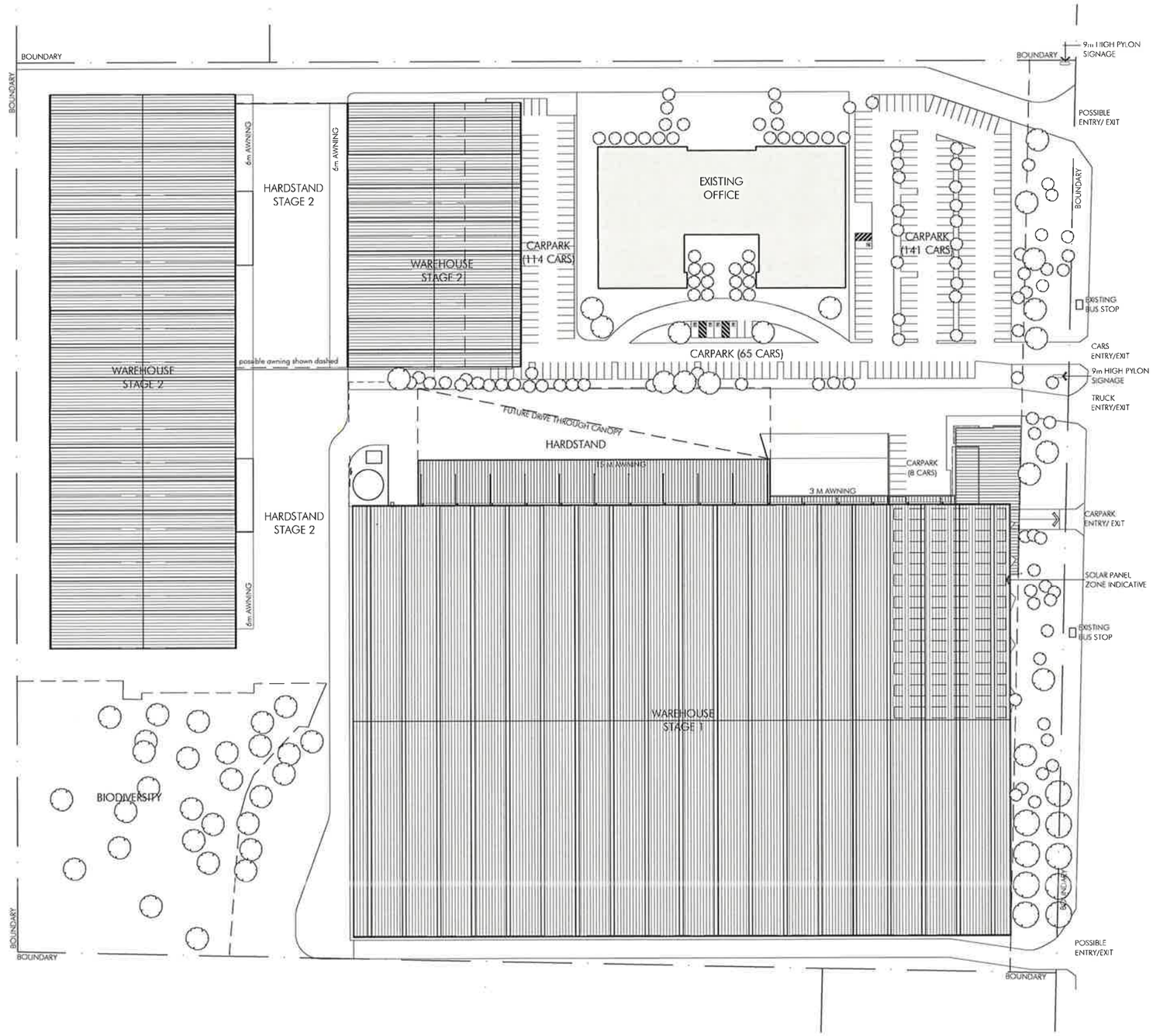
10248_DA-002	SITE PLAN
10248_DA-003	MASTER PLAN
10248_DA-004	MASTER PLAN - FUTURE CARPARK
10248_DA-011	GROUND FLOOR PLAN
10248_DA-012	L1 FLOOR PLAN
10248_DA-013	ROOF PLAN
10248_DA-014	STAGE 2 GF PLAN
10248_DA-016	STAGE 2 ROOF PLAN
10248_DA-017	BASEMENT CARPAR PLAN
10248_DA-018	OFFICE PLANS
10248_DA-019	EXISTING OFFICE PLANS

ELEVATIONS

10248_DA-021	STAGE 1 ELEVATIONS
10248_DA-022	STAGE 1 ELEVATIONS
10248_DA-023	STAGE 2 ELEVATIONS
10248_DA-024	STAGE 2 ELEVATIONS

JAYCAR
Development Application Draft
April 2017

Area Schedule	
Site Area	98,440 sqm
Biodiversity	9,300 sqm
Jaycar	
Warehouse	30,000 sqm
Office (Existing)	5,667 sqm
Office	693 sqm
Total	36,360 sqm
Warehouse 2	
Warehouse	10,520 sqm
Office	1,000 sqm
Total	11,520 sqm
Warehouse 3	
Warehouse	4,740 sqm
Office	60 sqm
Total	4,800 sqm
Total Warehouse	45,260 sqm
Total Office	7,420 sqm
Required Parking	
Warehouse (1 per 70m²)	647
OFFICE (1 per 50m²)	148
Total (parramatta council)	795
Existing Carpark	76
New Carpark	368
Future Carpark	351
Total	795



DRAFT

Client: Jaycar Electronics

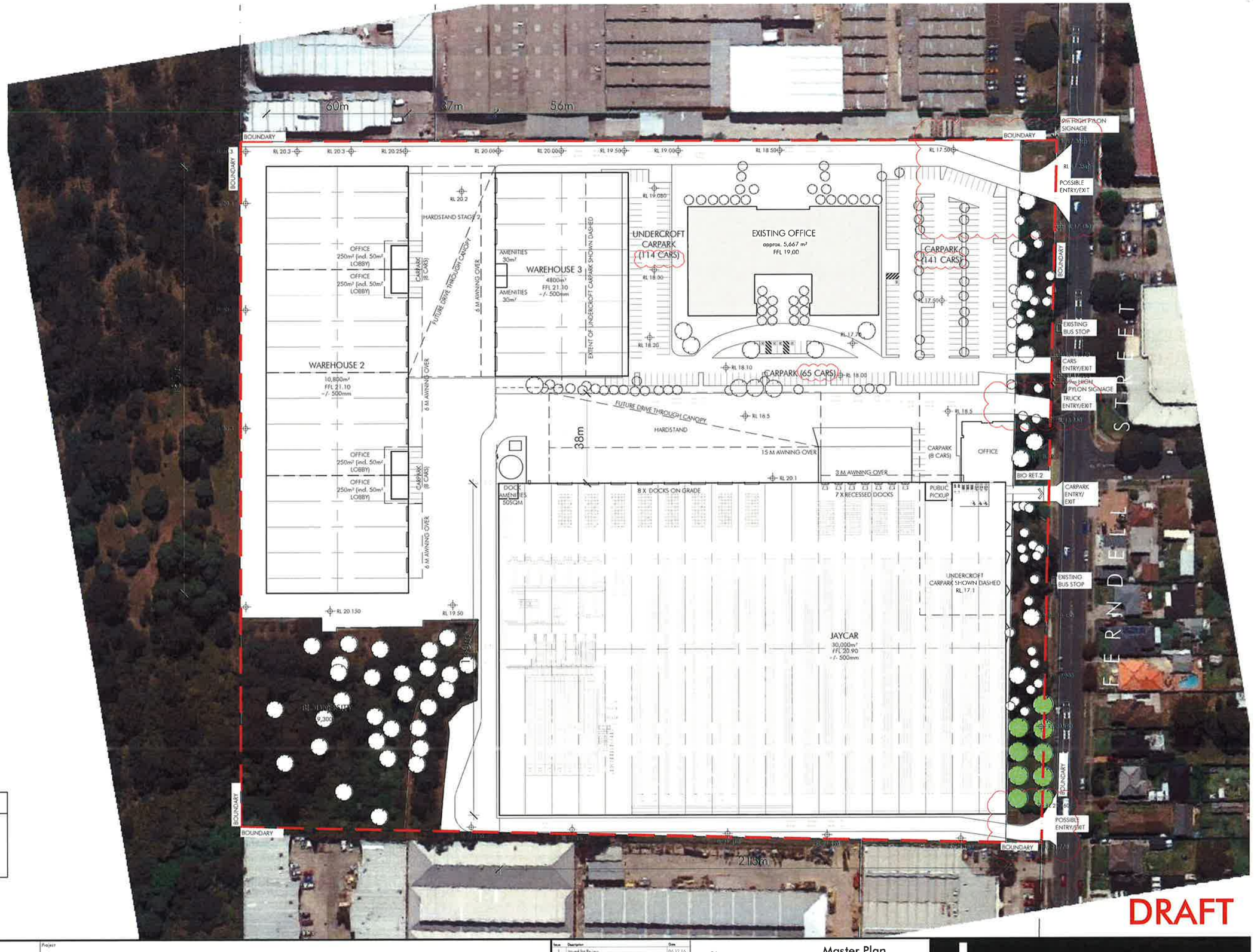
Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	10.11.16
2	Issued for Review	15.11.16
3	Updated for Pre-DA	21.11.16
4	Issued for Review	06.12.16
5	Issued for Review	06.02.17
6	DA Draft	11.04.17
7	Updated to Traffic Input	27.04.17

Title: Site Plan
Scale: 1:750@A1
Date: April 2017
Number: 10248_DA002

nettleton tribe partnership pty ltd ABN 58 161 683 122
117 willoughby road crows nest nsw 2065
t 02 9421 6421 f 02 9439 7474
sydney@nettletontribe.com.au w nettletontribe.com.au



LEGEND:

- EXISTING TREES TO BE RETAINED
- PROPOSED NEW TREES

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	06.12.16
2	Issued for Review	02.02.17
3	Issued for Review	06.03.17
4	DA Draft	11.04.17
5	Updated to Traffic Input	27.04.17

Title: Master Plan
Scale: 1:750@A1
Date: April 2017
Number: 10248_DA003

nettleton tribe partnership pty ltd ABN 58 161 683 122
117 willoughby road crows nest nsw 2065
t 02 9431 6431 f 02 9439 7474
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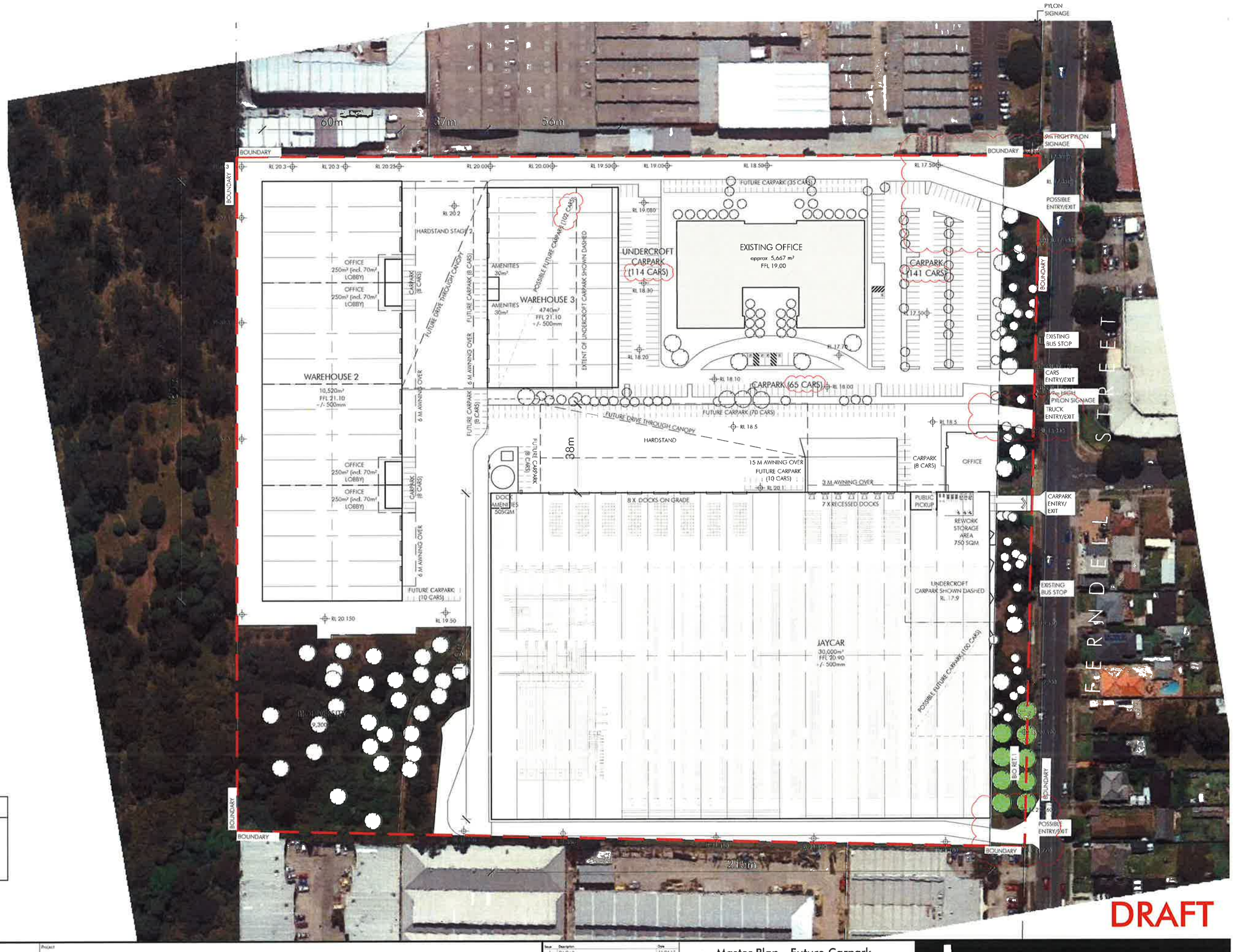

LEGEND:

- EXISTING TREES TO BE RETAINED
- PROPOSED NEW TREES

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	DA Draft	11.04.17
2	Updated to Traffic Input	27.04.17

Title: Master Plan - Future Carpark
Scale: 1:750@A1
Date: April 2017
Number: 10248_DA004

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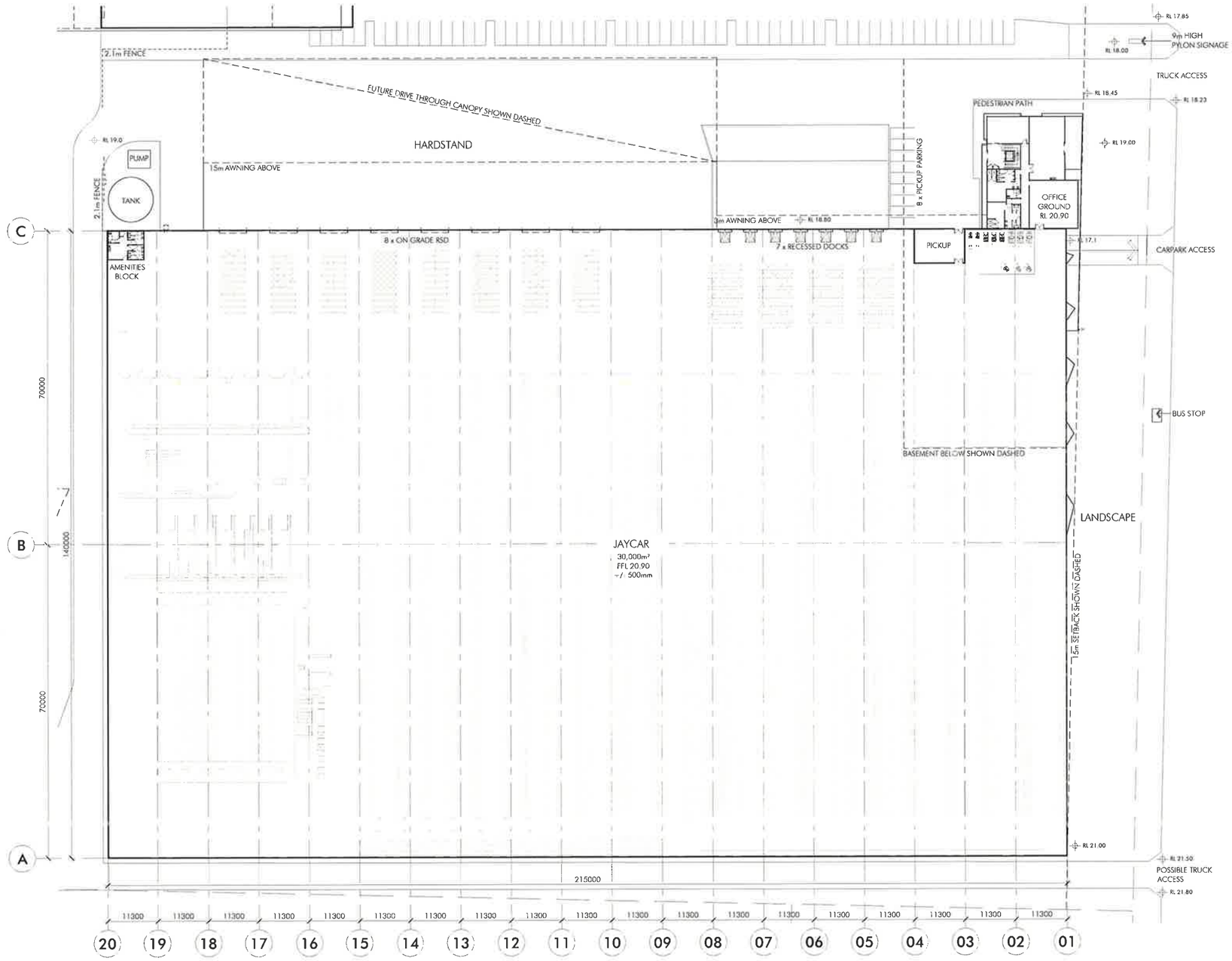

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Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	06.12.16
2	Issued for Review	02.02.17
3	Issued for Review	06.03.17
4	DA Draft	11.04.17

Title: Ground Floor Plan
Scale: 1:500@A1
Date: April 2017
Number: 10248_DA011

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117 willoughby road crows nest nsw 2065
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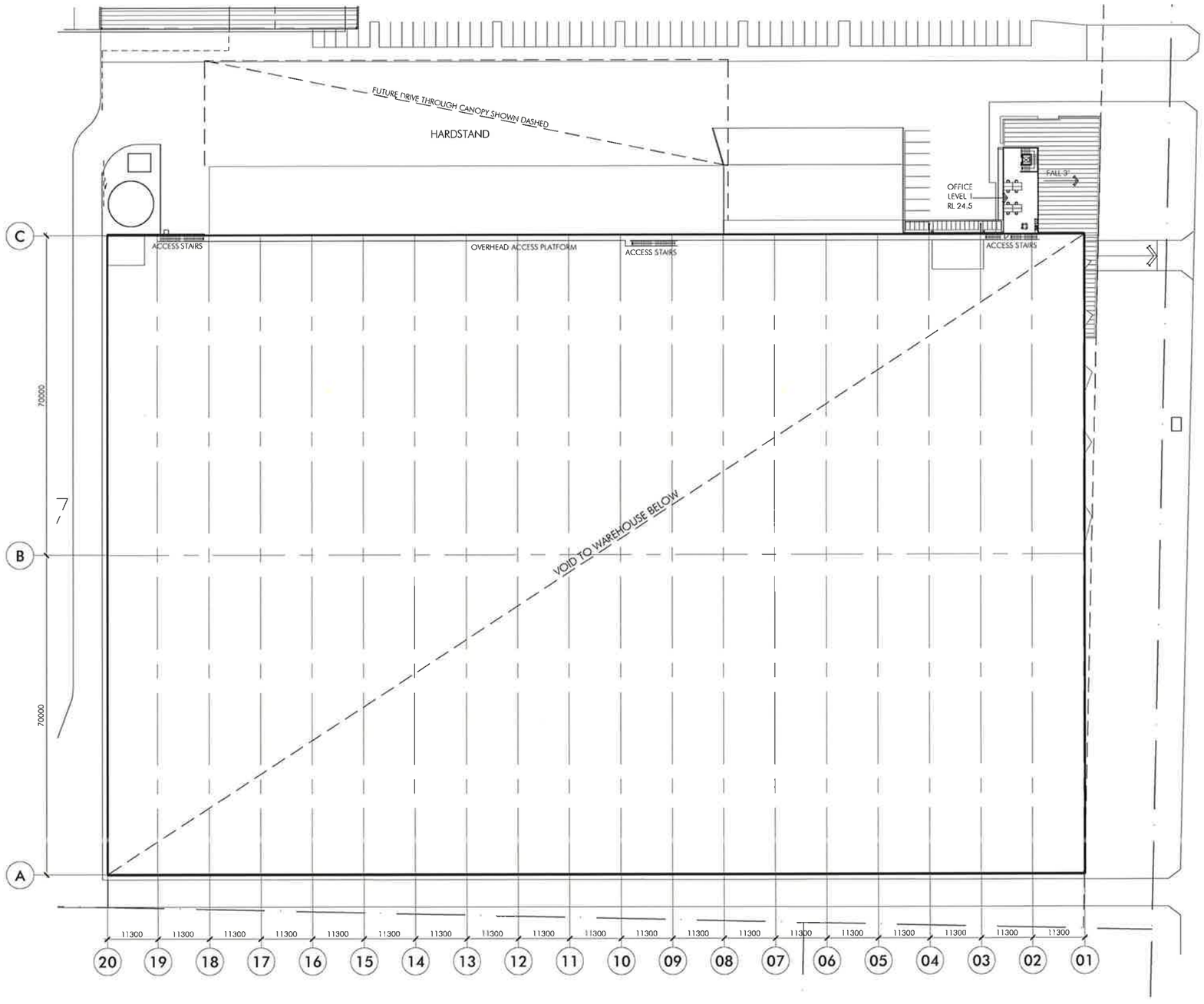

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	06.12.16
2	Issued for Review	02.02.17
3	Issued for Review	06.03.17
4	DA Draft	11.04.17

Title: Level 1 Plan
Scale: 1:500@A1
Date: April 2017
Number: 10248_DA012

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117 willoughby road crows nest nsw 2065
t 02 9431 6431 f 02 9439 7474
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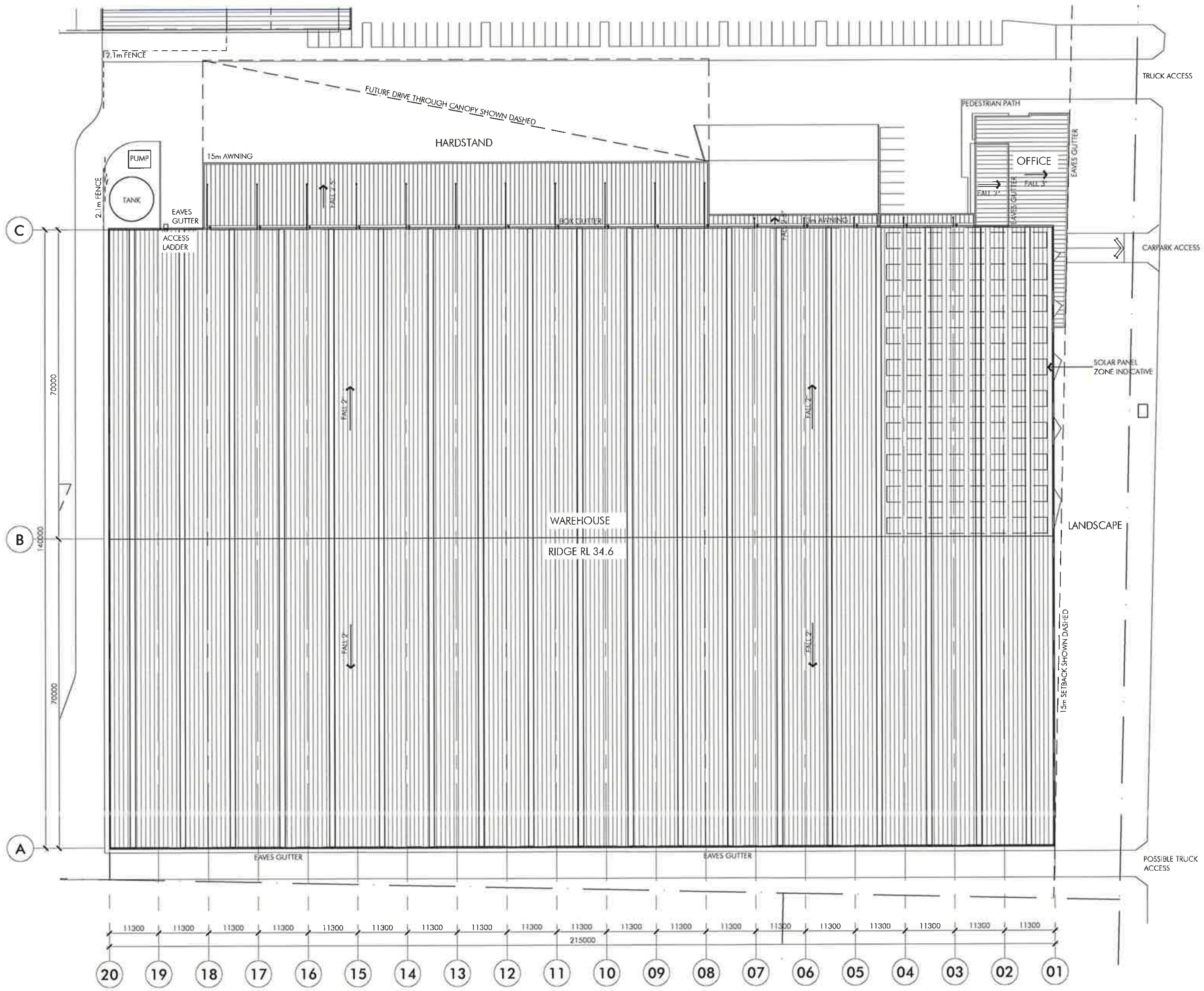

DRAFT

Issue	Description	Date
1	Issued for review	02.02.17
2	Issued for review	06.03.17
3	DA Draft	11.04.17

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Title: Roof Plan Stage 1

Scale: 1:500@A1

Date: April 2017

Number: 10248_DA013

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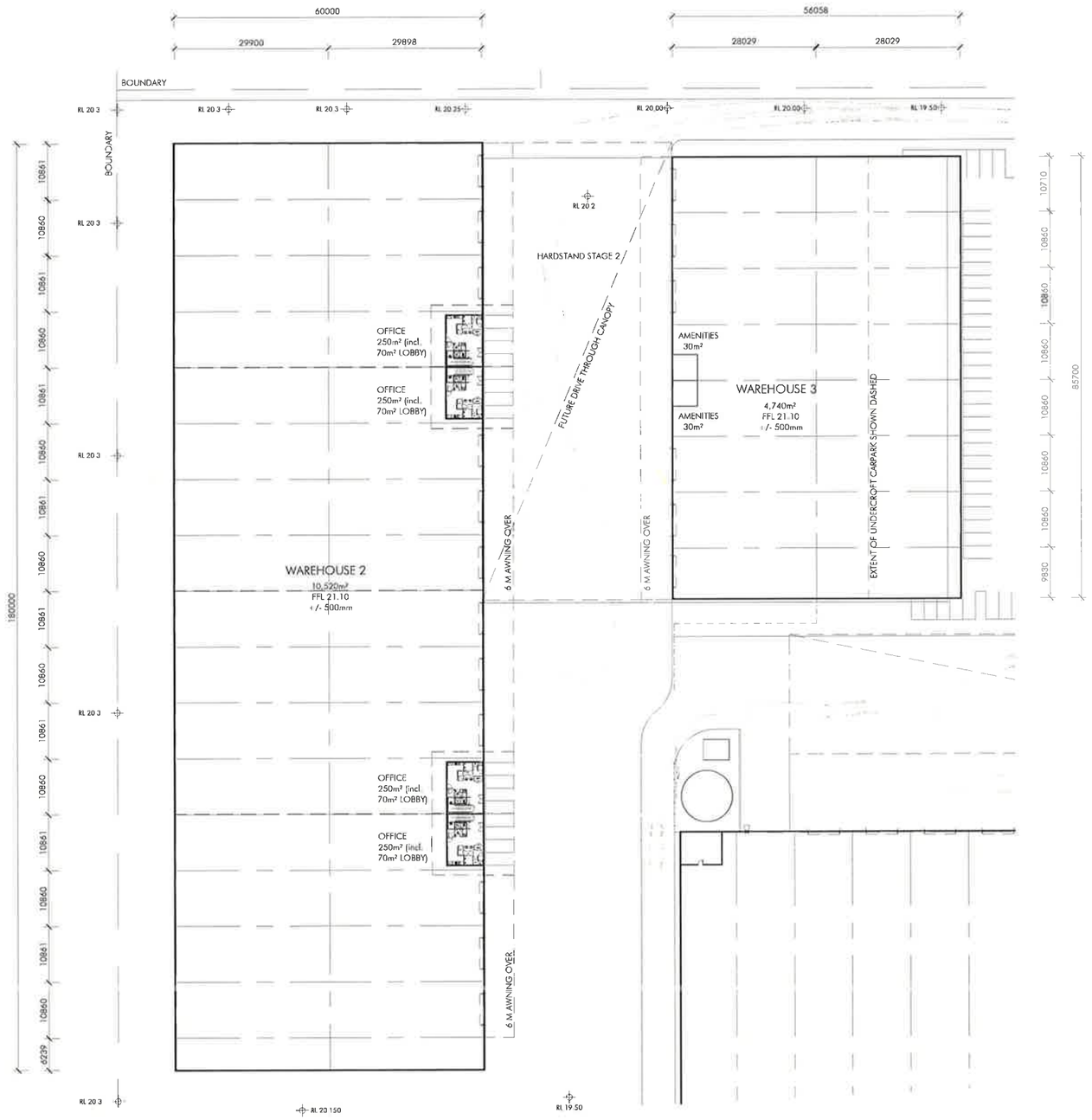

01 STAGE 2 WAREHOUSE
GROUND FLOOR

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	02.02.17
2	Issued for Review	06.03.17
3	DA Draft	11.04.17
4	Updated in Traffic Input	27.04.17

Title: Stage 2 GF Plans
Scale: 1:500
Date: April 2017
Number: 10248_DA014

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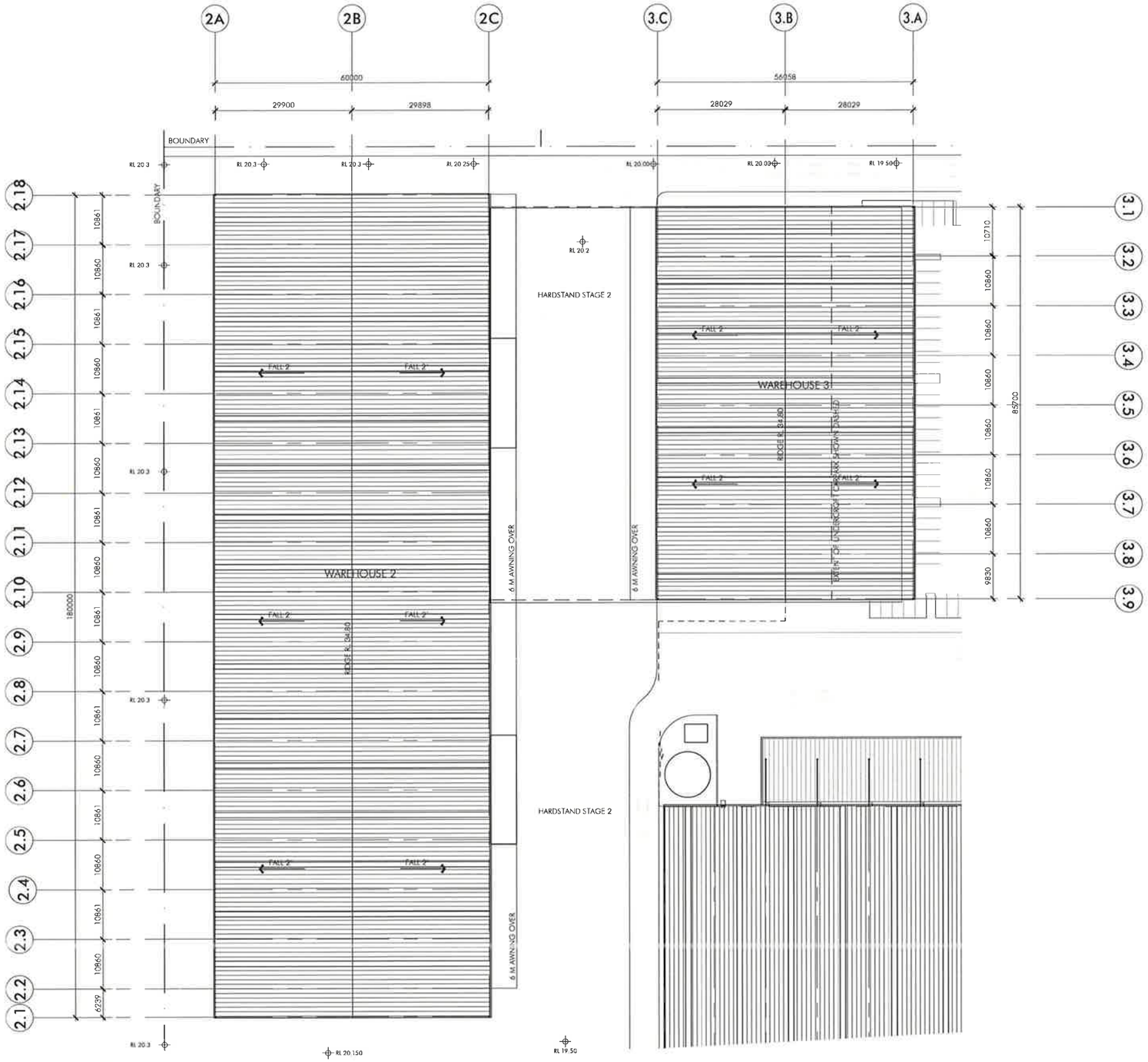

01 STAGE 2 WAREHOUSE
GROUND FLOOR

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

No.	Description	Date
1	Issued for Review	02.02.17
2	Issued for Review	06.03.17
3	DA Draft	11.04.17

Title: Stage 2 Roof Plan
Scale: 1:500
Date: April 2017
Number: 10248_DA016

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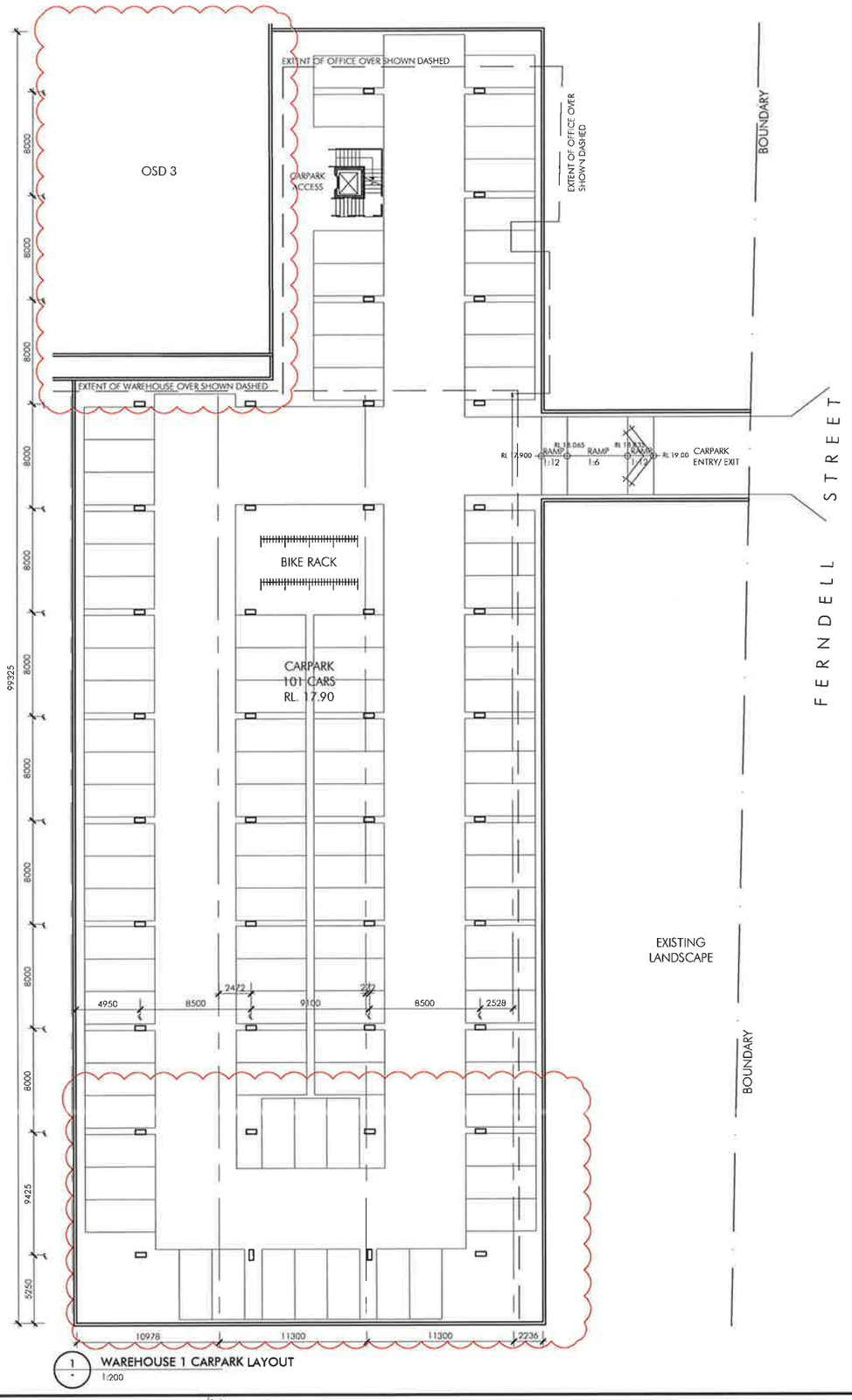
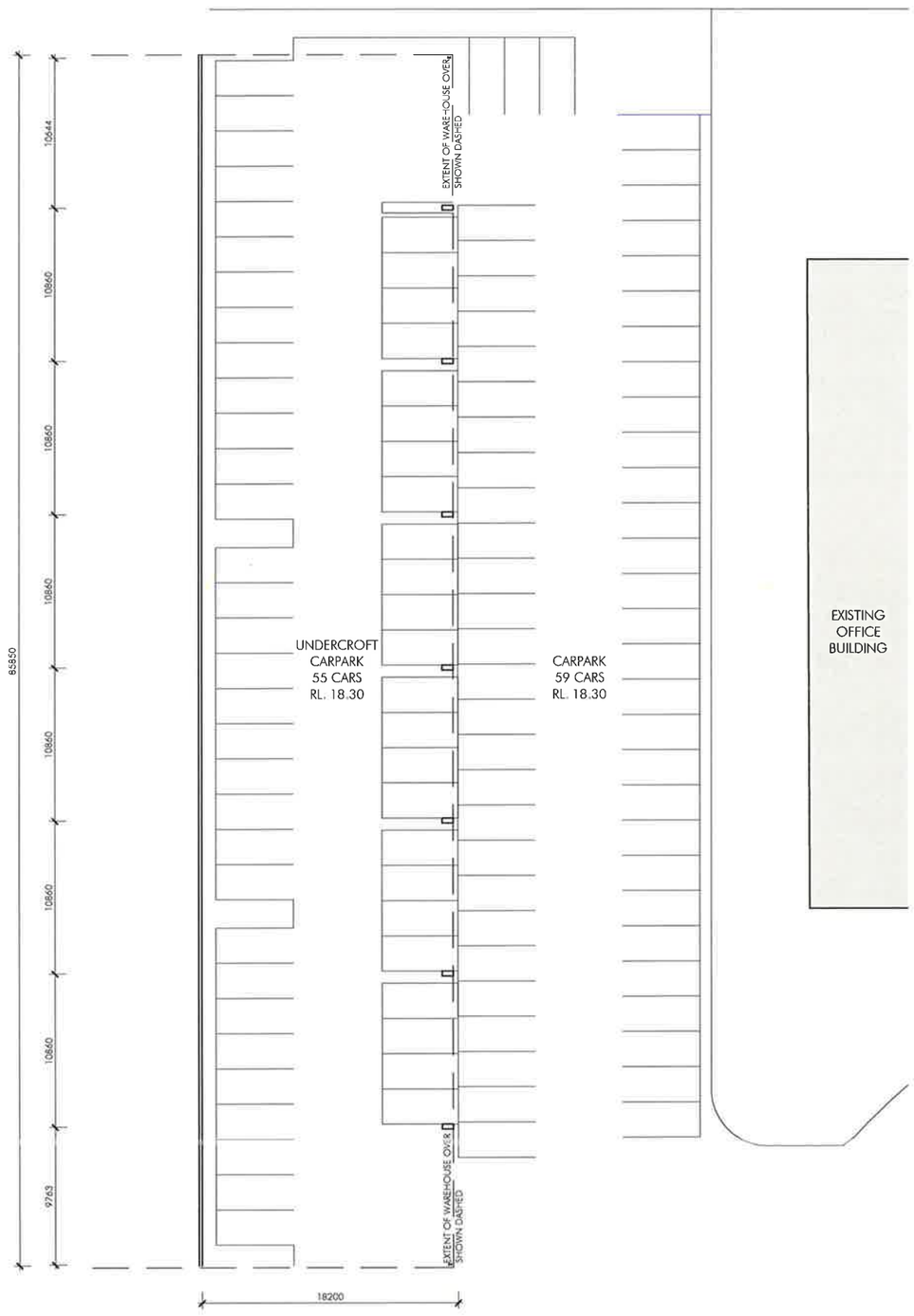


1 - WAREHOUSE 1 CARPARK LAYOUT
1:200



2 - WAREHOUSE 3 CARPARK LAYOUT
1:200

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	06.12.16
2	Issued for Review	02.02.17
3	Issued for Review	06.03.17
4	Dimension Updated	15.03.17
5	DA Draft	11.04.17
6	Updated to Traffic Input	27.04.17
7	OSD Tank added	18.10.17

Title: Basement Carpark Plans
Scale: 1:200@A1
Date: April 2017
Number: 10248_DA017

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117 willoughby road crows nest nsw 2065
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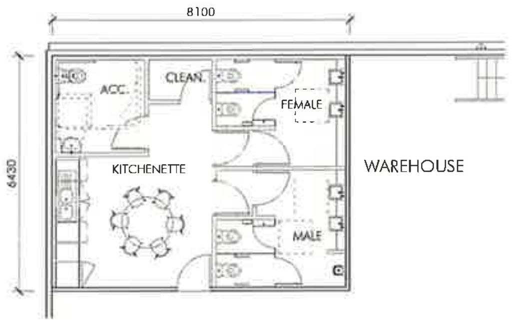
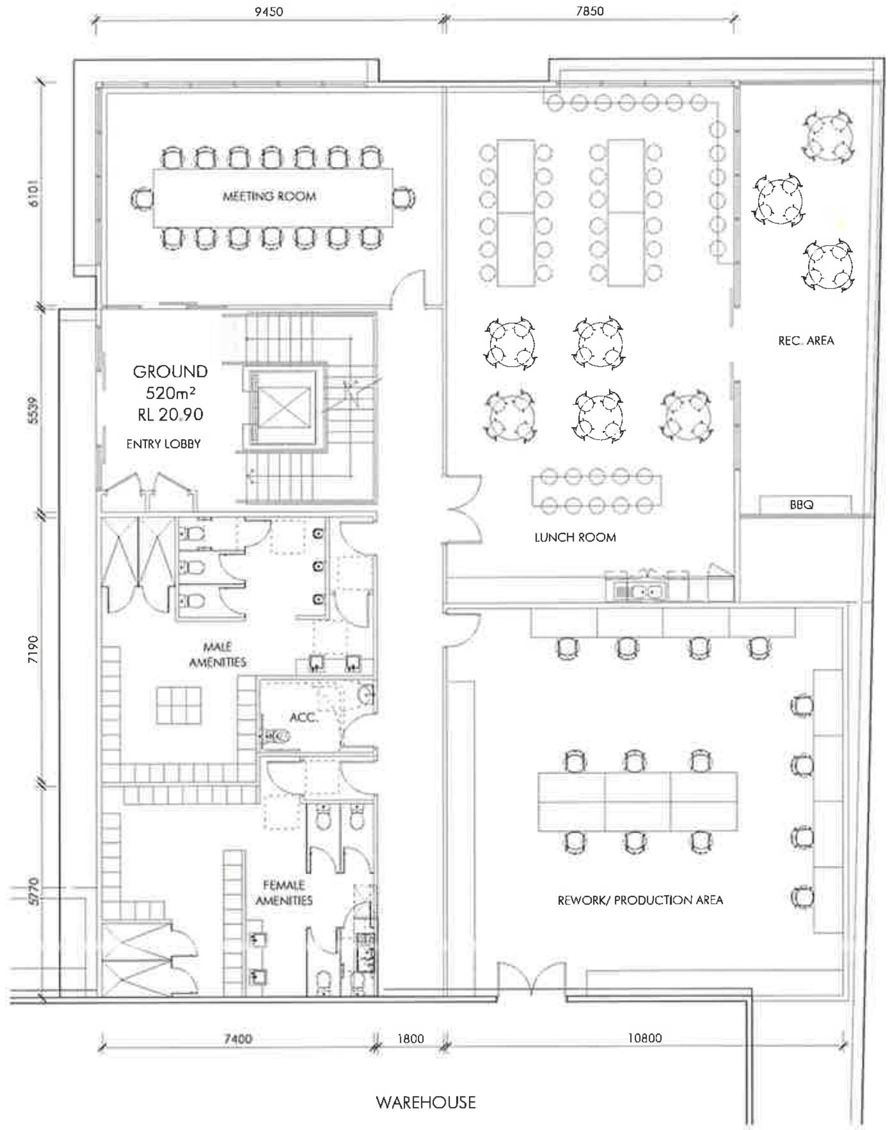
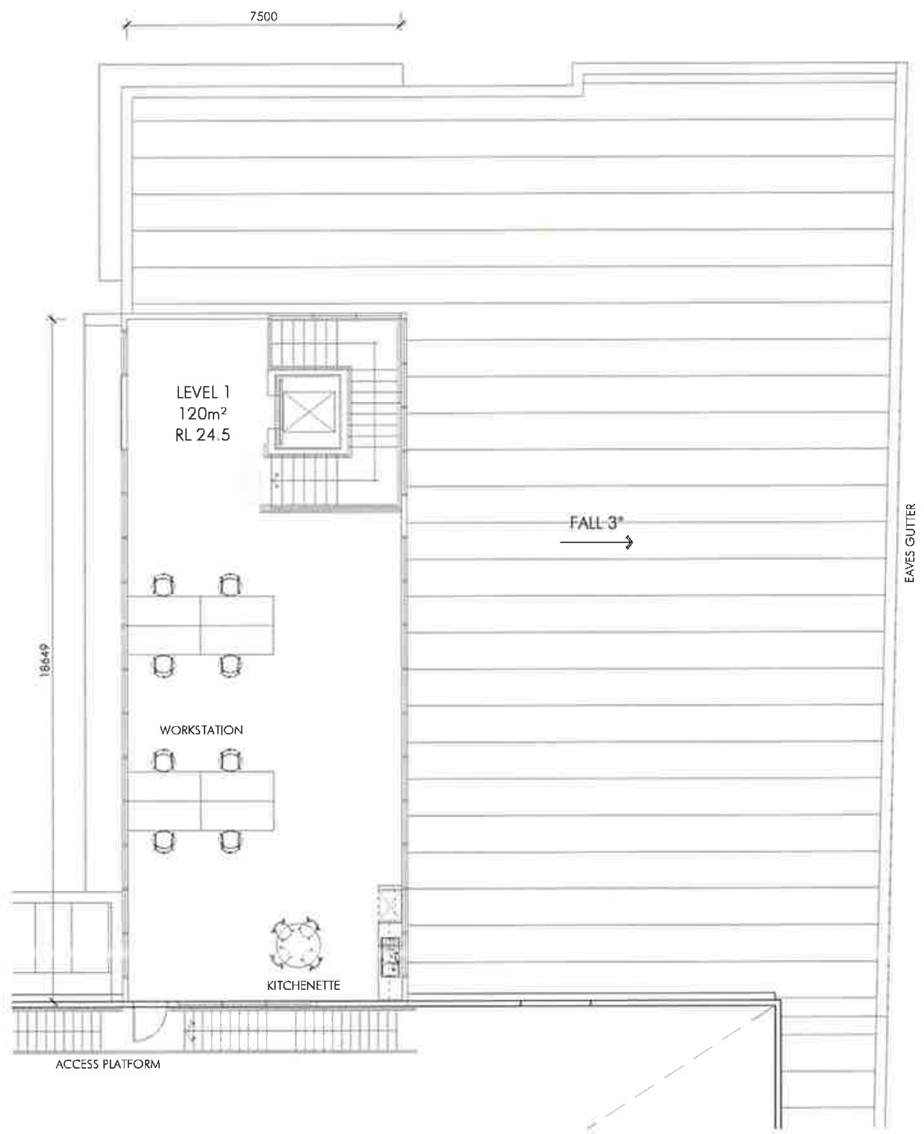


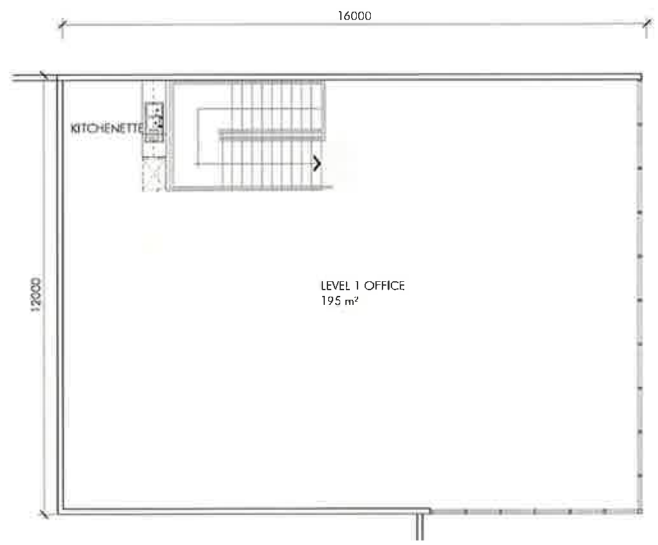
03 WAREHOUSE 1 AMENITIES
GROUND



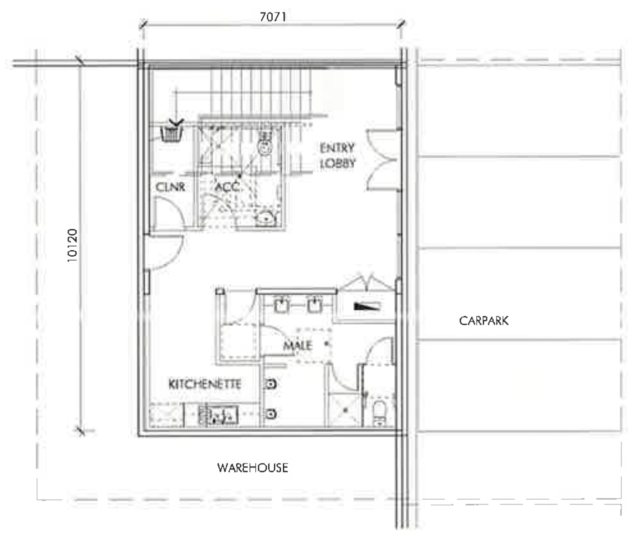
01 WAREHOUSE 1 OFFICE
GROUND



02 WAREHOUSE 1 OFFICE
LEVEL 1



05 WAREHOUSE 2 OFFICE
LEVEL 1



04 WAREHOUSE 2 OFFICE
GROUND

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	06.12.16
2	Issued for Review	02.02.17
3	Issued for Pre-DA	06.03.17
4	DA Draft	11.04.17

Title: Office Plans
Scale: 1:100
Date: April 2017
Number: 10248_DA018

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117 willoughby road crows nest nsw 2065
t 02 9431 6431 f 02 9439 7474
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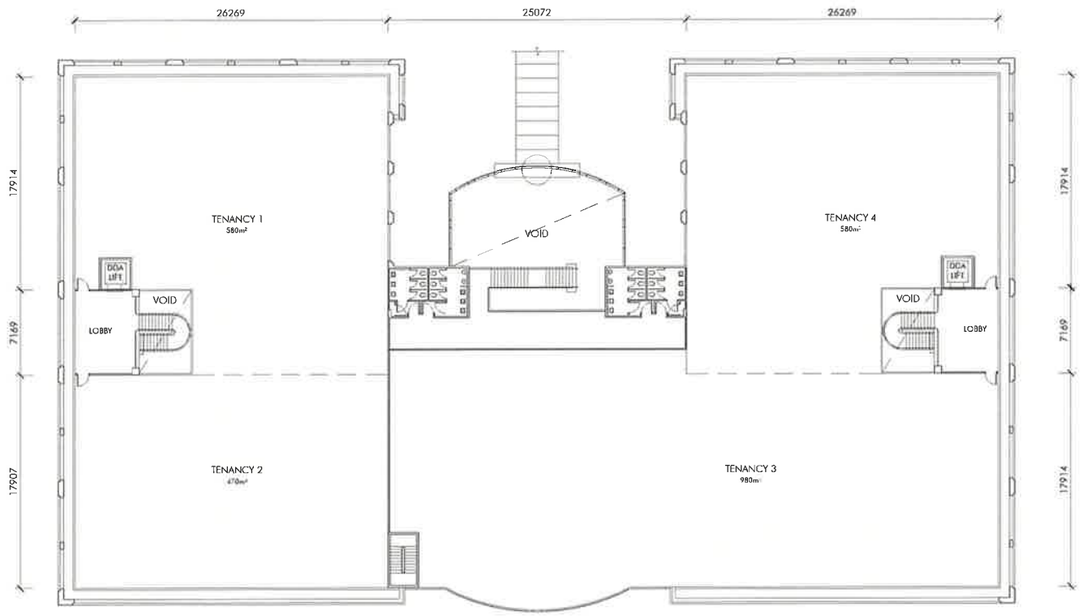
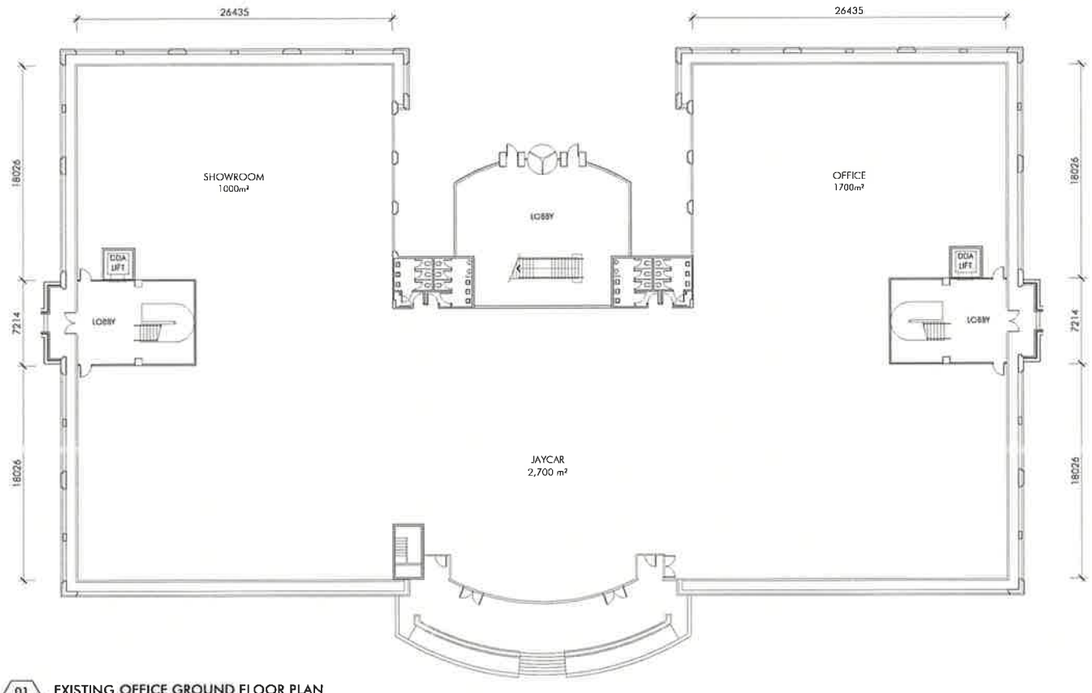


02 EXISTING OFFICE LEVEL 1 PLAN
1:250



01 EXISTING OFFICE GROUND FLOOR PLAN
1:250

DRAFT

Apr 12, 2017 4:57pm N:\10248\Arc\CAD\10248_DA019 Existing Office Plans.dwg

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	06.02.17
2	DA Draft	11.04.17

Title: Existing Office Plans
Scale: 1:250
Date: April 2017
Number: 10248_DA019

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117 willoughby road crows nest nsw 2065
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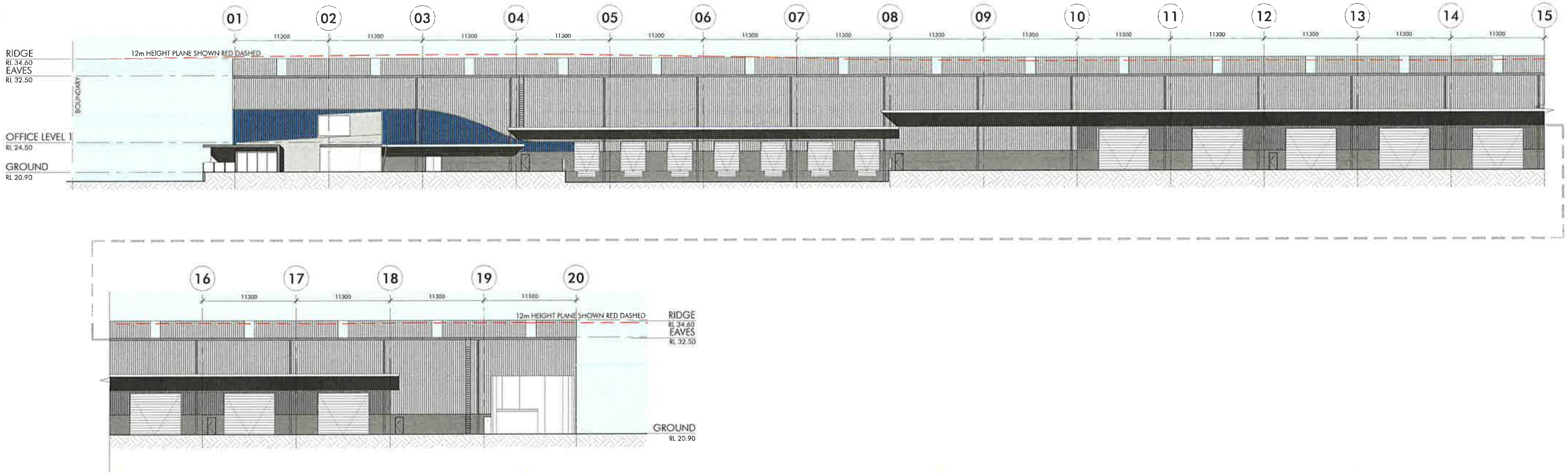
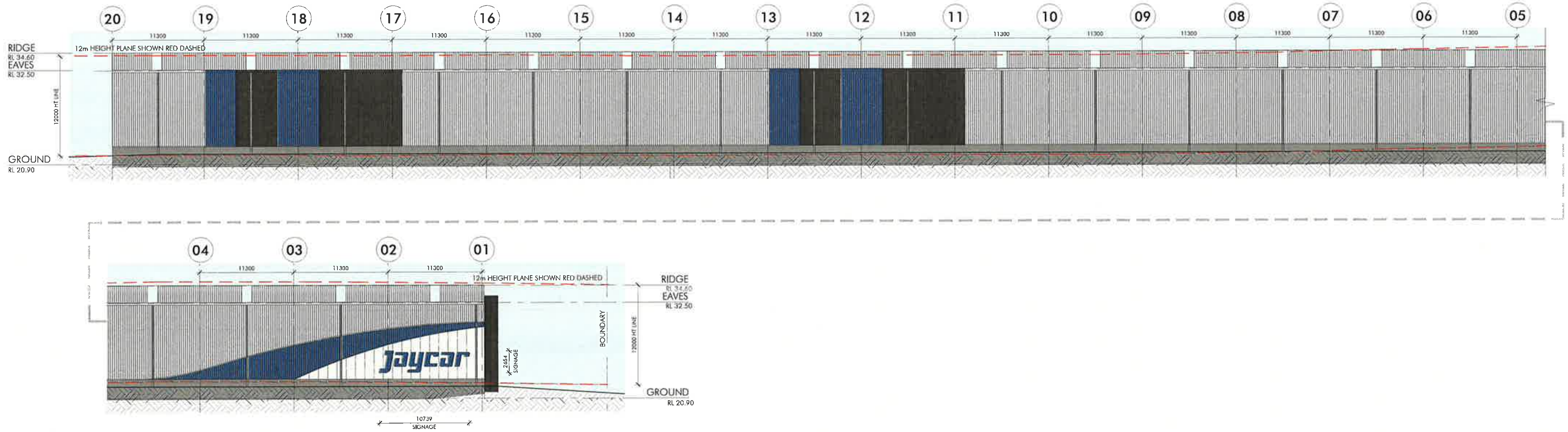


01 North Elevation Stage 1
Scale 1:250



02 South Elevation
Scale 1:250

DRAFT

Client	Project		
Jaycar Electronics	PROPOSED INDUSTRIAL DEVELOPMENT 54 - 68 FERNDELL STREET, SOUTH GRANVILLE		

Issue	Description	Date
1	Issued for Review	02.02.17
2	Issued for Review	06.03.17
3	DA Draft	11.04.17

Title: Stage 1 Elevations
Scale: 1:250@A1
Date: April 2017
Number: 10248_DA021

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117 willoughby road crows nest nsw 2065
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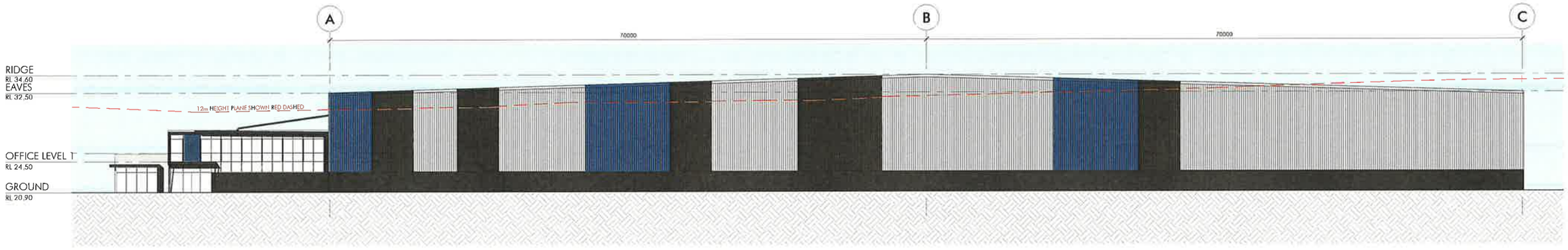
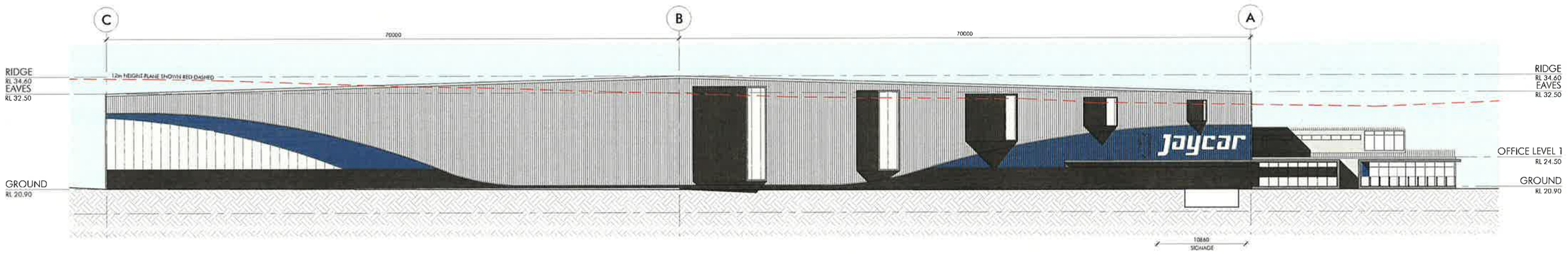


01 West Elevation
Scale 1:250



02 East Elevation
Scale 1:250

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	02.02.17
2	Issued for Review	04.03.17
3	DA Draft	11.04.17

Title: Stage 1 Elevations
Scale: 1:250@A1
Date: April 2017
Number: 10248_DA022

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117 willoughby road crows nest nsw 2065
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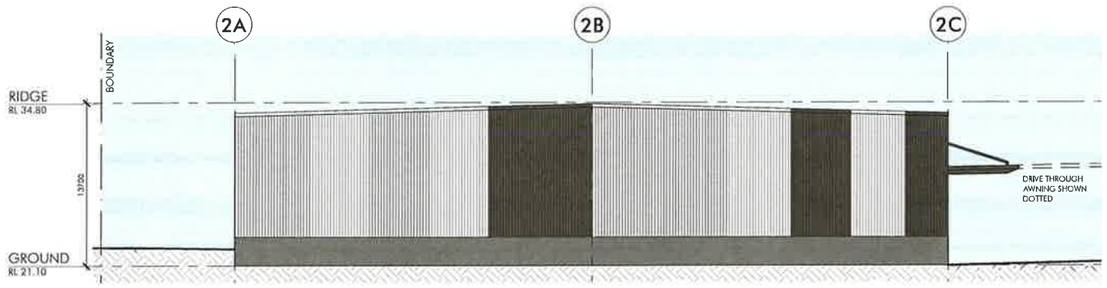
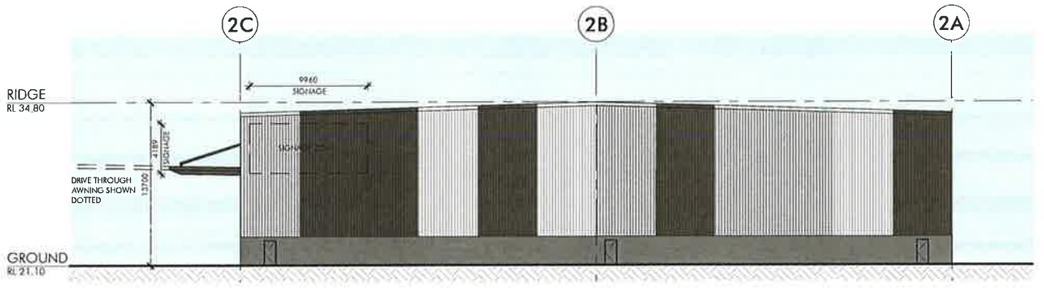
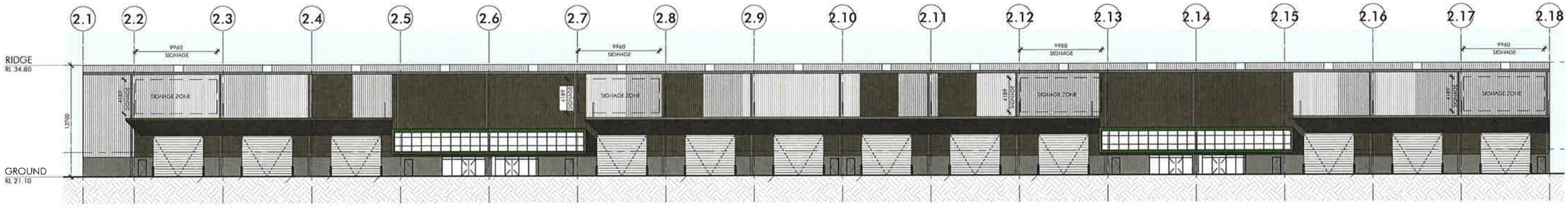
Apr 13, 2017 - P:\Jobs\10248\Arch\CAD\10248_DA022 Elevations Stage 1.vwx 2d.dwg



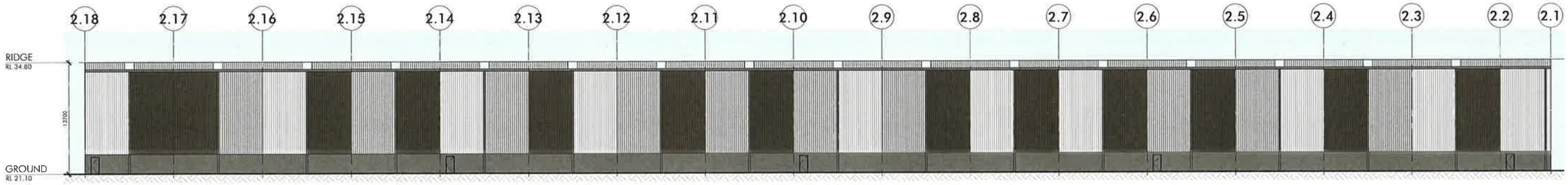
01 Warehouse 2 North Elevation
Scale 1:250



02 Warehouse 2 South Elevation
Scale 1:250



03 Warehouse 2 East Elevation
Scale 1:250



04 Warehouse 2 West Elevation
Scale 1:250

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	21.12.16
2	Issued for Review	22.02.17
3	Issued for Review	06.03.17
4	DA Draft	11.04.17

Title: Stage 2 Elevations
Scale: 1:250@A1
Date: April 2017
Number: 10248_DA023

nettleton tribe partnership pty ltd ABN 58 161 683 122
117 willoughby road crows nest nsw 2065
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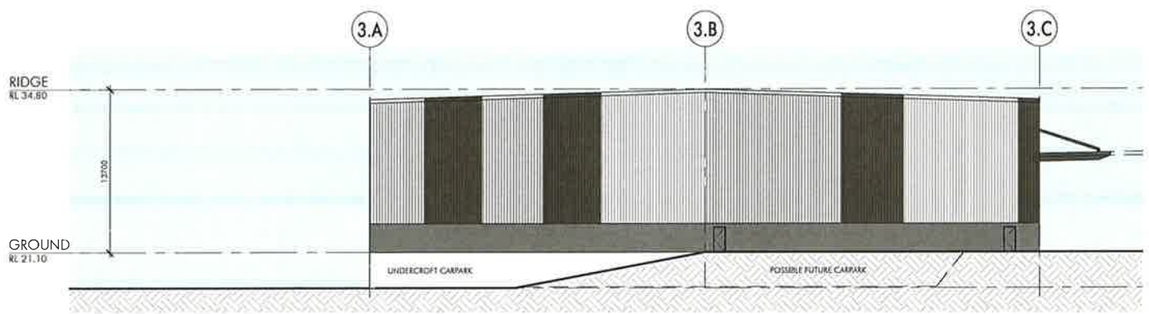
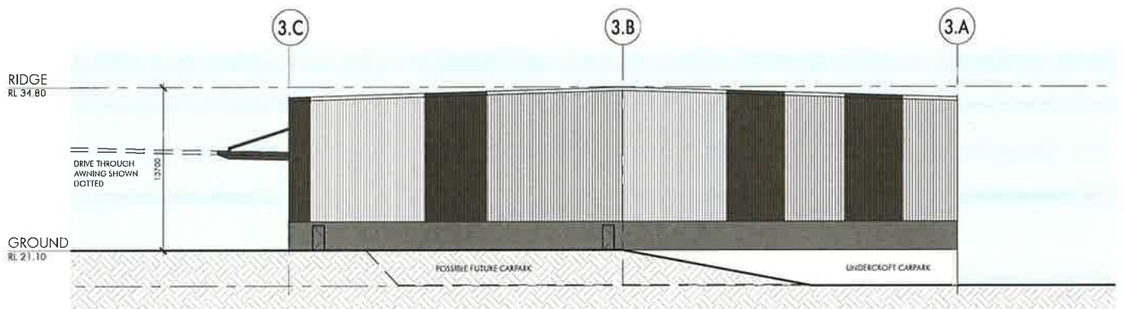
e sydney@nettletontribe.com.au w nettletontribe.com.au



A Warehouse 3 North Elevation
Scale 1:250



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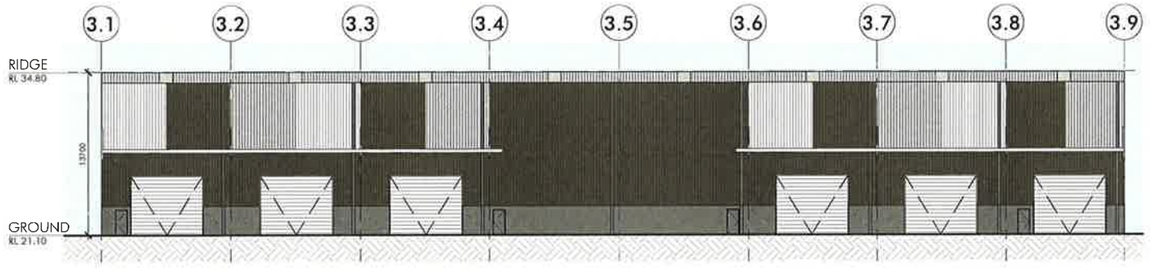
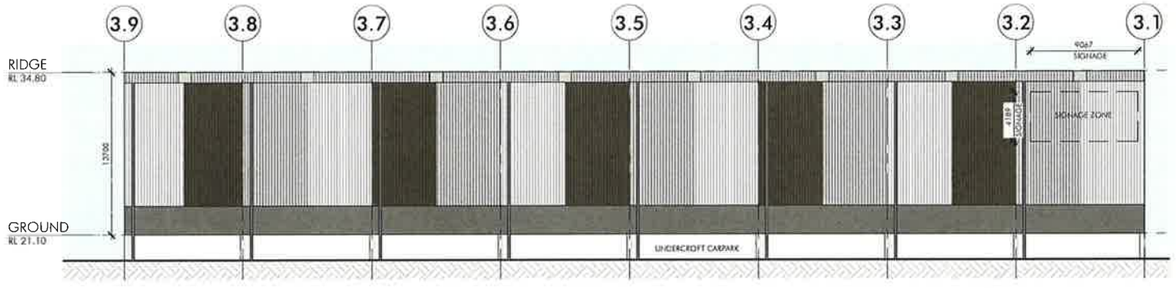
Scale 1:250



C Warehouse 3 East Elevation
Scale 1:250



D Warehouse 3 West Elevation
Scale 1:250

DRAFT

Client: Jaycar Electronics

Project: PROPOSED INDUSTRIAL DEVELOPMENT

54 - 68 FERNDELL STREET, SOUTH GRANVILLE

Issue	Description	Date
1	Issued for Review	21.12.16
2	Issued for Review	02.02.17
3	DA Draft	11.04.17

Title: Stage 2 Elevations
Scale: 1:250@A1
Date: April 2017
Number: 10248_DA024

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54-68 FERNDELL STREET, SOUTH GRANVILLE
CONCEPT STORMWATER MANAGEMENT PLAN

SITE WORKS - GENERAL

1. ALL WORKS ARE TO BE UNDERTAKEN IN ACCORDANCE WITH LOCAL COUNCIL, AUSTRALIAN AND AUTHORITY STANDARDS.
2. ALL TRENCHING WORKS ARE TO BE RESTORED TO ORIGINAL CONDITION
3. THE INTEGRITY OF ALL EXISTING AND NEW SERVICES IS TO BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD
4. ALL PLANS ARE TO BE READ IN CONJUNCTION WITH APPROVED ARCHITECTS, STRUCTURAL ENGINEERS AND OTHER CONSULTANTS PLANS. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER FOR CLARIFICATION
5. THE ENGINEER SHALL BE GIVEN A MIN OF 48 HOURS NOTICE FOR ALL STORMWATER DRAINAGE AND PAVEMENT INSPECTIONS. CONCRETE SHALL NOT BE DELIVERED UNTIL ENGINEERS APPROVAL IS OBTAINED

SITE WORKS - ACCESS AND SAFETY

1. ALL WORKS ARE TO BE UNDERTAKEN IN A SAFE MANNER IN ACCORDANCE WITH ALL STATUTORY AND INDUSTRIAL RELATION REQUIREMENTS
2. ACCESS TO ADJACENT BUILDINGS AND PROPERTIES SHALL BE MAINTAINED AT ALL TIMES.
3. WHERE NECESSARY SAFE PASSAGE SHALL BE PROVIDED FOR VEHICLES AND PEDESTRIANS THROUGH OR ADJACENT TO THE SITE.

SEDIMENT AND EROSION CONTROL

1. THE CONTRACTOR SHALL INSTIGATE ALL SEDIMENT AND EROSION CONTROL MEASURES IN ACCORDANCE WITH PARRAMATTA CITY COUNCIL STANDARDS AND THE "BLUE BOOK" MANAGING URBAN STORMWATER SOILS AND CONSTRUCTION. PRODUCED BY THE DEPARTMENT OF HOUSING! THESE MEASURES ARE TO BE REGULARLY INSPECTED AND MAINTAINED
2. THE SEDIMENT & EROSION CONTROL PLAN PRESENTS CONCEPTS ONLY. THE CONTRACTOR SHALL AT ALL TIMES BE RESPONSIBLE FOR THE ESTABLISHMENT & MANAGEMENT OF A DETAILED SCHEME MEETING COUNCIL'S DESIGN, AND ALL OTHER REGULATORY AUTHORITY REQUIREMENTS
3. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE SHALL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:
   a. INSTALL ALL TEMPORARY SEDIMENT FENCES AND BARRIER FENCES WHERE FENCES ARE ADJACENT TO EACH OTHER THE SEDIMENT FENCE CAN BE INCORPORATED INTO THE BARRIER FENCE.
   b. CONSTRUCT TEMPORARY STABILISED SITE ACCESS, INCLUDING SHAKE DOWN AND WASH PAD
   c. INSTALL SEDIMENT CONTROL MEASURES AS OUTLINED ON THESE SEDIMENT AND CONTROL PLANS ONCE APPROVED
4. THE CONTRACTOR SHALL UNDERTAKE SITE DEVELOPMENT WORKS SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF MINIMUM WORKABLE SIZE.
5. AT ALL TIMES AND IN PARTICULAR DURING WINDY AND DRY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL. TACIFIERS MAY BE USED TO CONTROL DUST DURING EXTENDED PERIODS OF DRY WEATHER.
6. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) SHALL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.
7. WATER SHALL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS THE CATCHMENT AREA HAS BEEN STABILISED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED OUT.
8. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES SHALL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE STABILISED / REHABILITATED
9. THE CONTRACTOR SHALL ALLOW FOR THE ESTABLISHMENT OF ANY OTHER EROSION PROTECTION MEASURES (IF APPLICABLE)
10. THE CONTRACTOR SHALL REGULARLY INSPECT (MINIMUM TWICE PER WEEK) ALL EROSION AND SEDIMENT CONTROL MEASURES TO ENSURE THEY ARE OPERATING EFFECTIVELY. REPAIRS AND/OR MAINTENANCE SHALL BE UNDERTAKEN REGULARLY AND AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS
11. ACCEPTABLE RECEPTORS SHALL BE USED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER. WASTE FROM THESE RECEPTORS SHALL BE DISPOSED OF IN ACCORDANCE WITH REGULATORY AUTHORITY REQUIREMENTS. PAY ALL FEES AND PROVIDE EVIDENCE OF SAFE DISPOSAL.

STORMWATER

1. DESIGN CRITERIA
   11. ROOF DRAINAGE - 100YR ARI
   12. PIPED DRAINAGE - 100YR ARI
2. WORKS SHOWN ARE CONCEPTUAL ONLY AND SUBJECT TO FINAL DESIGN AT CONSTRUCTION CERTIFICATE STAGE
3. ALL WORKS ARE TO BE UNDERTAKEN IN ACCORDANCE WITH THE FOLLOWING AUSTRALIAN STANDARDS AS2032, AS3500 AND AS3725 AS A MINIMUM
4. ALL PIPES LESS THAN OR EQUAL TO Ø300mm IN SIZE ARE TO BE SOLVENT WELD JOINTED UPVC CLASS SN8 U.N.O.
5. ALL PIPES Ø375mm OR GREATER IN SIZE ARE TO BE MIN CLASS 2 REINFORCED CONCRETE PIPE (RCP) OR FIBRE REINFORCED CONCRETE (FRC) RUBBER RING JOINTED (RRJ) U.N.O.
6. ALL PIPES ARE TO BE LAID AT MIN 1.0% GRADE U.N.O.
7. PIPE BEDDING IS TO BE HS2 UNDER ROADS AND TRAFFICKED AREAS AND SHALL BE H2 IN LANDSCAPED AND PEDESTRIAN TRAFFICKED AREAS U.N.O.
8. ALL PIPE BENDS AND JUNCTIONS ARE TO BE MADE WITH EITHER PURPOSE MADE FITTINGS OR STORMWATER DRAINAGE PITS.
9. MINIMUM COVER FROM THE OBVERT OF THE STORMWATER PIPE OF 300mm IS TO BE PROVIDED IN LANDSCAPED AREAS AND 600mm IN VEHICULAR TRAFFICKED AREAS U.N.O.
10. WHERE MINIMUM COVER CANNOT BE ACHIEVED CONCRETE ENCASEMENT OF THE AFFECTED PIPE IS MAY BE UNDERTAKEN WITH 20MPa CONCRETE WITH A MIN COVER OF 150mm TO ALL SIDES OF THE PIPE. THE CONTRACTOR SHALL CONFIRM THIS REQUIREMENT WITH THE ENGINEER OR SUPERINTENDENT.
11. LAID PIPELINES ARE TO HAVE THE FOLLOWING CONSTRUCTED TOLERANCES
    a. HORIZONTAL - 1:100 ANGULAR DEVIATION FROM REQUIRED ALIGNMENT.
    b. VERTICAL - 1:300 ANGULAR DEVIATION FROM REQUIRED ALIGNMENT.
12. ALL DRAINAGE PITS ARE TO BE CAST IN-SITU. PRECAST DRAINAGE PITS MAY BE USED WITH APPROVAL FROM THE ENGINEER. THE CONTRACTOR SHALL SUBMIT A PRECAST PIT INSTALLATION WORK METHOD STATEMENT FOR ASSESSMENT BY THE ENGINEER FOR APPROVAL.
13. DRAINAGE PIT COVERS ARE TO BE EITHER GALVANISED STEEL OR CAST IRON CLASS 'B' IN LANDSCAPED AND PEDESTRIAN TRAFFICKED AREAS AND CLASS 'D' IN ALL VEHICULAR TRAFFICKED AREAS U.N.O.
14. DRAINAGE PIT COVERS ARE TO BE 'HEELSAFE' TYPE IN ALL PEDESTRIAN TRAFFICKED AREAS U.N.O.
15. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED PRIOR TO COMMENCING WORKS ON SITE
16. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
17. DOWN PIPES CONNECTED DIRECT TO PIPES TO BE CONNECTED AT 45° TO THE FLOW DIRECTION WITH A CLEANING EYE PROVIDED AT GROUND LEVEL

FINISHED LEVELS

1. LEVELS BASED ON SURVEY PREPARED BY S.P. SITE SETOUT LTD, REF: SP1027_001.PRO DATED 01/08/16. THE CONTRACTOR SHALL VERIFY LEVELS PRIOR TO CONSTRUCTION COMMENCEMENT, ANY DISCREPANCIES SHALL BE NOTIFIED TO THE ENGINEER OR SUPERINTENDENT FOR CLARIFICATION
2. FINISHED LEVELS SHOWN ARE CONCEPTUAL ONLY AND SUBJECT TO DETAILED DESIGN PRIOR TO CONSTRUCTION CERTIFICATE APPLICATION. FINAL FINISHED LEVELS TO BE +/- 0.5m FROM LEVELS SHOWN
3. CARPARK & SERVICE AREA LAYOUT AND GRADES TO COMPLY WITH AS2890.
4. DRIVEWAY LAYOUT AND DESIGN TO COMPLY WITH LIVERPOOL CITY COUNCIL ACCESS DRIVEWAY DESIGN AND CONSTRUCTION SPECIFICATION
5. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN
6. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H U.N.O.
7. ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE U.N.O.
8. ALL PAVEMENTS ARE TO BE SET AT 50mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS U.N.O.

LOCALITY PLAN
NOT TO SCALE - COURTESY OF SIX MAPS

DRAWING SCHEDULE

DEVELOPMENT APPLICATION

DATE	No	AMENDMENT	INIT	REV
13.04.17		ISSUE FOR COORDINATION	BB	1
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	2
28.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	3

CHECKED | DATE
APPROVED | DATE
PAGE PLOT DATE: A0 | November 8, 2019
NORTH POINT
SCALE: NOT TO SCALE

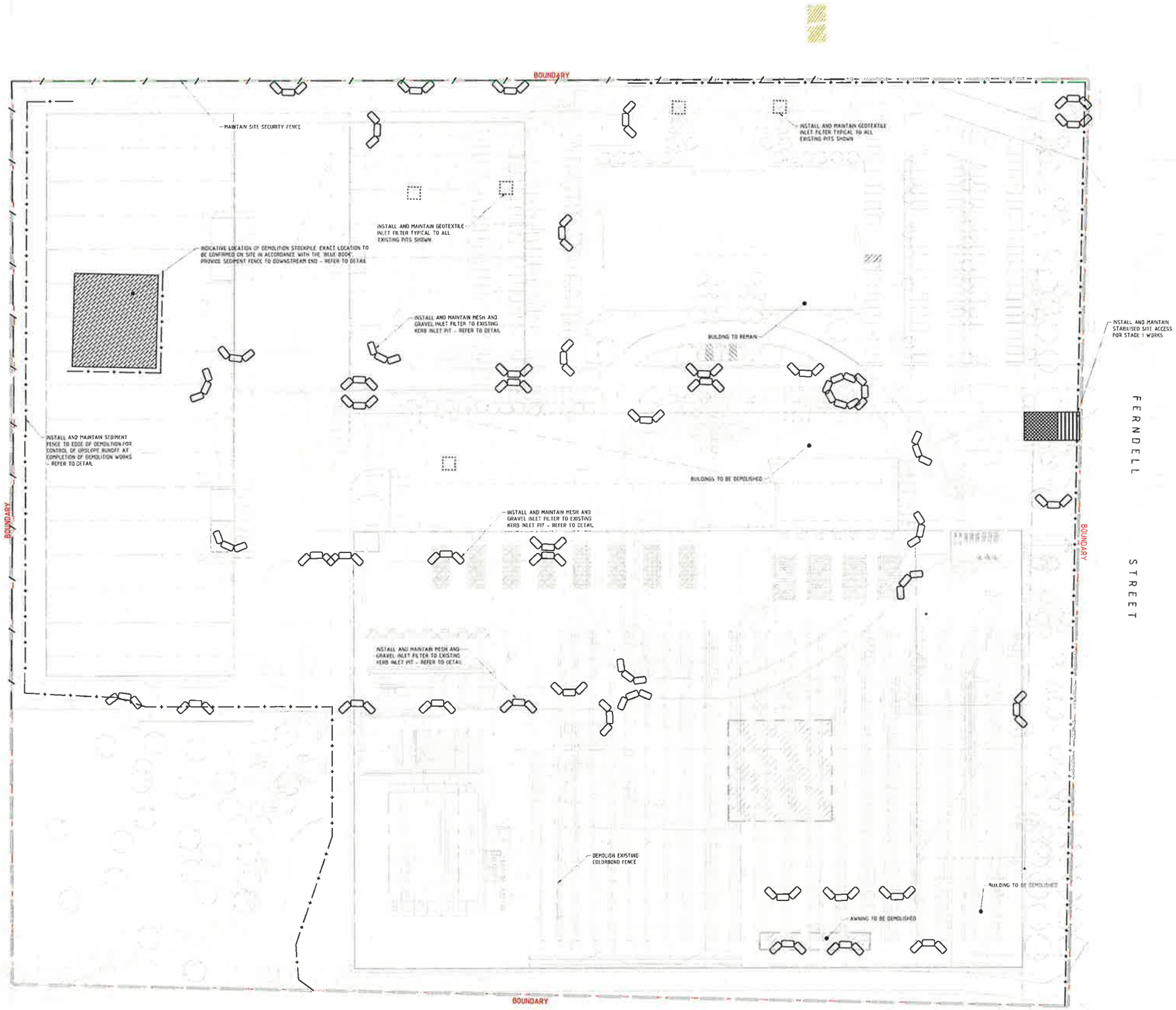
BUILDER: FDC
CLIENT: Jaycar
ARCHITECT: nt
PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE
DRAWING TITLE: CIVIL DESIGN
COVER SHEET, LOCALITY PLAN, AND DRAWING SCHEDULE

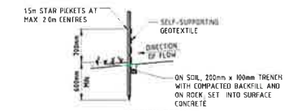
SPARKS+PARTNERS
CONSULTING ENGINEERS
HYDRAULIC | CIVIL | FIRE
Level 1, 31 Orchid Street | Parramatta | NSW 2150
P 02 9891 5022 | F 02 9891 3299 | E admin@sparksandpartners.com.au

AHSCA

DATE	DESIGN	DRAWN	CHECKED
-----	SK	SK	
SCALE: NTS			

JOB No: 16166 | DRG No: DA1.01 | REV: 3





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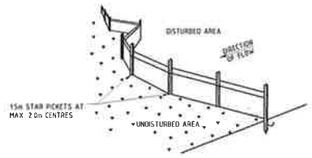


PLAN

SEDIMENT FENCE
NOT TO SCALE

NOTES:

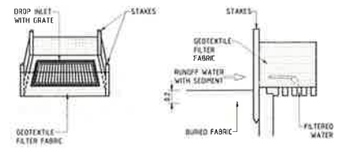
1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN ON THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50L/s IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 200mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED
3. DRIVE 15m LONG STAR PICKETS INTO GROUND AT 2.0m INTERVALS (MAX) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE

LEGEND

- SITE SECURITY FENCE
- SEDIMENT FENCE
- STABILISED SITE ACCESS
- SITE STOCKPILE
- MESH AND GRAVEL INLET FILTER
- GEOTEXTILE INLET FILTER
- BUILDING TO REMAIN
- BUILDINGS TO BE DEMOLISHED

NOTES

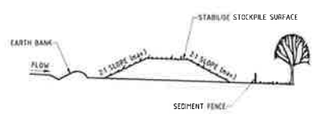
1. REFER TO CDC202 FOR DETAILS



GEOTEXTILE INLET FILTER DROP INLET SEDIMENT TRAP
NOT TO SCALE

NOTES:

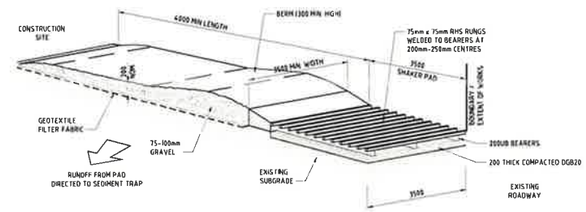
1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. CUT A 200mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. DRIVE 10m LONG STAR PICKETS INTO GROUND AT THE FOUR CORNERS OF PIT. WALLS ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.



STOCKPILE
NOT TO SCALE

NOTES:

1. PLACE STOCKPILES MORE THAN 2 (PREFERABLY 5) METRES FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2 METRES IN HEIGHT. 4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES 1 TO 2 METRES DOWNSLOPE



STABILISED SITE ACCESS
NOT TO SCALE

MAINTENANCE

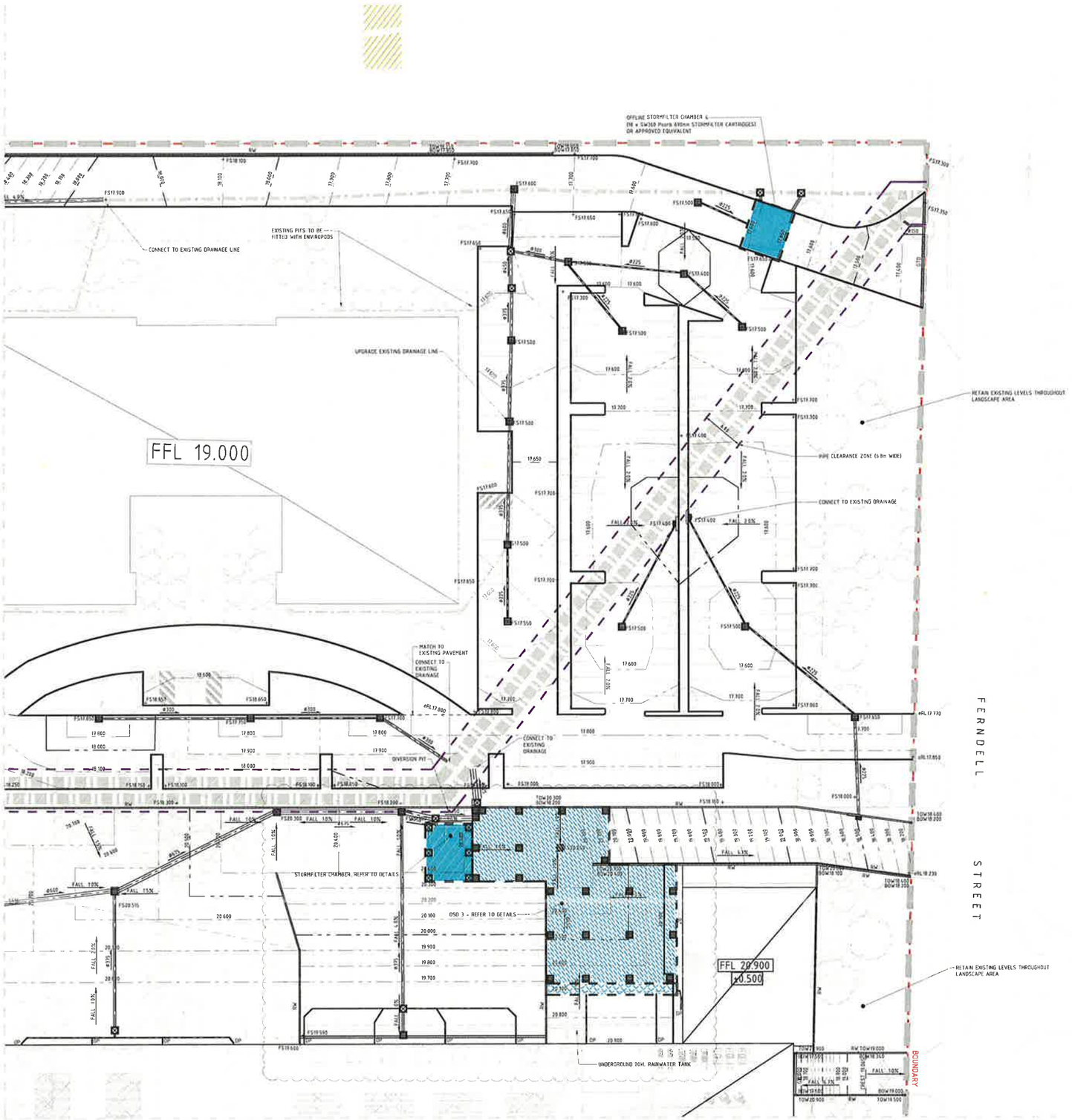
- THE TEMPORARY ACCESS SHALL BE MAINTAINED IN A CONDITION THAT PREVENTS TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS OF WAY.
- THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL GRAVEL AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
- ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS OF WAY MUST BE REMOVED IMMEDIATELY
- INSTALL BARRIER ON EITHER SIDE OF SHAKER PAD TO ENSURE VEHICLES ARE GUIDED ON TO THE PAD
- INVERT OF SHAKER PAD TO BE DRAINED VIA AGRICULTURAL PIPE WRAPPED IN GEOTEXTILE FABRIC

DEVELOPMENT APPLICATION

DATE	No	AMENDMENT	INIT	REV
15.11.16		ISSUE FOR CDC APPROVAL	MW	1
13.04.17		ISSUE FOR COORDINATION	BR	2
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BR	3
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BR	4

CHECKED | DATE
APPROVED | DATE
ISSUE PLOT SIZE: A0 | November 8, 2017
NORTH POINT
SCALE: 0 5 10 15 20 25 30 35 40 METERS

BUILDER: FDC
CLIENT: Jaycar
ARCHITECT:
PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE
DRAWING TITLE: CIVIL DESIGN SEDIMENT AND EROSION CONTROL PLAN AND DETAILS
SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC & CIVIL
DRAWN: SK | CHECKED:
SCALE: 1:500 @ A0 | 1:00 @ A3
JOB No: 16166 | DRG No: DA2.01 | REV: 4



REFER DA4.02 FOR CONTINUATION

REFER DA4.02 FOR CONTINUATION

LEGEND

- PROPOSED STORMWATER PIPE
- EXISTING STORMWATER PIPE
- PROPOSED STORMWATER PIT
- EXISTING STORMWATER PIT
- PROPOSED KERB INLET PIT
- DP — PROPOSED DOWNPIPE
- ENERGY DISSIPATOR
- Ø225 — PIPE FLOW DIRECTION AND SIZE
- RAINWATER TANK
- STORMFILTER CHAMBER
- GTD — PROPOSED GRATED TRENCH DRAIN
- PROPERTY BOUNDARY LINE
- 2100 — FINISHED SURFACE MAJOR CONTOUR LINE
- 2110 — FINISHED SURFACE MINOR CONTOUR LINE
- 2130 — FINISHED SURFACE CREST LINE
- FFL 555.555 — FINISHED FLOOR LEVEL OF PROPOSED BUILDING
- + FS55.555 — FINISHED SURFACE LEVEL
- + eRL55.555 — EXISTING SURFACE LEVEL
- + TOW55.555 — TOP OF WALL LEVEL
- + BOW55.555 — BOTTOM OF WALL LEVEL
- FALL 1.28% — DIRECTION OF SURFACE FALL
- RW — RETAINING WALL
- PIPE CLEARANCE ZONE
- CULVERT

NOTES

1. REFER TO DRAWING DA1.01 FOR GENERAL NOTES AND SPECIFICATIONS
2. REFER TO DRAWING DA1.06-07 FOR CATCHMENT PLANS
3. REFER TO DA1.11-15 FOR STORMWATER MANAGEMENT DETAILS AND SECTIONS
4. REFER TO DA1.21-24 FOR FLOODING PLANS
5. ALL GRATED INLET PITS TO BE FITTED WITH STORMWATER 360 ENCIROPODS OR APPROVED EQUIVALENT

NOTES

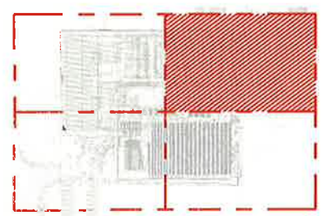
6. STORMFILTER CHAMBER CALCULATIONS

STORMFILTER CHAMBER 4:
FILTRATION CHAMBER VOLUME SIZED TO CAPTURE FIRST FLUSH FROM 13 MONTH ARI EVENT FOR Tc=6min.

TOTAL AREA DRAINING TO FILTRATION CHAMBER = 20,914m2 (AS PER CATCHMENT PLAN)

Tc = 6mins
I5 = 85.4mm/h
Cy = 0.92
Qfi = 357.2L/s
13 MONTH RUNOFF IS APPROXIMATELY 30% OF THE Qfi FLOW = 107.2L/s

MINIMUM VOLUME OF FILTRATION CHAMBER TO BE 32.3m3 (107.2L/s x 60sec x 6mins)
VOLUME PROVIDED = 35.1m3



KEY PLAN
SCALE 1:4000

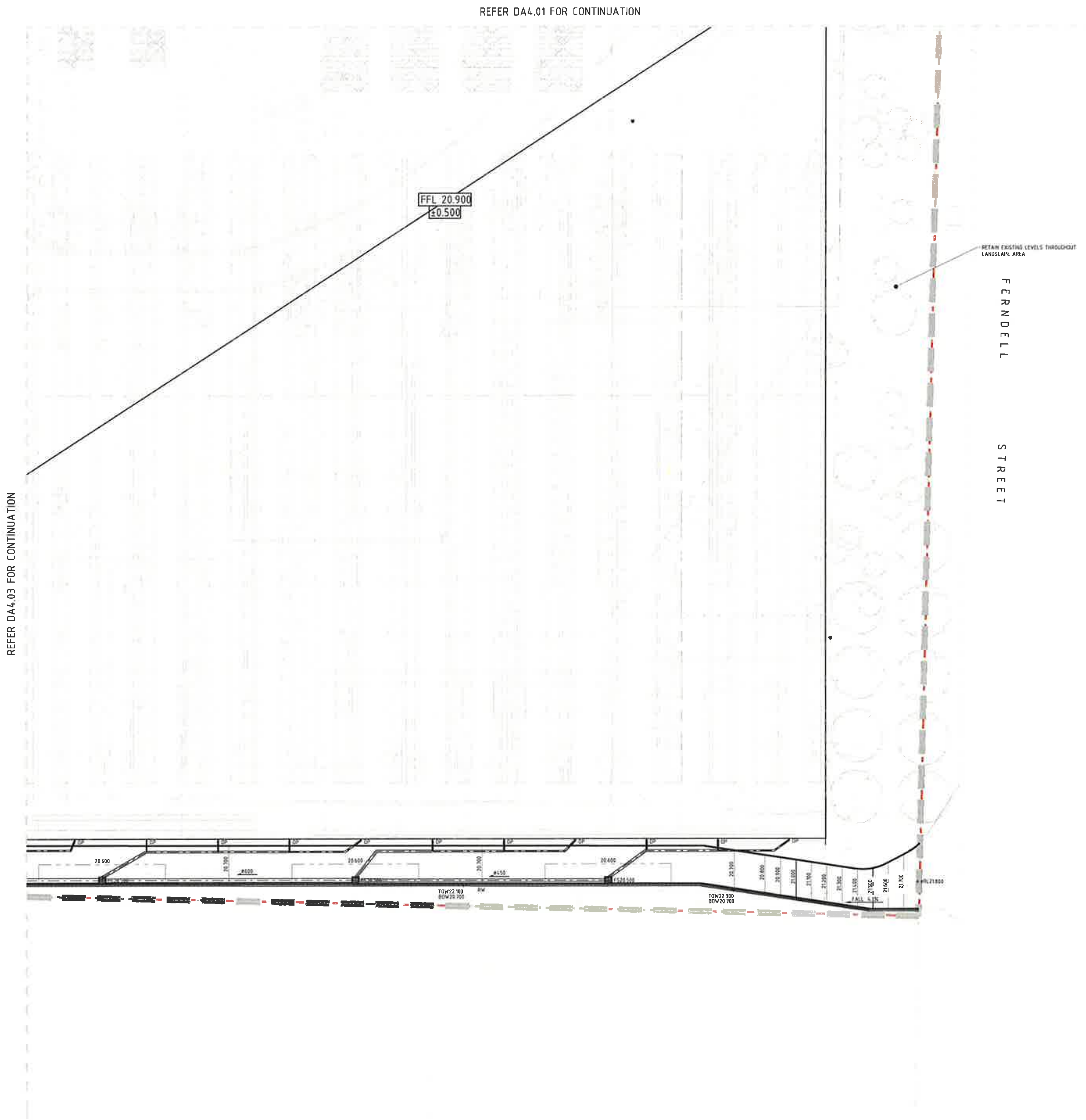
DATE	No	AMENDMENT	INIT	REV
17.01.17		ISSUE FOR COORDINATION	SK	1
17.03.17		ISSUE FOR COORDINATION	SK	2
24.03.17		ISSUE FOR COORDINATION	BB	3
30.03.17		ISSUE FOR COORDINATION	BB	4
13.04.17		ISSUE FOR COORDINATION	BB	5
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	6
03.10.17		ISSUED FOR COORDINATION	SK	7

DATE	No	AMENDMENT	INIT	REV
06.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	8

CHECKED DATE
APPROVED DATE
PLOT DATE: A0 November 8, 2017
SCALE: 1:250 METRES

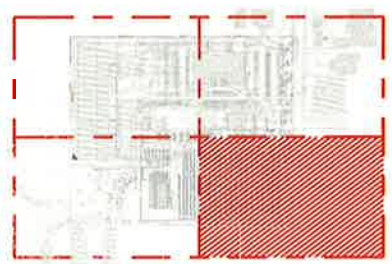
DEVELOPMENT APPLICATION

BUILDER: FDC
CLIENT: Jaycar
ARCHITECT: nt
PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE
DRAWING TITLE: CIVIL DESIGN SITEWORKS AND STORMWATER MANAGEMENT PLAN SHEET 1
SPARKS+PARTNERS CONSULTING ENGINEERS WOLLONGONG
DATE: ---- DESIGNED: SK
SCALE: 1:250 @ A0 DRAWN: SK
JOB No. 16166 DWG No. DA4.01 REV. 8



NOTES

1. REFER TO DRAWING DA4.01 FOR LEGENDS AND NOTES



KEY PLAN
SCALE 1:4000

DEVELOPMENT APPLICATION

DATE	No	AMENDMENT	INT	REV
13.01.17		ISSUE FOR COORDINATION	SK	1
17.02.17		ISSUE FOR COORDINATION	SK	2
24.02.17		ISSUE FOR COORDINATION	BB	3
30.03.17		ISSUE FOR COORDINATION	BB	4
13.04.17		ISSUE FOR COORDINATION	BB	5
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	6
03.10.17		ISSUED FOR COORDINATION	SK	7
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	8

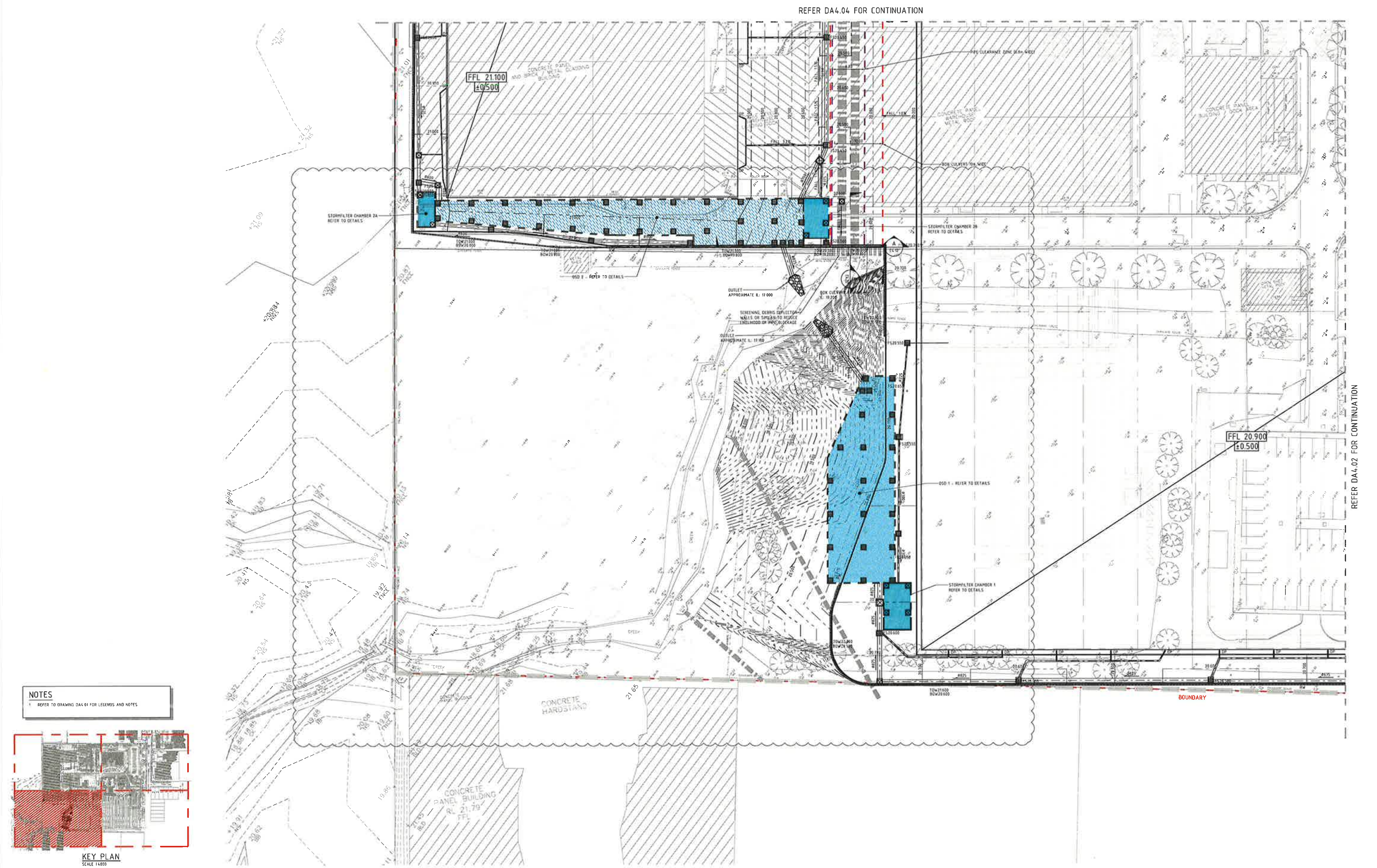
AO November 8, 2017

PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE

DRAWING TITLE: CIVIL DESIGN SITEWORKS AND STORMWATER MANAGEMENT PLAN SHEET 2

SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE

DESIGNED	DRAWN	SCALE	JOB No	DWG No	REV
SK	SK	1:250 @ A0	16166	DA4.02	8



DEVELOPMENT APPLICATION

DATE	No	AMENDMENT	INT	REV
13.01.17		ISSUE FOR COORDINATION	SK	1
17.02.17		ISSUE FOR COORDINATION	SK	2
24.02.17		ISSUE FOR COORDINATION	BB	3
10.03.17		ISSUE FOR COORDINATION	BB	4
13.04.17		ISSUE FOR COORDINATION	BB	5
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	6
03.10.17		ISSUED FOR COORDINATION	SK	7
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	SK	8
25.07.18		ISSUED FOR DEVELOPMENT APPLICATION	SK	9

BUILDER: PROJECT STRATEGY

CLIENT: Jaycar

ARCHITECT: nettletontribe

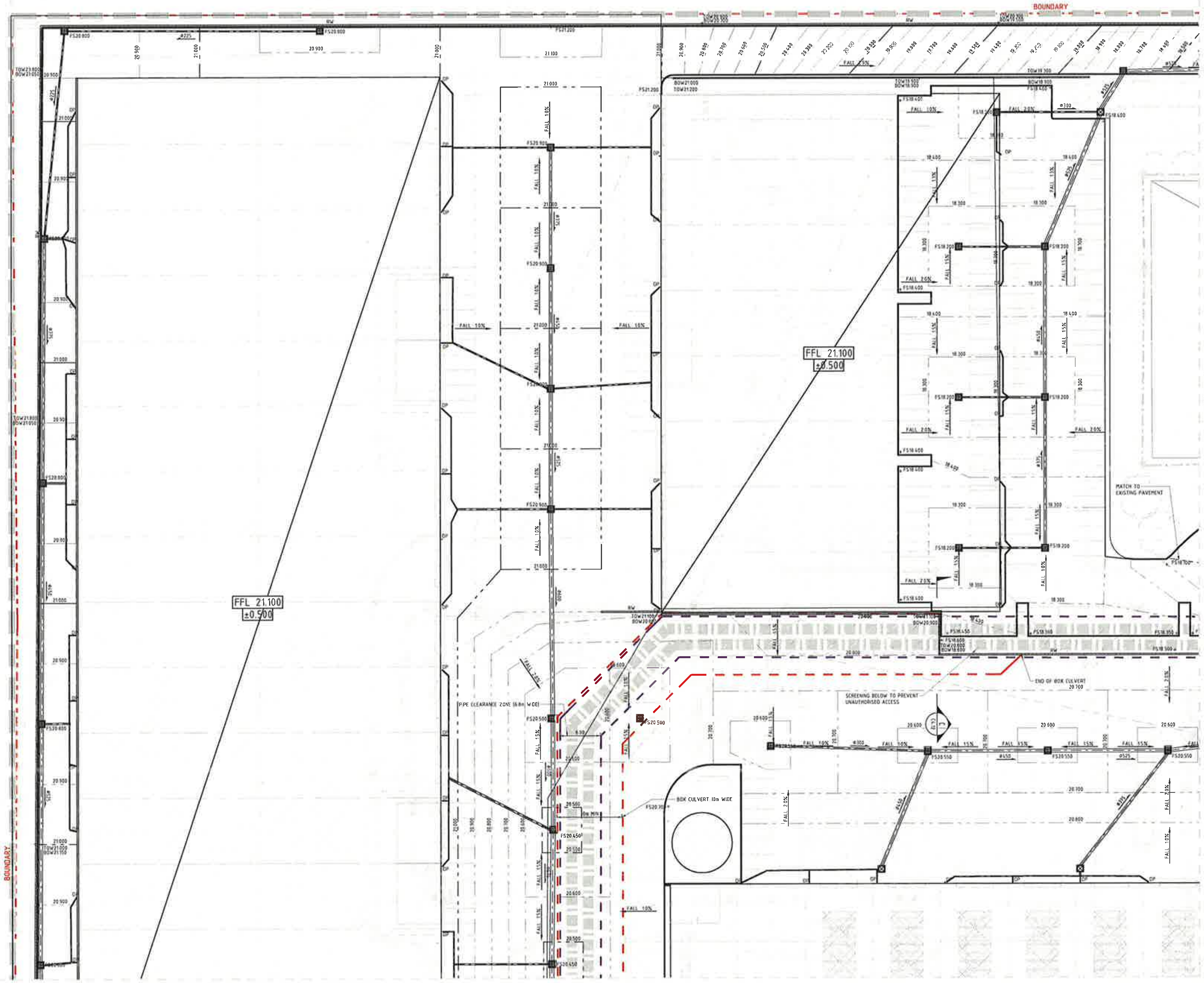
PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE

DRAWING TITLE: CIVIL DESIGN SITEWORKS AND STORMWATER MANAGEMENT PLAN SHEET 3

SPARKS + PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE

SCALE 1:250 @ A0 | DESIGNED SK | DRAWN SK

JOB No 16166 | DWG No DA4.03 | REV 9

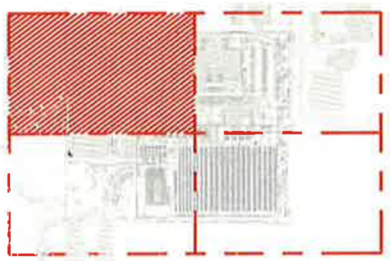


REFER DA4.01 FOR CONTINUATION

REFER DA4.03 FOR CONTINUATION

NOTES

1. REFER TO DRAWING DA4.01 FOR LEGENDS AND NOTES



KEY PLAN
SCALE 1:4000

DATE	No	AMENDMENT	INT	REV
13.01.17		ISSUE FOR COORDINATION	SK	1
17.02.17		ISSUE FOR COORDINATION	SK	2
24.02.17		ISSUE FOR COORDINATION	BB	3
30.03.17		ISSUE FOR COORDINATION	BB	4
13.04.17		ISSUE FOR COORDINATION	BB	5
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	6
03.10.17		ISSUED FOR COORDINATION	SK	7
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	SK	8

DEVELOPMENT APPLICATION

BUILDER: FDC
CLIENT: Jaycar

PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE

DRAWING TITLE: CIVIL DESIGN
SITEWORKS AND STORMWATER MANAGEMENT PLAN SHEET 4

SPARKS+PARTNERS
CONSULTING ENGINEERS
HYDRAULIC | CIVIL | FIRE

AHSCA

DESIGNED	SK
SCALE	1:250 @ A0
DRAWN	SK
JOB No	16166
DWG No	DA4.04
REV	8

LEGEND

OSD 1

OSD 1 CATCHMENT 18,301m²

OSD 1 BYPASS 2,900m² (14% OSD 1 AREA)

TOTAL OSD 1 CATCHMENT AREA 21,201m²

OSD 2

OSD 2 CATCHMENT: 24,067m²

OSD 2 BYPASS 617m² (3% OSD 2 AREA)

TOTAL OSD 3 CATCHMENT AREA 24,684m²

OSD 3

OSD 3 CATCHMENT: 23,123m²

OSD 3 BYPASS 1,523m² (6% OSD 3 AREA)

TOTAL OSD 3 CATCHMENT AREA 24,646m²

BIODIVERSITY AND FLOODING AREA 29,695m² (NOT INCLUDED IN OSD CALCULATION)

TOTAL AREA: 100,225m²

DEVELOPMENT APPLICATION

DATE	No	AMENDMENT	INT	REV
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	1

CHECKED DATE

APPROVED DATE

PAPER POST SIZE A0 November 8, 2013

NORTH POINT

SCALE 1:500 @ A0

BUILDER FDC

CLIENT Jaycar

ARCHITECT nt

PROJECT 54-68 FERNDELL STREET, SOUTH GRANVILLE

DRAWING TITLE CIVIL DESIGN
STORMWATER MANAGEMENT OSD
CATCHMENT PLAN

SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC CIVIL LIFE

DESIGNED SK

DRAWN SK

CHECKED

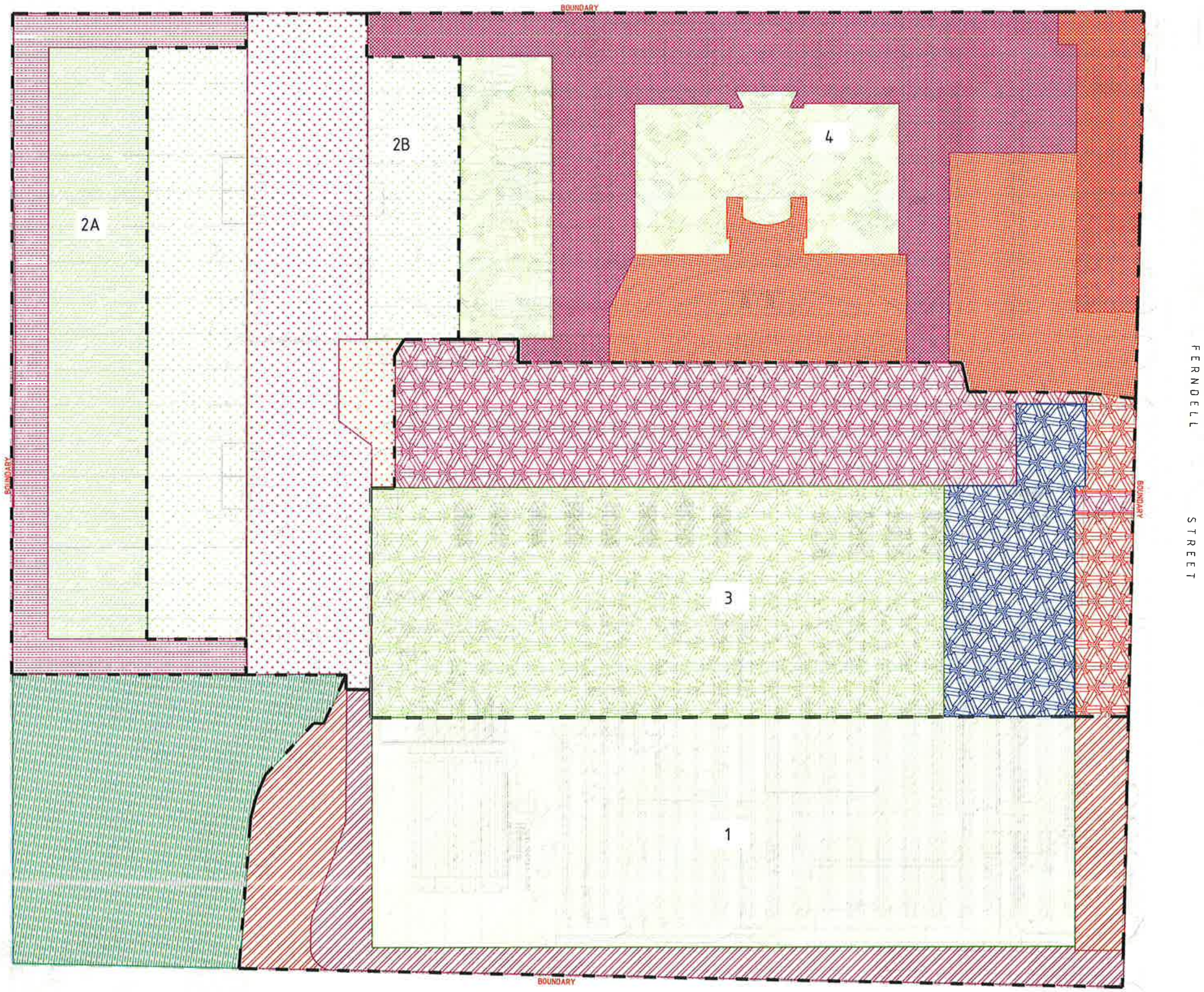
SCALE 1:500

JOB NO 16166

DRAWING NO DA4.06

OF

REV 1



LEGEND

(dashed outline)	CATCHMENT AREA FOR TREATMENT MEASURES
4	NO REFERRING TO DIFFERENT TREATMENT MEASURES
(pattern)	ROOF CATCHMENT AREA TO TREATMENT CHAMBER 1 (STORMFILTER CHAMBERS) 15,060m²
(pattern)	HARDSTAND CATCHMENT AREA TO TREATMENT CHAMBER 1 (ENVIROPODS AND STORMFILTER CHAMBERS) 3,240m²
(pattern)	BYPASS TREATMENT CATCHMENT AREA (WITHIN TREATMENT CATCHMENT 1) 2,900m²
(pattern)	ROOF CATCHMENT AREA TO TREATMENT CHAMBER 2A (STORMFILTER CHAMBERS) 5,449m²
(pattern)	HARDSTAND CATCHMENT AREA TO TREATMENT CHAMBER 2A (ENVIROPODS AND STORMFILTER CHAMBERS) 3,435m²
(pattern)	ROOF CATCHMENT AREA TO TREATMENT CHAMBER 2B (STORMFILTER CHAMBERS) 7,898m²
(pattern)	HARDSTAND CATCHMENT AREA TO TREATMENT CHAMBER 2B (ENVIROPODS AND STORMFILTER CHAMBERS) 7,285m²
(pattern)	HARDSTAND CATCHMENT AREA TO ENVIROPODS ONLY 617m²
(pattern)	ROOF CATCHMENT AREA TO RAINWATER TANK 3,340m²
(pattern)	ROOF CATCHMENT AREA TO TREATMENT CHAMBER 3 (STORMFILTER CHAMBERS) 12,260m²
(pattern)	HARDSTAND CATCHMENT AREA TO TREATMENT CHAMBER 3 (ENVIROPODS AND STORMFILTER CHAMBERS) 7,523m²
(pattern)	BYPASS TREATMENT CATCHMENT AREA (WITHIN TREATMENT CATCHMENT 3) 1,513m²
(pattern)	ROOF CATCHMENT AREA TO TREATMENT CHAMBER 4 (STORMFILTER CHAMBERS) 5,910m²
(pattern)	HARDSTAND CATCHMENT AREA TO TREATMENT CHAMBER 4 (ENVIROPODS AND STORMFILTER CHAMBERS) 8,665m²
(pattern)	HARDSTAND CATCHMENT AREA TO ENVIROPODS ONLY 6,400m²
(pattern)	BYPASS TREATMENT CATCHMENT AREA 1,770m²
(pattern)	BIODIVERSITY AREA 6,960m²
	TOTAL AREA 100,225m²

PAGE A0 PLOT DATE November 8, 2017

SCALE 0 5 10 15 20 25 30 35 40 METERS

DATE	No	AMENDMENT	INT	REV
13.04.17		ISSUE FOR COORDINATION	BB	1
03.05.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	2
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	3

DEVELOPMENT APPLICATION

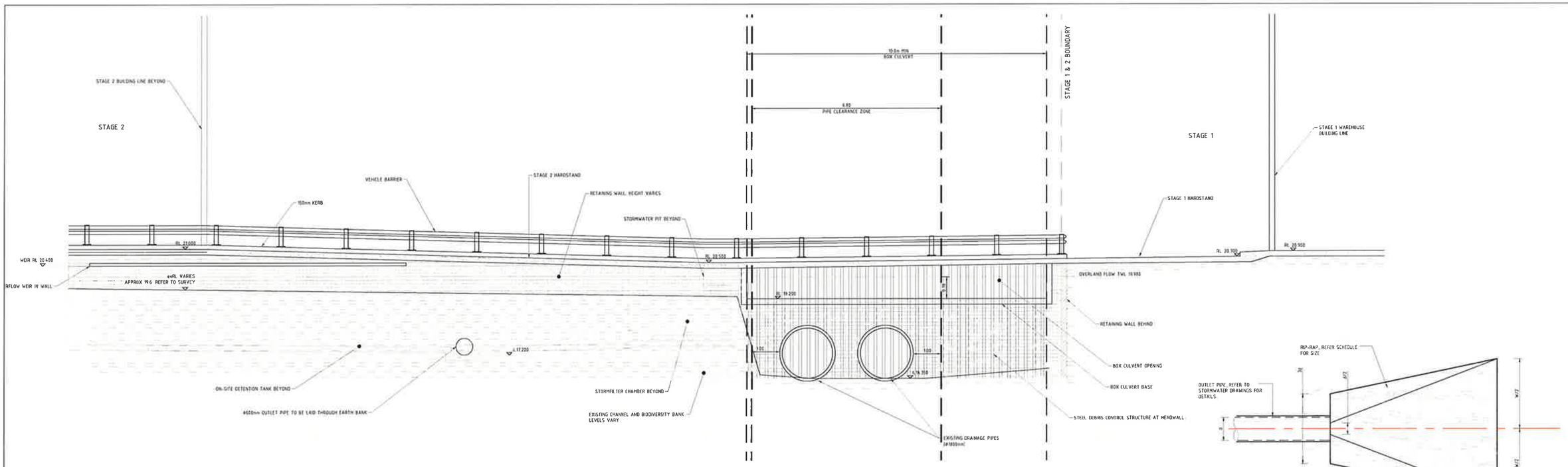
BUILDER: FDC
CLIENT: Jaycar

PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE

DRAWING TITLE: CIVIL DESIGN STORMWATER MANAGEMENT WSUD CATCHMENT PLAN

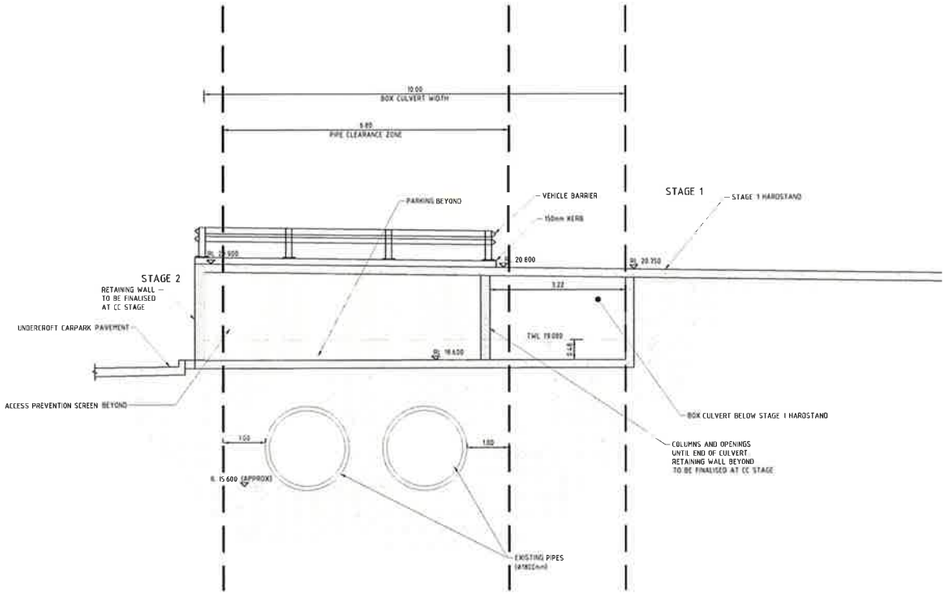
SPARKS + PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE

DESIGNED SK | DRAWN SK | SCALE 1:500 @ A0 | JOB No 16166 | DWG No DA4.07 | REV 3

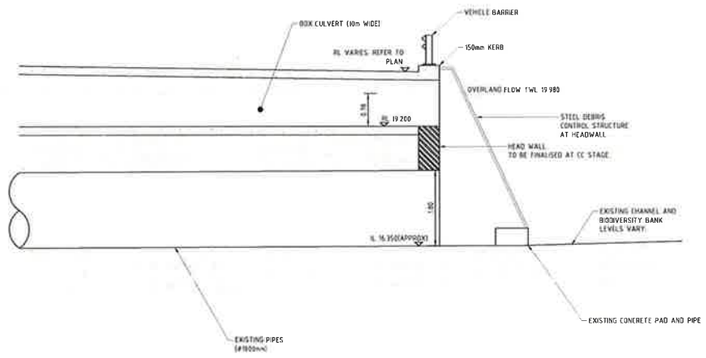


BOX CULVERT SECTION (A) DA4.03
SCALE 1:50

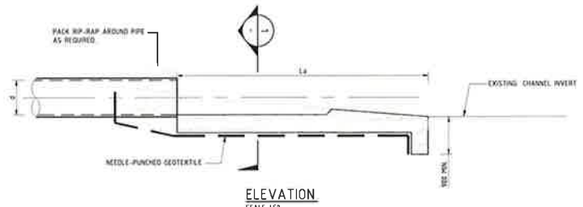
PLAN VIEW
SCALE 1:50



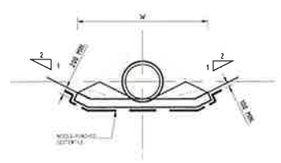
BOX CULVERT SECTION (C) DA4.04
SCALE 1:50



BOX CULVERT SECTION (B) DA4.03
SCALE 1:50



ELEVATION
SCALE 1:50



SECTION (1)
SCALE 1:50

DISSIPATER NOTES:

1. ALIGN STRUCTURE EVENLY WITH BANK
2. LOCATE STRUCTURE AT INVERT LEVEL OF STREAM AND POINT IN A DOWNSTREAM DIRECTION
3. PIPE TO REST ON, AND BE PACKED IN, BY RIP-RAP (SIZE AS NOTED)
4. DISCHARGE INTO STREAM WHERE BEDROCK IS PRESENT, OTHERWISE SCOUR PROTECT AS REQUIRED
5. SCOUR PROTECT THE OPPOSITE BANK AS REQUIRED
6. RIP-RAP TO CONSIST OF ANGULAR RUN-OF-QUARRY ROCK AS NOTED PLACED OVER A 200mm LAYER OF 10mm GRANULES OVER NEEDLE-PUNCHED GEOFAB A4A.
7. GAPS IN RIP-RAP TO BE PLANTED WITH NATIVE SEDGES & RUSHES

DISSIPATER SCHEDULE

DISCHARGE POINT	d	La	W	RIP-RAP
OUTLET	525 (TBC)	4000	2300	150

STORMWATER OUTLET DISSIPATER
SCALE 1:50

DEVELOPMENT APPLICATION

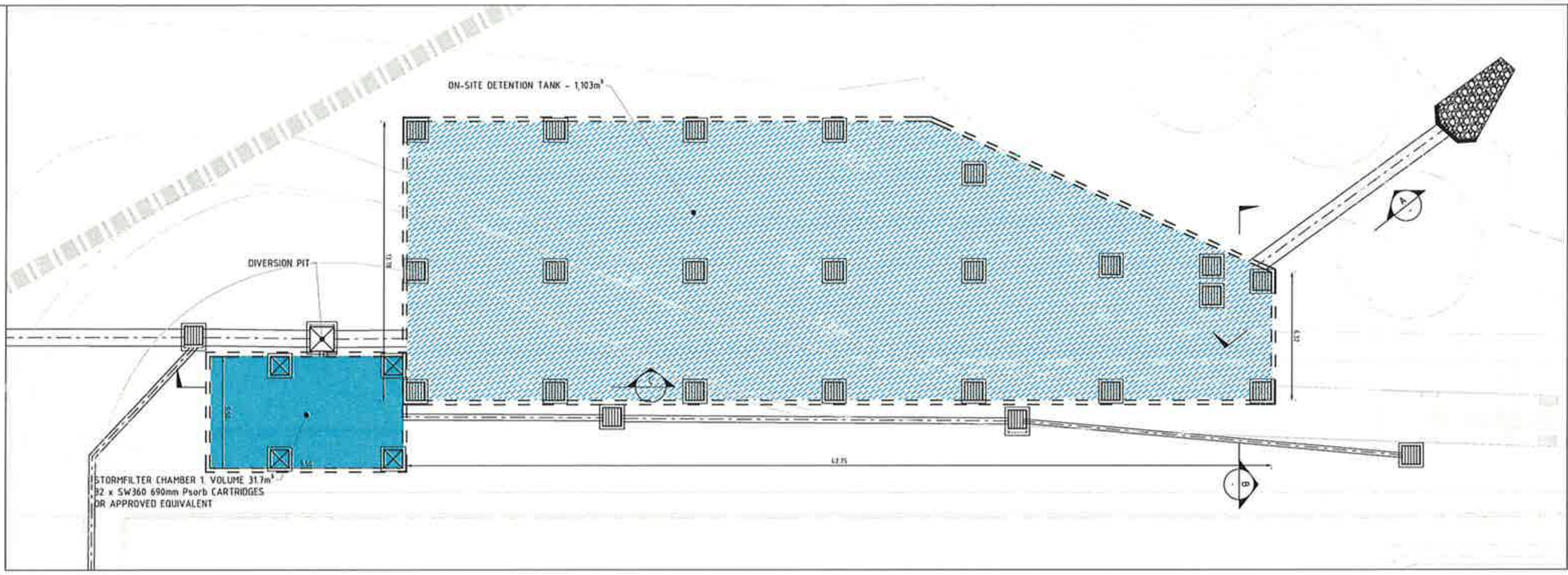
No	AMENDMENT	INT	REV
13.04.17	ISSUE FOR COORDINATION	BB	1
28.05.17	ISSUE FOR DEVELOPMENT APPLICATION	BB	2
28.11.19	ISSUE FOR DEVELOPMENT APPLICATION	BB	3

PAPER SIZE A0 | November 8, 2019

BUILDER: FDC Construction & Fitout Pty Ltd
CLIENT: Jaycar
ARCHITECT:
PROJECT: 54-60 FERNDELL STREET, SOUTH GRANVILLE
DRAWING TITLE: CIVIL DESIGN BOX CULVERT SECTIONS AND STORMWATER OUTLET DISSIPATER DETAILS

SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE
Level 1, 91 George St (cnr) Parramatta | NSW 2150
P 02 9291 5033 | F 02 9891 3858 | E admin@sparksandpartners.com.au

DRAWN: SK | DESIGNED: SK
SCALE: 1:50 @ A0
JOB NO: 16166 | DRAWING NO: DA4.12 | REV: 3



OSD 1 AND SW TREATMENT CONFIGURATION PLAN

SCALE 1:100

NOTES & CALCULATIONS

1. REFER TO DA 4.03 FOR TANK LOCATION
2. REFER TO DA4.06 & DA4.07 FOR CATCHMENT PLANS
3. REFER TO WSUD REPORT FOR OSD CALCULATIONS
4. STORMFILTER CHAMBER CALCULATIONS

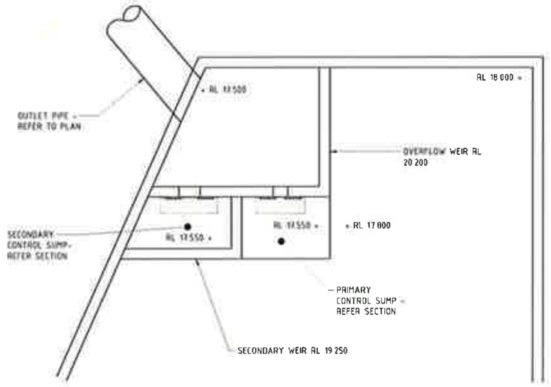
STORMFILTER CHAMBER 1

FILTRATION CHAMBER VOLUME SIZED TO CAPTURE FIRST FLUSH FROM 13 MONTH ARI EVENT FOR Tc=6min

TOTAL AREA DRAINING TO FILTRATION CHAMBER = 8884m2 (AS PER CATCHMENT PLAN)

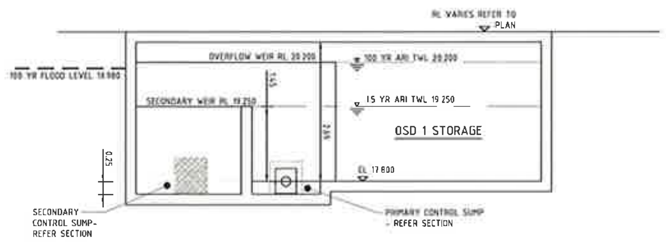
Tc = 6mins
I5 = 80mm/h
Cy = 0.72
QI = 292.8L/s
13 MONTH RUNOFF IS APPROXIMATELY 30% OF THE QI FLOW = 87.9l/s

MINIMUM VOLUME OF FILTRATION CHAMBER TO BE 31.7m3 (87.9l/s x 60sec x 6mins)
VOLUME PROVIDED = 35.8m³



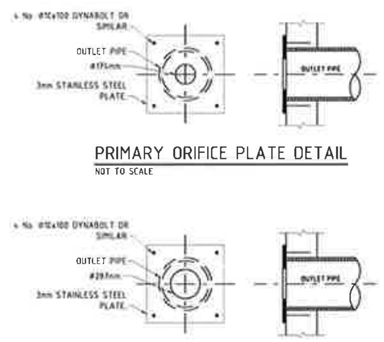
OSD 1 STAGED DISCHARGE CONTROL SUMP AND WEIR LAYOUT

SCALE 1:50



OSD 1 SECTION B

SCALE 1:50

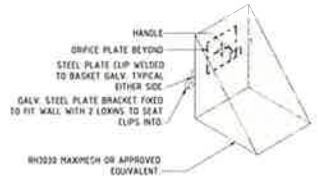


PRIMARY ORIFICE PLATE DETAIL

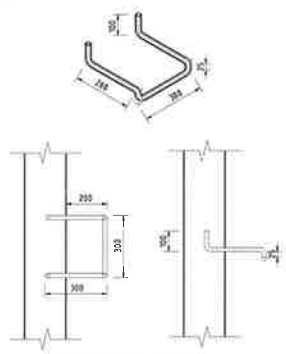
NOT TO SCALE

SECONDARY PLATE DETAIL

NOT TO SCALE



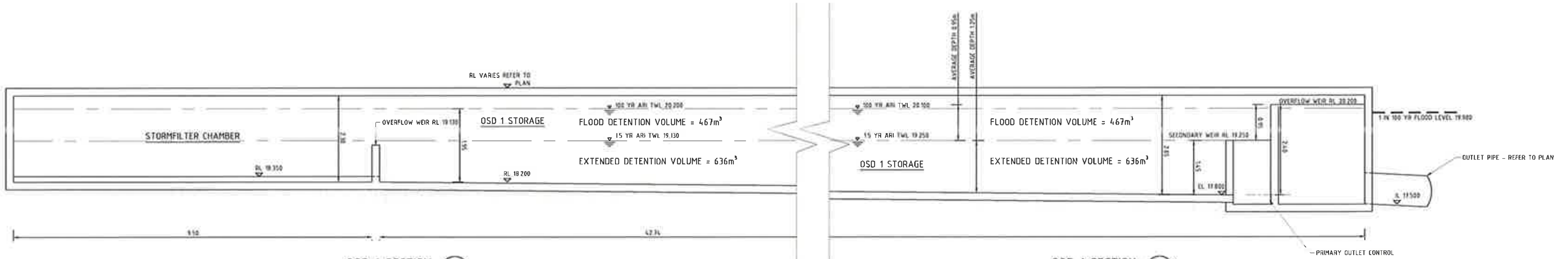
TRASH SCREEN DETAIL



STEP IRON DETAIL

NOT TO SCALE

STEP IRON OF 20mm GALVANIZED STEEL MADE TO SHAPE AND DIMENSIONS SHOWN AND PLACED AT 300 CENTRES AND STAGGERED HORIZONTALLY FOR PITS DEEPER THAN 1.0m



OSD 1 SECTION C

SCALE 1:50

OSD 1 SECTION A

SCALE 1:50

DATE	No	AMENDMENT	INIT	REV
03.10.17		ISSUED FOR COORDINATION	SK	1
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	2

A0 November 8, 2017

SCALE AS SHOWN ON PLAN

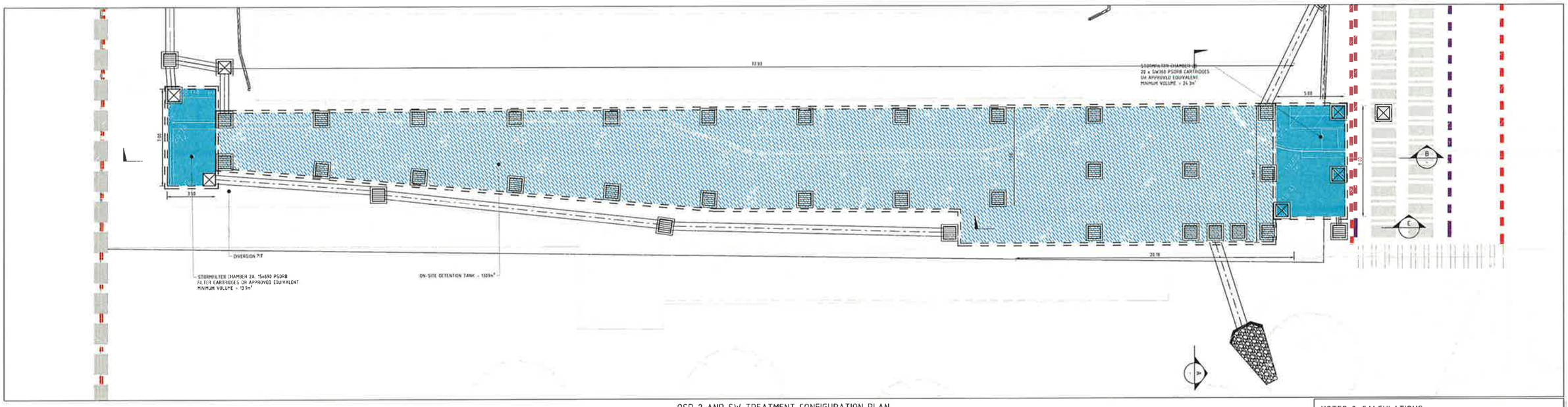
DEVELOPMENT APPLICATION

PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE

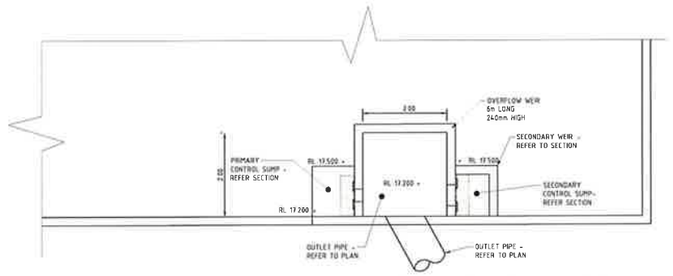
DRAWING TITLE: CIVIL DESIGN OSD 1 PLAN AND DETAILS

SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE

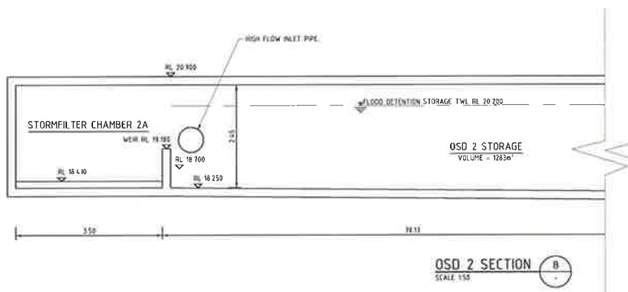
DESIGNED	DRAWN	SCALE	JOB No	DWG No	REV
SK	SK	AS SHOWN	16166	DA4.13	2



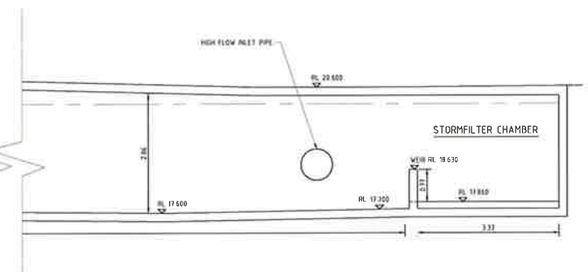
OSD 2 AND SW TREATMENT CONFIGURATION PLAN
SCALE 1:100



OSD 2 STAGED DISCHARGE CONTROL SUMP AND WEIR LAYOUT
SCALE 1:50



OSD 2 SECTION B
SCALE 1:50



NOTES & CALCULATIONS

1. REFER TO DA 4.03 FOR TANK LOCATION
2. REFER TO DA4.06 & DA4.07 FOR CATCHMENT PLANS
3. REFER TO WSUD REPORT FOR OSD CALCULATIONS
4. STORMFILTER CHAMBER CALCULATIONS

STORMFILTER CHAMBER 2A
FILTRATION CHAMBER VOLUME SIZED TO CAPTURE FIRST FLUSH FROM 13 MONTH ARI EVENT FOR Tc+5mins

TOTAL AREA DRAINING TO FILTRATION CHAMBER = 8886m2 (AS PER CATCHMENT PLAN)

Tc = 5mins
I5 = 85.4mm/h
Cy = 0.72
Q1 = 153.7l/s
13 MONTH RUNOFF IS APPROXIMATELY 30% OF THE Q1 FLOW = 45.5l/s

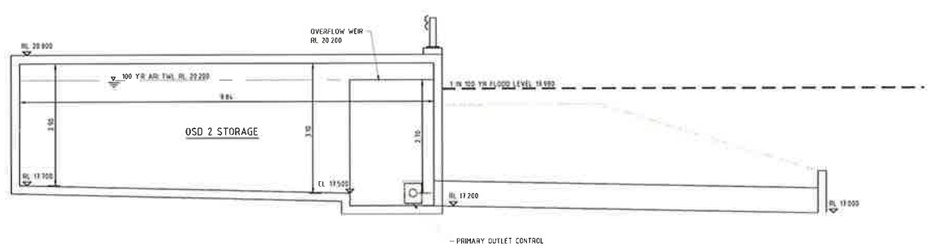
MINIMUM VOLUME OF FILTRATION CHAMBER TO BE 13.7m3 (45.5l/s x 60sec x 5mins)
VOLUME PROVIDED = 16.9m³

STORMFILTER CHAMBER 2B
FILTRATION CHAMBER VOLUME SIZED TO CAPTURE FIRST FLUSH FROM 13 MONTH ARI STORM EVENT FOR Tc+5mins

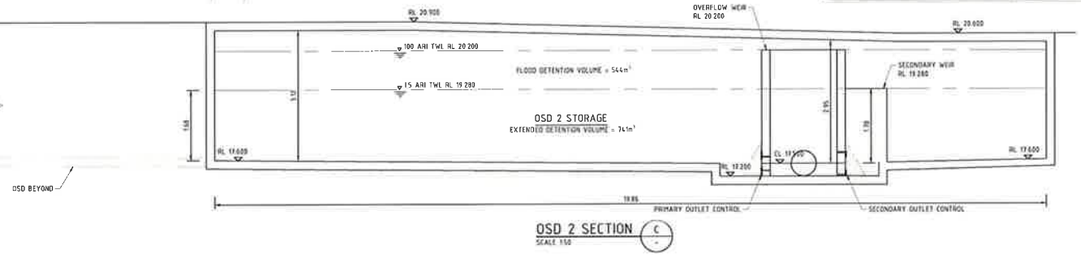
TOTAL AREA DRAINING TO FILTRATION CHAMBER = 15800m2 (AS PER CATCHMENT PLAN)

Tc = 5mins
I5 = 85.4mm/h
Cy = 0.72
Q1 = 269.9l/s
13 MONTH RUNOFF IS APPROXIMATELY 30% OF THE Q1 FLOW = 81.0l/s

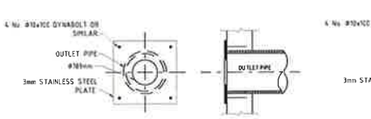
MINIMUM VOLUME OF FILTRATION CHAMBER TO BE 24.3m3 (81.0l/s x 60sec x 5mins)
VOLUME PROVIDED = 27.6m³



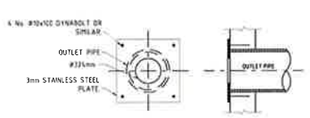
OSD 2 SECTION A
SCALE 1:50



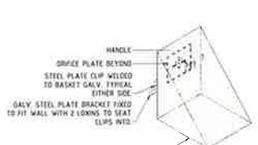
OSD 2 SECTION C
SCALE 1:50



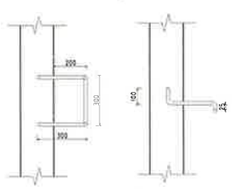
PRIMARY ORIFICE PLATE DETAIL
NOT TO SCALE



SECONDARY PLATE DETAIL
NOT TO SCALE



TRASH SCREEN DETAIL



STEP IRON DETAIL
NOT TO SCALE

STEP IRON OF 20mm GALVANIZED STEEL MADE TO SHAPE AND DIMENSIONS SHOWN AND PLACED AT 300 CENTRES AND STAGGERED HORIZONTALLY FOR PITS DEEPER THAN 1.0m

DEVELOPMENT APPLICATION

DATE	No	AMENDMENT	INT	REV
03.10.17		ISSUED FOR COORDINATION	SK	1
08.11.17		ISSUE FOR DEVELOPMENT APPLICATION	BB	2

CHECKED DATE
APPROVED DATE
PAPER SIZE DATE
A0 November 8, 2017
NORTH POINT
SCALE AS SHOWN ON PLAN

BUILDER FDC

CLIENT Jaycar

ARCHITECT sf

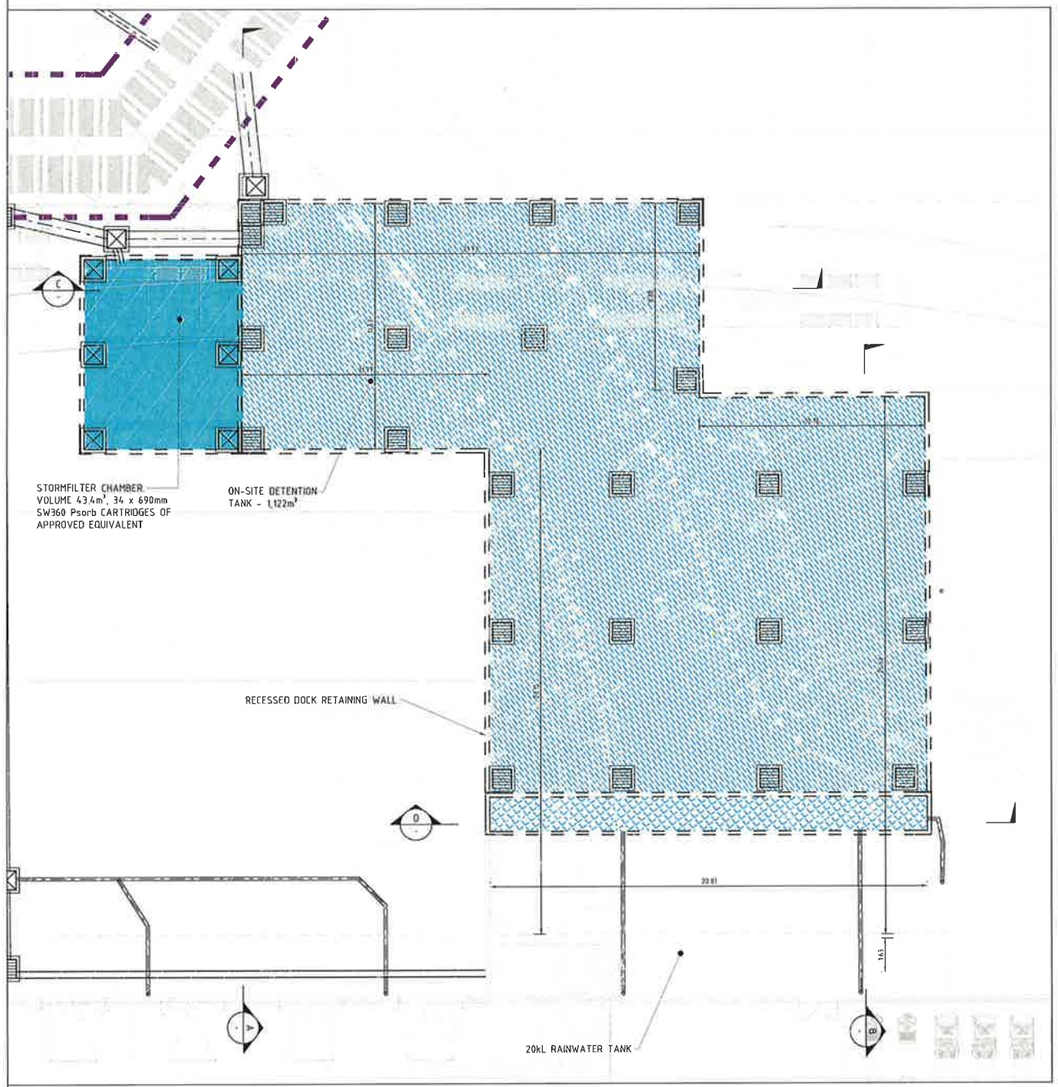
PROJECT 54-68 FERNDELL STREET, SOUTH GRANVILLE

DRAWING TITLE CIVIL DESIGN
OSD 2 PLAN AND DETAILS

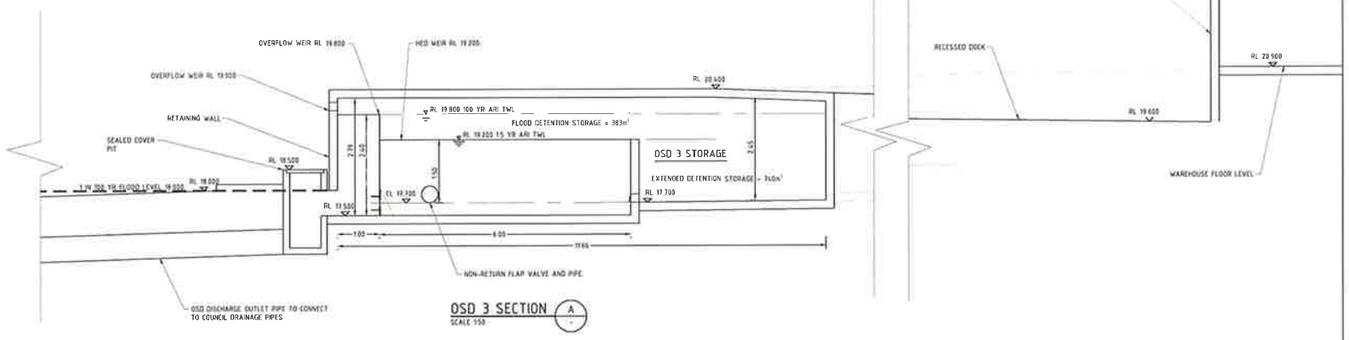
SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE

DESIGNED SK
DRAWN SK
SCALE AS SHOWN
JOB No. 16166
DWG No. DA4.14
REV 2

AHSCA



OSD 3 AND SW TREATMENT CONFIGURATION PLAN
SCALE 1:100



OSD 3 SECTION (A)
SCALE 1:50

NOTES & CALCULATIONS

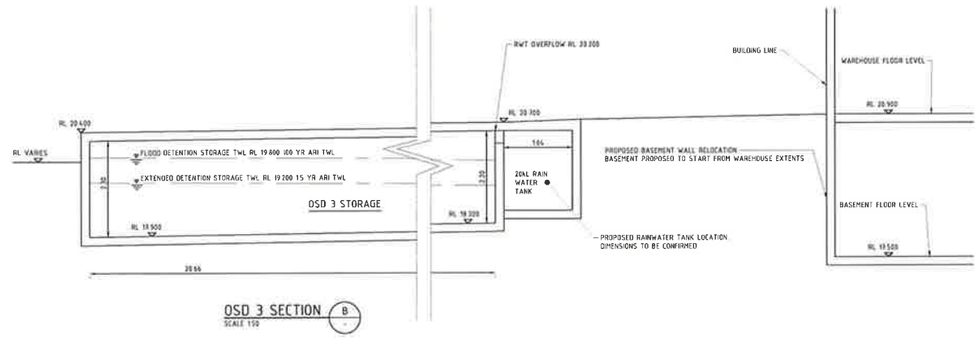
1. REFER TO DA 4.03 FOR TANK LOCATION
2. REFER TO DA4.06 & DA4.07 FOR CATCHMENT PLANS
3. REFER TO WSUD REPORT FOR OSD CALCULATIONS
4. STORMFILTER CHAMBER CALCULATIONS

STORMFILTER CHAMBER 3
FILTRATION CHAMBER VOLUME SIZED TO CAPTURE FIRST FLUSH FROM 13 MONTH ARI EVENT FOR Tc:6min

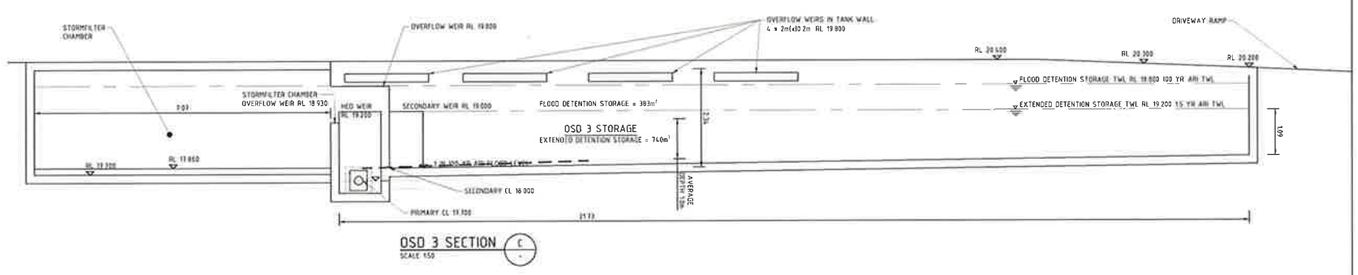
TOTAL AREA DRAINING TO FILTRATION CHAMBER = 2312.3m2 (AS PER CATCHMENT PLANS)

Tc = 6mins
I5 = 80mm/h
Cy = 0.72
Q3 = 370L/s
13 MONTH RUNOFF IS APPROXIMATELY 30% OF THE Q3 FLOW = 111l/s

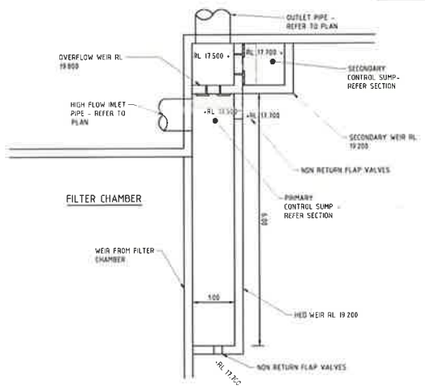
MINIMUM VOLUME OF FILTRATION CHAMBER TO BE 40m³ (87.9l/s x 60sec x 6mins)
VOLUME PROVIDED = 43.4m3



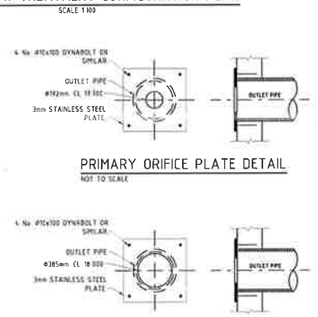
OSD 3 SECTION (B)
SCALE 1:50

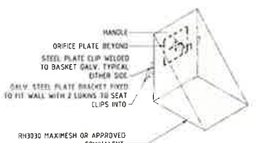


OSD 3 SECTION (C)
SCALE 1:50

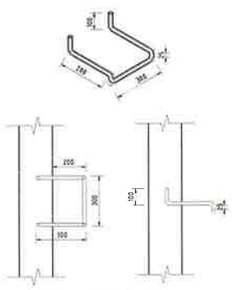


OSD 3 STAGED DISCHARGE CONTROL SUMP AND WEIR LAYOUT
SCALE 150



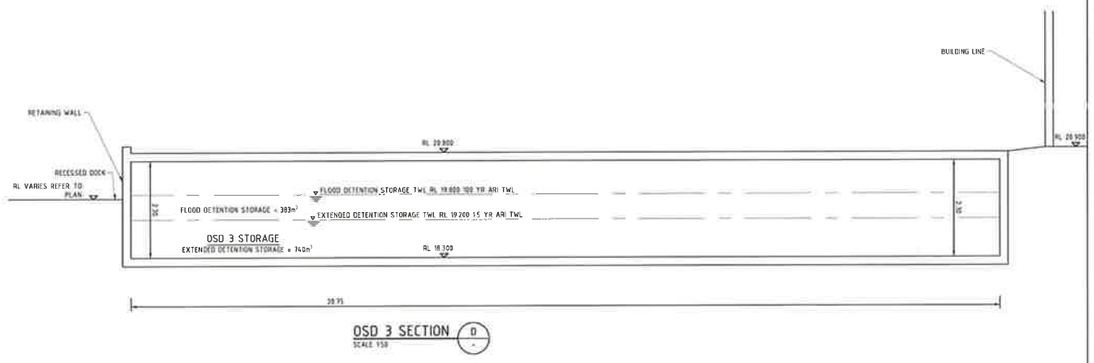


TRASH SCREEN DETAIL



STEP IRON DETAIL
NOT TO SCALE

STEP IRON OF 20mm GALVANIZED STEEL MADE TO SHAPE AND DIMENSIONS SHOWN AND PLACED AT 300 CENTRES AND STAGGERED HORIZONTALLY FOR PITS DEEPER THAN 1.0m



OSD 3 SECTION (D)
SCALE 1:50

DATE	No	AMENDMENT	INT	REV
23.10.19		ISSUED FOR COORDINATION	SK	1
28.11.19		ISSUE FOR DEVELOPMENT APPLICATION	BB	2

CHECKED / DATE
APPROVED / DATE
PAGE PLOT DATE: A0 | November 9, 2017
SCALE: SCALE AS SHOWN ON PLAN

DEVELOPMENT APPLICATION

BUILDER: FDC
CLIENT: Jaycar
ARCHITECT: nt
PROJECT: 54-68 FERNDELL STREET, SOUTH GRANVILLE
DRAWING TITLE: CIVIL DESIGN
OSD 3 PLAN AND DETAILS

SPARKS+PARTNERS CONSULTING ENGINEERS HYDRAULIC | CIVIL | FIRE

DRAWN: SK | DESIGN: ---- | CHECK: SK | SCALE: AS SHOWN | JOB No: 16166 | DWG No: DA4.15 | REVISION: 2